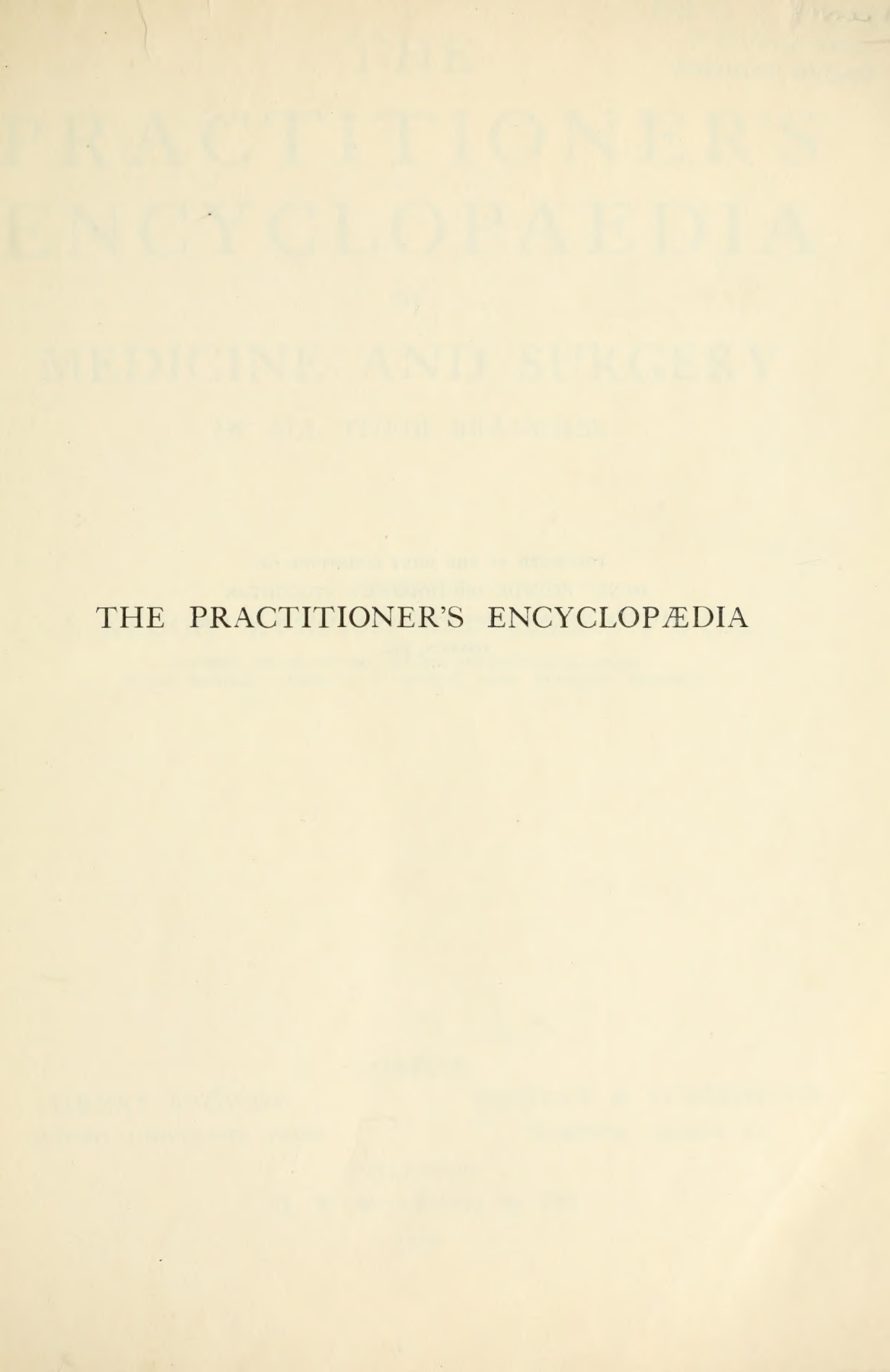


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THE
PRACTITIONER'S
ENCYCLOPAEDIA
OF
MEDICINE AND SURGERY

IN ALL THEIR BRANCHES

EDITED BY

J. KEOGH MURPHY, M.C. (Cantab.), F.R.C.S.

SURGEON, MILLER GENERAL HOSPITAL FOR SOUTH-EAST LONDON,
SENIOR ASSISTANT SURGEON TO PADDINGTON GREEN CHILDREN'S HOSPITAL

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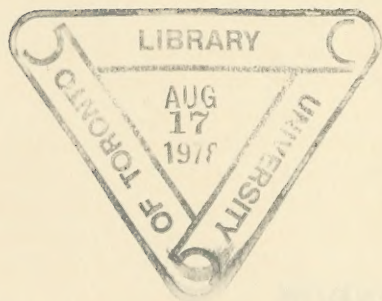
SIR WILLIAM OSLER, BART., M.D., F.R.S.,

REGIUS PROFESSOR OF PHYSIC IN THE

UNIVERSITY OF OXFORD

IN TOKEN OF ADMIRATION AND GRATEFUL

REMEMBRANCE OF VERY MUCH KINDNESS



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1912

PREFACE

THE general public to-day, more than ever before, inclines to the belief that the practitioner of medicine is, or at least ought to be, omniscient in every department.

The relative merits of health resorts and the comparative virtues of patent foods, the latest scheme for the social improvement of degenerates or the significance of an operation performed yesterday for the first time by some distinguished specialist and duly reported in the lay press—all these lie within the ordinary compass of his attainment.

When we consider the enormous advances that have taken place during the past few years, and how many and great are the consequent changes in medical practice, it would appear to be essential that every practitioner should have ready access to information which has become indispensable. The vast increase in medical literature makes it impossible, however, for him to possess separate volumes of reference upon every subject, or to find time to consult even a small proportion of them.

A compact practical encyclopædia of medicine in all its aspects has therefore become a necessity if a medical man is to keep his knowledge abreast of the times, an encyclopædia of such a size and scope that the busy practitioner can, within a single volume, at once find reliable information, simply and clearly set forth, upon all subjects with which he may be called to deal in his daily work.

The Practitioner's Encyclopædia of Medicine and Surgery is designed to meet this need.

It has been my endeavour to select, for all parts of this work, experts in their own subjects and to obtain from each contributor articles which convey the latest information in the most succinct and most definite manner. As a result of the guiding principles I have had before me, but few anatomical and pathological details will not be found in these pages, except where they are of practical application, nor have the authors attempted to include any full description of such surgical operations as are outside the scope of general practice. It has been their aim to produce a *practitioner's* encyclopædia and not a general encyclopædia, a work, however, in which nothing of real importance to the practitioner in medicine, surgery and obstetrics, with their allied subjects, has been omitted.

The encyclopædia is arranged under sections familiar to the practitioner, so that he may find it easy to refer to its pages in cases of medical, surgical and other difficulties, whilst the index provides the fullest possible cross references.

To Sir William Osler, for his cordial approval of the scheme of the encyclopædia, for his unflinching kindness and ready help during all the stages of its growth, and to all the contributors who have so generously placed at my disposal their time and their knowledge, and who in many cases have, I know, sacrificed much in order to forward the production of this work, I desire to express my most grateful thanks. I am greatly indebted to Dr. C. Roney Schofield for his care in the preparation of the index.

J. KEOGH MURPHY.

August, 1912.

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PART I

I.—GENERAL MEDICINE

CONSTITUTIONAL DISEASES

DIABETES

THE normal individual does not pass sugar in the urine unless four and a half to six ounces of sugar are taken at one time. It is not physiological for glycosuria to occur after the ingestion of any amount of starch, as its conversion into sugar is sufficiently gradual to prevent the flooding of the portal vein with sugar. This power of assimilating sugar may be upset—

1. By cerebral lesions, which prevent accumulation of glycogen in the liver.
2. By pancreatic diseases, which lead to loss of the internal secretion of that organ.
3. By excess of other internal secretions, such as adrenalin or iodothyrene.
4. By certain drugs, such as phloridzin, and by excess of CO₂, as in asphyxia.

The first and last groups do not represent true diabetes. The simplest working hypothesis that we can adopt to explain the various stages of glycosuria and diabetes is somewhat as follows:—The internal secretion of the pancreas links the sugar of the blood on to larger molecules, probably of protein, and thus prevents its escape in the urine. If the amount of sugar in the blood is suddenly raised by the ingestion of four and a half to six ounces of sugar from the alimentary canal the whole of this cannot be so linked, and therefore overflow occurs (physiological glycosuria). In some individuals the internal secretion is reduced, so that sugar appears with quite a moderate amount of carbohydrate in the diet (alimentary glycosuria); in others the internal secretion is so seriously reduced that it is unable to deal with the sugar molecules set free from the ordinary breakdown of proteins of the food or the tissues, and therefore glycosuria occurs on a carbohydrate-free diet (diabetes). No hard-and-fast line can be drawn between quite mild alimentary glycosuria and the severest diabetes, and this is best explained by postulating a progressive reduction in the internal secretion of the pancreas. It is important to notice the influence of other internal secretions, such as that of the thyroid, suprarenal and pituitary body, in exciting glycosuria. For the due performance of metabolism a certain balance is necessary between the various internal secretions, and an upset in this equilibrium results in glycosuria; there

is a relative deficiency of the pancreatic internal secretion from an excess of one of the others.

Etiology.—During the last ten years 253 cases of diabetes were admitted to the medical wards of St. Bartholomew's Hospital—almost exactly one per cent. of the total admissions—182 being males and 71 females. No cases occurred under five years of age and very few under ten. Then the curve of incidence rose slowly to twenty years, rapidly reaching its maximum between twenty and thirty, and began to fall again a little after fifty. These figures are typical of those for the whole community, if we allow for the drop after fifty being partly due to the cases being milder and therefore more often treated as out-patients. From eleven to fifty the mortality for each decade was constantly twenty-five per cent., and above that fifteen to eighteen per cent. All observers are agreed as to the special liability of the Jewish race to this disease. On the other hand, it is rare in negroes. In this country, apart from the Jews, the subjects are most frequently of a fair or sandy complexion. It is certainly commoner among the well-to-do than in the hospital class. Obesity is believed by some to be a contributing factor. It is possible that persistent over-indulgence in carbohydrate food may tax and finally exhaust the metabolic powers of the body, and thus contribute to the onset of diabetes. It is certainly true that prolonged abstinence from any such excess may result in the diabetic re-establishing some degree of tolerance for carbohydrates. Alcoholic excess is liable to produce glycosuria, usually of an amenable type.

Heredity is believed to play a part, though in my cases I have found very few instances of this. Neurotics appear to be particularly liable. Mental shocks, nervous strain and worry are important factors in inducing the onset. Gout is thought to be a predisposing cause, but this is probably merely because both gout and alimentary glycosuria occur in elderly, fat persons. Syphilis can play a part by setting up pancreatic lesions. Injuries to the brain and spinal cord have apparently been responsible in some cases, but definite intracranial lesions should be regarded as a cause of symptomatic glycosuria rather than of true diabetes. A number of instances in which diabetes in the husband has been followed by its occurrence

in the wife has led to the hypothesis of contagion. But, to sum up, we cannot get much further at present than Osler's statement that "a combination of intense application to business, over-indulgence in food and drink, with a sedentary life, seems particularly prone to induce the disease."

Signs and Symptoms.—The onset is nearly always insidious, and it is sometimes met with unexpectedly in the course of examination for life assurance, or ocular complications may be the reason for the patient seeking advice. Everything points to the conclusion that patients usually suffer from glycosuria for some time before there are any symptoms to call their attention to it.

The prominent symptoms are thirst, polyuria and wasting. The *urine* is increased to about four pints in the mild cases, and may reach eight or ten pints in the severe. It is pale and limpid, sometimes with a greenish tinge. The specific gravity usually lies between 1030 and 1045. The best criterion of the presence of sugar is that equal quantities of boiling Fehling's solution and boiling urine should, on mixing, yield an orange precipitate *without reboiling*. Confirmatory points are that the urine ferments with yeast, that on heating on a water bath with phenyl hydrazine and sodium acetate it yields within twenty minutes yellow needles of dextrosazone arranged in sheaves which melt at 206° C., and that it rotates the plane of polarized light to the right. The amount may be estimated by running urine diluted ten times from a burette into 10 c.c. of Fehling's solution made up to about 50 c.c. with strong caustic soda, which is kept boiling until all trace of a blue colour has disappeared. We know that we have then added three-quarters of a grain (.05 gram) of sugar from the burette, and from the number of c.c. used the percentage of sugar can be readily calculated. This can also be done by the fermentation method; two cylindrical glasses are filled with urine, and to one a small quantity of yeast is added, while the other is used as a control. Both are kept in a warm place for twenty-four hours and the difference in specific gravity between the two noted. The loss of each degree of specific gravity by fermentation corresponds to one grain of sugar per ounce. These quantitative methods are sufficiently accurate for clinical purposes. The amount of sugar varies greatly; I regard 3000 grains per diem (*i. e.* five per cent. in 125 oz.) as representing the total excreted in a moderately severe case. But in very bad cases as much as 12,000 grains may be passed. The examination for acetone and diacetic acid should never be omitted. Acetone is most readily detected by dissolving a crystal of sodium nitroprusside in the urine and pouring

strong ammonia down the side of the test tube. A magenta ring develops at the line of junction in the course of a few minutes and spreads upwards. The sensitiveness of the reaction is increased by the addition of some saturated solution of ammonium sulphate to the urine. Previous boiling of the urine prevents this reaction. Diacetic acid gives a claret colour with ferric chloride. This must not be confused with the purple colour given by salicylates, which is not affected by boiling as is the diacetic reaction. Moreover, if diacetic acid be present the acetone reaction will always be obtained also, but not if the colour be due to salicylates.

Wasting is present in the serious cases, when acetone and diacetic acid will be found also, since they come from β -oxybutyric acid, a fatty acid which results from the decomposition and incomplete oxidation of fats. The gravity of acetonuria in diabetes is partly that it is symptomatic of starvation, partly that it indicates that an "acid intoxication" of the tissues is proceeding, which leads to a drainage of the inorganic alkaline bases and to a breakdown of the tissue proteins to set free ammonia in the attempt to neutralize these acids. As long as wasting does not occur and the acetone bodies are absent from the urine the outlook is more favourable and the case is more amenable to treatment.

Alimentary Canal. The tongue may be covered with fur which tends to become black towards the base, or it may be raw and glazed; the former being commoner in the stout, and the latter in the emaciated patients with acetonuria. The saliva may become acid instead of alkaline, and dental caries is common. The patient may complain of a sweet taste in the mouth, and the breath may have a heavy sweet odour. Though the appetite is voracious the loss of weight may continue. Usually the appetite is good, a fortunate circumstance in view of the monotonous and highly protein diet. But I have come across a group of cases in which severe symptoms of acid dyspepsia have occurred. I believe that these cases are dependent on a pancreatic lesion. If pancreatic secretion is inadequate neutralization of the hydrochloric acid of the gastric juice in the duodenum is interfered with. As long as the duodenal contents are acid the pyloric sphincter is kept closed. In this way acid is retained in the stomach and the symptoms typical of hyperchlorhydria ensue.

The *skin* is harsh and dry, the hair becomes thin and falls out, and the nails are brittle. There is often a high colour on the cheeks which spreads up into the roots of the hair. Sugar can be demonstrated in the sweat, tears and saliva, and it is, of course, present in excess in the blood. The *cardio-vascular system* displays

signs of weakness; in spite of the diuresis there is not hypertrophy of the heart nor a raised blood pressure. There is usually profound muscular weakness, the mind is depressed and the sexual appetite is lost.

Complications.—A number of important changes may occur in the *skin*. Carbuncles or crops of boils are common. Xanthoma—indurated, rounded or conical lumps, dull red in colour with yellow tips—was described by Addison and Gull. Perforating ulcers may occur on the feet when neuritis is present, and gangrene is apt to follow slight injuries, generally in the older subjects. Little centres of necrosis may occur about the ankles or the dorsum of the feet, starting apparently in the sweat glands. Unlike perforating ulcers, these may form while the knee-jerks are still present. Pruritus and eczema vulvæ set up by yeast and other organisms in the saccharine urine may be a cause of great discomfort and the starting-point of a troublesome dermatitis. Balanitis in men is less common.

The *nervous system* is involved in nearly all severe cases of any duration. Neuralgia, sciatica or definite peripheral neuritis with loss of the knee-jerk are the most frequent complications. The condition may closely resemble tabes in the lightning pains, ataxia, crises, loss of reflexes and perforating ulcers. The pupils are not affected, however, and the exceptional instances in which the Argyll-Robertson pupil has been described are probably cases of true tabes occurring in diabetics. *Insanity* is not very rare.

Of the *special senses* the eye is the most likely to be involved. The muscles of accommodation may be impaired or a soft cataract may form. A sudden amblyopia may occur in one or both eyes, or a central scotoma. This is nearly always in smokers. Some authorities state that this is invariably the case, and I certainly have not seen an instance in non-smokers, though such have been recorded. It is probably an instance of the action of combined toxins, for quite a moderate amount of tobacco will produce these symptoms in a diabetic. Retinitis with hæmorrhages or small white glistening patches may also be found. Otitis media without fever has been described.

Special attention has been called by R. T. Williamson to the occurrence of *heart failure*, which is usually quite sudden and unassociated with any valvular lesion. This possibility should be borne in mind in cases of diabetes of long duration, especially when the pulse is weak and there are other signs of feeble action of the heart.

Respiratory complications are always dangerous in diabetes. Pneumonia has a bad prognosis, for even if the crisis is successfully passed

gangrene of the lung may ensue. Phthisis is a common complication and a cause of death. During any fever there may be a temporary absence of sugar in the urine.

Association of Albuminuria with Glycosuria. A patient with granular kidney, if "gouty," obese or alcoholic, is liable to glycosuria, usually of an amenable type. On the other hand, prolonged glycosuria almost inevitably leads to albuminuria in time. Pavy regarded it as the result of irritation of the kidney. The condition of the cardio-vascular system will give the clue as to which of the two types we are dealing with; hypertrophy of the heart, thickened arteries and high blood pressure place it in the first group, and it is the kidney condition which demands treatment. The absence of these signs and the presence of the diacetic reaction places it in the second group, when the treatment is that of the glycosuria. The appearance of casts in the urine of a diabetic is always of serious import. They have nothing to do with the intensity of the albuminuria, but are probably due to the irritation of the kidney by the abnormal acids, and are often prognostic of coma.

Diabetic Coma may terminate the case at any age, but more commonly in the young. There are usually some premonitory symptoms, such as a fall in the excretion of sugar and a rise in the excretion of a diacetic acid, epigastric pain, a burning sensation in the throat, air hunger, drowsiness and sometimes vomiting. The patient rapidly becomes unconscious, with deep and sighing respirations, thirty to forty a minute. The face is very pale, the extremities cold and the temperature subnormal. There is usually obstinate constipation. The smell of diacetic acid in the breath, which has been compared to that of apples packed in hay, is very marked. Death generally occurs within forty-eight hours.

Course and Prognosis.—Speaking generally, the younger the patient the more rapid the course. A mild case, which with care may go on for many years, would be one where the patient was over forty and not wasting and his tongue not raw. The urine would contain no acetone bodies. Restriction of the diet would cause the sugar to disappear quickly, though acetone bodies would now probably make a brief appearance, as in any one on a suddenly restricted diet. Moderate exercise would cause a diminution of the glycosuria. A severe case, which would probably prove fatal within two years, would be one in a patient under thirty, who was wasting and had a raw "beefy" tongue. The knee-jerks might be absent. Diacetic acid would be present, and sugar would persist on a restricted diet. Acetone and diacetic acid would be markedly

and persistently increased by a sudden restriction of the diet, and exercise would increase the glycosuria. Cases with persistent acetonuria are always unfavourable. Diabetics are always regarded as uninsurable, for apart from the seriousness of the condition itself, any respiratory disorder is likely to be rapidly fatal. An easy existence and ample means are naturally important factors in prolonging life.

Is diabetes ever curable? In some of the reported cases the evidence that the reducing substance in the urine was dextrose was not sufficiently complete, and others are suggestive of a transitory pancreatitis. Before we can conclude that a case of diabetes is cured, not only must the urine have been free from sugar for two years, but the tolerance for starch and sugar must have been normal for at least as long. Such cases do occur, and I have had one under my own care, but the event is too rare to justify our holding out to our patients the hope of so favourable a result.

Diagnosis. The first point to be determined is whether a reducing substance found in the urine is really dextrose. (1) *It may not be a sugar at all.* Uric acid, kreatinin and salicylic acid (in the urine of patients taking salicylates) may cause a slight greenish opacity on boiling for some time or on subsequent cooling. But if the quantity of urine used does not exceed the amount of Fehling's solution, and they are mixed while hot and not boiled again, reduction is not likely to occur with these substances. Glycuronic acid may cause reduction but it does not ferment. (2) *It may be some other sugar than dextrose.* The commonest other sugar is lactose, which may often be found in the urine of women during lactation, and less commonly during pregnancy. It may also be found in the urine of milk-fed infants during gastro-intestinal disturbance. It does not ferment within twenty-four hours and yields an osazone with considerable difficulty. Levulose seldom occurs by itself, and pentose is extremely rare.

If the reducing substance is dextrose, we must exclude temporary glycosuria from head injuries, administration of excess of thyroid extract or anæsthetics. We must also exclude the symptomatic glycosuria of cerebral tumours, acromegaly, exophthalmic goitre and diseases of the pancreas. Patients may be brought into hospital comatose from cerebral hæmorrhage, when the urine is very apt to contain sugar, leading to the diagnosis of diabetic coma. This mistake can easily be avoided by testing for diacetic acid, which will be absent in these cases but always present in diabetic coma. The finding of diacetic acid without sugar in life-assurance work should raise the

suspicion of dieting having been practised to enable a glycosuric to pass examination. This can be detected by giving three ounces of sugar and examining the urine passed an hour later.

Treatment. The ideal to be aimed at is a regulation of the diet to a point at which both sugar and diacetic acid are absent from the urine. In the severer cases these aims are in a sense antagonistic, for it is the deprivation or non-utilization of carbohydrates that is the cause of the acetonuria. It is, of course, no use pouring in carbohydrates that cannot be used, but the failure to utilize carbohydrates is rarely complete, and efforts must be made to find some form of this food-stuff which can be assimilated. The absolute deprivation of carbohydrates formerly practised is not to be recommended; it is really better that a patient should pass sugar rather than diacetic acid, which implies starvation, if not intoxication. Under-nutrition is the diabetic's greatest danger. After determining the total daily output of sugar on an ordinary diet, the sugar, but not the starch, in the food should be cut off. If this is sufficient to check the glycosuria the case is a mild one. If, as is more probable, sugar is still excreted, the starches are cut off gradually; to do so suddenly is to place the patient in peril of diabetic coma. It is important to determine as accurately as possible the degree of tolerance for starch for each case. For this purpose some standard diet of known carbohydrate content, such as Von Noorden's, should be given.

Breakfast. Coffee or tea, with one to two tablespoonfuls of thick cream, six ounces; hot or cold meat (weighed after cooking), three ounces; butter; two eggs with bacon; white bread, two ounces.

Lunch. Two eggs (cooked as desired, but without flour); meat, about six ounces; vegetables, such as spinach, cabbage, cauliflower, asparagus, prepared with broth, butter or other fat, eggs or cream, but without flour; cheese and butter, one ounce; two glasses of light wine; one cup of coffee, with one to two tablespoonfuls of thick cream; white bread, two ounces.

Dinner. Clear meat soup (with eggs or vegetables); one or two meat dishes, with vegetables, salad of lettuce and tomatoes; wine; no bread.

Drinks. One or two bottles of aerated waters.

If this diet, which contains about 100 grams of carbohydrate, does not cause any glycosuria, then the bread is gradually increased until sugar appears. If sugar does appear on this test diet, the diet is continued until the sugar is constant and the bread then gradually diminished. Even supposing that in a severe case we are unable to render the urine free from

sugar, we can probably find a point to which the intake of carbohydrate can be raised without increasing the glycosuria while diminishing the acetonuria. This will be the best point at which to maintain the patient's metabolism, for even if further restriction produces a fall in the amount of sugar, it is not beneficial if it causes a return or an increase in the acetonuria. We can assist the patient to reach as high a toleration point as possible—

1. By choosing those forms of carbohydrate which he can assimilate, and by studying the effect of exercise on the excretion of sugar, and regulating it accordingly.

2. By diminishing the production of the acetone bodies.

Wheat seems to be the form of starch least tolerable to the diabetic, and the abiding difficulty is to find a satisfactory substitute for bread. As Osler says, "Of the gluten foods, many are very unpalatable, others are frauds." Under the present system of more moderate restriction of the carbohydrates we need not as a routine insist on a pure gluten bread, and the Brusson-Jeune rolls, which consist of gluten mixed with some starch, are palatable and convenient. Protein diabetic bread or almond cakes made up with eggs can sometimes be taken when gluten breads cannot. The only advantage of very dry toast over bread is that it requires so much mastication that less of it can be eaten. Potato starch and oatmeal are better assimilated than wheat starch, and the patient's tolerance for them should be determined, as it is quite possible that a fair amount of carbohydrate can be given in this way. The capacity of a diabetic to utilize levulose is limited to the amount which his tissues can consume on the spot. This is not more than five drachms as a rule, but by cautiously divided doses as much as one and a half ounces may be taken in the day without increasing the excretion of sugar. Its cost, however, is prohibitive except for wealthy patients or in emergencies such as threatened coma. I have seen striking benefit from its use.

Can anything else replace the carbohydrate in metabolism? To a limited extent citric and glutaric acids and alcohol can do so. Citrates can be added to the alkaline mixture which should always be given when acidosis is marked. While bearing in mind the dangers of the alcohol habit, it is nevertheless often advisable to give alcohol to the extent of about an ounce of the pure spirit in the day. Malt liquors, sweet wines, champagne and liqueurs will naturally be avoided. There is no objection to small quantities of saccharin as a sweetening agent. Fats can be given freely as long as the lower fatty acids are got rid of from butter by kneading it thoroughly in cold water.

More elaborate methods of determining the coefficient of excretion on different diets can hardly be carried out under the conditions of general practice and require treatment for a time in a nursing home. It is usually inadvisable to confine a severe case to bed, except for some intercurrent affection.

Drugs have little influence on glycosuria; codein appears to be the most effective, and can be given in doses of from two to five grains a day. Salicylate or aspirin are sometimes useful in the milder cases, but have the great objection that they mask the diacetic reaction in the urine. I have never observed lessening of the sugar that could be ascribed to any other drugs. But alkalis help in acidosis; Spriggs has pointed out that when two drachms of sodium bicarbonate are given to a normal individual the urine becomes alkaline and remains so for twenty-four hours. But if excess of acid is being formed this is not enough, and the amount of alkali that can be taken without neutralizing the urine is a measure of the acidosis. If the condition improves under treatment the urine will become alkaline, and the amount of alkali may be gradually diminished without a return of the acid reaction. It is not sufficient to give sodium alone, as is too often done, for other metallic salts are also being drained from the tissues. I employ the following mixture—

Sodii. Bicarb.	5 i	
Pot. Citrat.	gr. xxx	
Calcii Carb.	gr. iii	
Mag. Carb.	gr. iii	
Aq. ad	3 i	t.d.s.

increased up to tertiis horis according to the severity of the case.

It has been urged against this method of treatment that under it the intensity of the diacetic reaction in the urine is increased, at any rate for a time. But this is merely because the excretion of the acetone bodies is being facilitated, not that their production is being increased. They are now excreted as metallic salts instead of in combination with ammonia derived from the breakdown of the protein of the tissues. This alkaline treatment should never be omitted in severe diabetes.

If coma supervenes at least a pint of two per cent. of bicarbonate of soda solution should be infused intravenously at a temperature of about 103° F. It is less effective per rectum or into the cellular tissues. I have added two per cent. of levulose with marked benefit. There is often a temporary return of consciousness, which it is sometimes very important to obtain, but relapse soon occurs, for we cannot strike at the root of the mischief. As there is evidence of incomplete oxidation in this

condition oxygen inhalations are usually tried, but I cannot say that I have ever seen them do any good, nor should we expect it, for the poisoned cell cannot avail itself of the oxygen presented to it. It is still true that in diabetic coma "the duration of life is to be measured by hours rather than by days." W. L. B.

DIABETES INSIPIDUS

Definition. A chronic affection characterized by the passage of large quantities of normal urine of a low specific gravity.

Ralfe distinguished between hydruria, in which the watery overflow is the chief feature, and polyuria, in which the drain of one or more of the solid constituents is persistent. As will be seen, true diabetes insipidus, when due allowance is made for complicating factors, is essentially a hydruria.

The amount of urine secreted may be increased by (1) a general vaso-constriction producing a rise of blood pressure, as in chronic interstitial nephritis; (2) a local vasodilatation of the vessels of the kidney; (3) an increase in the quantity of the circulating fluid by increased absorption (*a*) from the bowel—polydipsia produces polyuria—or (*b*) from the tissues, by a rise in the osmotic pressure of the blood, as in diabetes mellitus or as a result of saline diuretics.

Diabetes insipidus must fall into the second of these groups. It cannot be an example of the first, for the blood pressure does not appear to be raised, though more observations on this point are needed; in a child of seven at St. Bartholomew's Hospital the blood pressure was only 82 mm. It cannot be an example of the last, for diuresis is the cause and not the result of the large quantity of water drunk, and there is no evidence of an increased osmotic concentration of the blood. By a process of exclusion we are thrown back on a local dilatation of the renal vessels, probably through irritation of their nerves, as the immediate cause. This is supported by the fact that similar symptoms have been found in two cases of abdominal aneurysm (Ralfe) and one of abdominal tumour involving the solar plexus (Dickinson). Lesions of the medulla of the brain, such as tumours, specific pachymeningitis or the result of injury may act in the same manner, and it is important to distinguish such symptomatic diuresis from true diabetes insipidus.

Incidence. It is a comparatively rare disease; only fifteen cases occurred during the last ten years among more than 25,000 admissions to the medical wards of St. Bartholomew's Hospital, and in some of these the diagnosis was not beyond cavil. It is

a disease of childhood and early middle life, and it is at least twice as common in males as in females. Tubercle, syphilis and gout are supposed to be hereditary influences. The parents of children suffering from the disease are not infrequently albuminuric or glycosuric. Malnutrition, neglect and anything tending to depress the central nervous system are factors in exciting the onset. Syphilis is probably the most important of all.

Signs and Symptoms. The onset is sometimes quite sudden; thus a man of fifty-two woke up one morning feeling very thirsty; he passed much urine during that day and continued to do so. Injury or fright may induce an equally sudden beginning. In others the increased flow may come on quite gradually. The *urine* is increased in quantity more than in diabetes mellitus, eight pints being often passed in a day, while such figures as sixteen or twenty pints may be reached. It is pale greenish-yellow in colour or a very pale bluish tint, faintly acid or neutral, soon becoming turbid and alkaline. The specific gravity is as low as 1002 or 1003, but allowing for the quantity of urine passed this may mean an increased excretion of solids of about twenty-five to thirty per cent. The increased output of nitrogen is simply due to the extra amount eaten, and there is no need to regard this as a special condition, "azoturia." The extra amount of salt also is merely due to the extra quantity ingested. Occasional calcium oxalate and phosphate crystals may be found. Muscle sugar, inosite, is sometimes found and exceptionally a trace of dextrose, when the case shades off into diabetes mellitus. Albuminuria may come on as cachexia develops. Diabetes insipidus has a point of resemblance to chronic interstitial nephritis in that the kidney has lost its power of excreting a concentrated urine. A larger proportion of the water drunk is excreted by the kidney than normally, so that the *skin* is drier and rougher than usual, and the quantity of sweat is not only relatively, but may be absolutely, reduced. The *thirst* is intense; at the Metropolitan Hospital a girl of seventeen got into the ward kitchen and drank off six siphons of soda water, and would, if not prevented, drink the contents of her washing basin. If deprived of water they will even drink their own urine. *Digestion* is well performed until the health fails, when there is anorexia. The tongue becomes red and glazed, while the throat and mouth are covered with sticky mucus and the breath becomes fetid. The *bowels* are constipated until late in the disease, when attacks of uncontrollable diarrhoea may occur. The *temperature* is subnormal except for complications, when with fever the

amount of diuresis falls considerably. The pulse is feeble and easily compressible, and there are no signs of high tension. Various nervous symptoms are common: lumbago, sciatica, muscular cramps, pruritus, hiccup, headache, impotence and insomnia. The reflexes disappear early. Amblyopia may occur without any special lesion; Bousfield has described two cases of primary optic atrophy, but in the absence of a post-mortem examination it is impossible to exclude the more probable diagnosis of an intracranial lesion.

The prognosis is very variable. It is best in those of sudden onset, where the disease may cease with equal abruptness. In the cases coming on after head injuries the disease seldom becomes pronounced and does not often last more than two years, unless some secondary brain lesion follows. The cases with insidious onset are generally chronic, and if they are also progressive the outlook is very unfavourable. Syphilis is a very important factor in this group. The mild cases usually subside under proper management, but once emaciation has become profound, or anorexia and muscular weakness are pronounced, a fatal issue must be expected within about six months. In children the disease, like diabetes mellitus, generally runs a rapid and unfavourable course. Death may result at any age from coma, diarrhoea or intercurrent affections, such as phthisis or a low form of pneumonia. In children convulsions may usher in the fatal issue. Saundby has pointed out that the cause of death is often a gradual destruction of the kidney substance, so that the terminal symptoms described above are really uræmic in character.

Diagnosis. Although a trace of sugar is occasionally present, the diagnosis is easily made from diabetes mellitus, in which the specific gravity is high and the sugar persistent. Hysterical polyuria is distinguished by its intermittent occurrence and by the presence of other hysterical stigmata. Actual measurement of the amount passed is desirable to distinguish the condition from one of mere frequency of micturition. Imposture can generally be detected by keeping a watch on the amount of fluid drunk. Such quantities cannot continue to be excreted without copious drinking. The most important point in diagnosis is to recognize cases of symptomatic diuresis dependent on a definite cerebral lesion. Cranial palsies, interference with the motor tracts and optic neuritis would settle this question.

Treatment. Most authorities are agreed that it is inadvisable to reduce the amount of water drunk, as it causes great suffering and

dangerously depletes the tissues, while it does not touch the cause of the disease. Ralfe advised that if the fluid ingested and excreted approximately balanced, the amount of fluid drunk should be reduced by two pints; if this is followed by a fall in the urine excreted the fluid drunk is reduced by another pint every third day, but as soon as there is no more reduction in diuresis the intake should not be restricted any further. Acidulated drinks, or half an ounce of raw oatmeal stirred into two pints of water and flavoured with lemon, are pleasant. Tea, coffee and alcohol are all to be avoided as stimulating to diuresis. For the same reason salt aggravates the condition. Among drugs valerian holds the first place, and it has been used in such heroic doses as to nauseate. As much as half an ounce of the tincture may be given four times a day, however, with good results. It may be reinforced with advantage by five to ten minims of tincture of cannabis indica and some bromide of ammonium. Valerianate of zinc, in doses of fifteen grains gradually increased to thirty three times a day, has had a good effect in some cases. Ergot is advised by some, nitroglycerine by others; it will be noted that these drugs must have opposite effects. Arsenic, belladonna and iron have all proved useful as adjuvants. Any syphilitic taint must be thoroughly treated. Robertson recommends the application of the constant current, the positive pole being applied to the back of the head, while the negative is passed along the floor of the nose until the cervical spine is reached. Starting with half a milli-ampere, the current is increased to five, and applied for one minute, prolonging this every second or third day till it is used for five or six minutes. This course of treatment should be employed for seven weeks. W. L. B.

GOUT

The sturdy dogmatism formerly prevalent concerning gout has more recently been replaced by an almost blank agnosticism. We shall adopt here the hypothesis that gout is due to an error of metabolism leading to an incomplete oxidation of the purin bodies by the liver and a consequent deposit of them in the joints and elsewhere as biurate of soda. Associated with this there is a delayed excretion of purins by the kidney. Both these factors must operate; for mere excess of uric acid in the blood from over-production, as in leukaemia, or from simple retention, as in nephritis, does not cause gout.

Purins are bodies containing the group C_5N_4 , and uric acid is tri-oxy-purin. We take purins in our food as—

1. Free purins—the xanthin and hypoxanthin of meat juices and extracts.

2. Bound purins—contained in the nuclei of cellular foods. Liver or sweetbread contain abundance of these, since they have so many nuclei.

3. Methyl purins—the alkaloids of tea, coffee and cocoa.

Even on a purin-free diet the urine will contain about 0.2 gramme of purin nitrogen a day (endogenous purin), which appears to come mainly from the muscles and leucocytes of the body.

Of the ingested purins a large part, varying from fifty to ninety per cent., are normally destroyed by the liver, being oxidized to uric acid and thence to urea; the excreted portion being that which has escaped destruction. The uric acid theory of disease assumes that the body can deal with its endogenous purins but is poisoned by its ingested purins; there is little, however, in the history of purin metabolism to support this. If purins in the food lead either to a uratic deposit in the tissues or to a high purin output, this is a sign of hepatic insufficiency rather than a cause of disease. If in addition the kidneys excrete uric acid badly, there will be excess of uric acid in the blood, while the output of purins in the urine will be diminished. Amid all the confusion that reigns on the subject we can hold to the two definite facts established by Sir Alfred Garrod: in gout there is an excess of uric acid in the blood and before the paroxysm there is a diminished output of uric acid in the urine. The whole reveals a deficiency in the capacity of the body to katabolize purins. The purin that ought to be consumed is not really poisonous, any more than the sugar not consumed by a glycosuric is poisonous, but it has the disadvantage of being but sparingly soluble, and is therefore apt to be precipitated in outlying parts of the circulation, such as the joints and cartilages of the ear, in the form of fine needle-shaped crystals of biurate of soda, with a considerable degree of accompanying inflammation. There is no satisfactory evidence that diminished alkalinity of the blood occurs to favour such deposition.

Etiology and Incidence. That there is hereditary transmission of gout is undoubted; what is not so clearly recognized is that, like hæmophilia and pseudohypertrophic muscular paralysis, the disease, though attacking males, is transmitted most often by the female line. Errors of food and drink play an important part, excess of rich animal foods, containing abundant purins, and alcohol, especially the stronger sweet wines, liqueurs and malt liquors, being largely responsible. Lead poisoning is another important factor. Sedentary habits

play a part, more particularly in those who in earlier life were accustomed to take plenty of exercise.

Men are much more liable to gout than women. During the last ten years there were in the wards of St. Bartholomew's Hospital 114 men and only eleven women suffering from gout. In women it rarely, if ever, occurs before the climacteric. In men the first attack usually takes place between forty and fifty. If its appearance is delayed until later life the attacks will probably be comparatively mild.

Signs and Symptoms. Sometimes there are no premonitory signs of an attack at all, the patient feeling unusually well. In other cases there may have been some digestive troubles, or disturbances referable to the nervous system, such as neuralgia, cramps, depression or marked irritability. There is a remarkable uniformity in the mode of onset. The patient has gone to sleep as usual and is awakened by a severe pain in a joint, most commonly the metatarso-phalangeal joint of the big toe. It is thought that the special liability of this joint is due to its being so frequently injured by the wearing of boots; if the knee or wrist have been injured in any way they may be the first attacked. By the morning the joint has become hot, red, glazed, swollen, œdematous and exquisitely tender. During the day there is some remission of symptoms, to be followed by an exacerbation the next night. This may happen for several nights in succession, but as the swelling increases the pain subsides, and in about a week the attack passes off, and the joint will probably recover completely for the time. As the swelling goes down the skin over it desquamates. The paroxysm is accompanied by moderate pyrexia, scanty high-coloured urine, thirst and anorexia. At first there may be an interval of a year or more between the attacks, but then they begin to recur more frequently, and more joints become involved. The attacks, though perhaps less severe, last longer and recovery is less complete, so that the joints, particularly those of the knuckles, become deformed, and chalk-stones may appear. The skin over them becomes red and thin and may give way. Fortunately under treatment the course of the case may be arrested or its severity diminished, so that a progressive crippling of the joints is avoided. Even without treatment a man may outlive the periodic tendency to attacks. Gout seldom involves other joints beyond those of the big toes, fingers, wrists, ankles, knees and occasionally the elbows, but deposits (tophi) may occur in ligaments, tendons, bursæ, fascial sheaths, eyelids and conjunctivæ and, most commonly of all, in the pinna of the ear. Those in the eyelid and ear are usually painless.

The Blood in Gout. Sir Alfred Garrod's classical experiment served to prove the abundance of uric acid in the blood of gouty subjects. To about two drachms of blood in a watch-glass twelve drops of strong acetic acid are added and a fine linen thread inserted. As the serum is allowed to evaporate slowly, uric acid crystallizes out on to the thread. But even this is not pathognomonic of gout, for it may be found in leukæmia.

The Urine in Gout. During the paroxysm the urine is simply that of a febrile state. Between the attacks the uric acid may be much diminished, but by the second or third day of an attack the output will have risen to normal and may even exceed it: the so-called "uric acid shower." In some people attacks of gravel may alternate with the arthritic paroxysms. In chronic gout the urine is copious, of low specific gravity, pale, nearly always containing less uric acid than normal, and often a trace of albumin.

When we come to the phenomena classed as suppressed and irregular gout there is much less substantial agreement. Almost every condition characteristic of the middle and degenerative periods of life have been thus described, and the evidence that they are really gouty in nature is often quite unsatisfactory. Suppressed or retrocedent gout is a name applied to alarming and often fatal symptoms referable to the alimentary canal (pain, vomiting and diarrhoea), the cardio-vascular system (dyspnoea, palpitations, syncopal and anginal attacks) and the nervous system (headache, twitchings, delirium and coma). They are said to come on as a result of chilling of, or the direct application of cold to, affected joints, and they certainly may be accompanied by a diminution of the local signs. It can hardly be doubted, however, that they are essentially uræmic in character.

Irregular Gout.—The following symptoms have perhaps the best claim to be so denominated :—

(1) *Cutaneous system*—a dry scaly eczema, chiefly attacking the face, forehead, ear and back of the neck; Dupuytren's contraction of the palmar fascia. (2) *Special senses*—episcleritis and conjunctivitis (the "hot, itching eye" of gout), iritis and perhaps glaucoma. (3) *Nervous system*—migraine, neuralgia, neuritis and sciatica. (4) *Respiratory system*—chronic bronchitis and asthma. We may observe that true spasmodic asthma is more likely to occur in gouty families rather than in patients with gout. Any one who has chronic bronchitis long enough will become emphysematous, when a secondary asthma is liable to follow. From implication of the heart or kidneys so-called cardiac or uræmic asthma may result, which is, of course, an entirely different thing. (5) *Circulatory system*—Gout may set up chronic

interstitial nephritis and atheroma, with their attendant effects upon the cardio-vascular system, and it is to these changes rather than to gout itself that many of the symptoms should be referred. Systematic records of the blood pressure in these conditions would help very much to elucidate their true character. Recurrent phlebitis, especially in the legs, is often attributed to gout, and may lead to pulmonary embolism. (6) *Digestive system*—"Bilious attacks" are common, in which the tongue is furred, the breath offensive, and the bowels constipated; the liver is said to be sluggish, but certainly some of these attacks are due to *B. coli* infections, as are the "gouty" cystitis and urethritis. (For "gouty" glycosuria see the article on *Diabetes*.)

Prognosis. This depends on whether cardio-vascular changes or chronic interstitial nephritis ensue. If so, the prognosis as to duration of life is that of these sequelæ. In their absence gouty subjects may be long-lived, and the attacks tend to lessen as age advances.

Diagnosis. In any case of arthritis due regard must be paid to a past or family history pointing to gout and to the presence of tophi in the ears. Woolner's marks and little sebaceous cysts must not be mistaken for tophi. If necessary they may be pricked, when a tophus will yield, if recent, a drop of milky fluid full of needle-shaped crystals, or a felt-work of crystals if of longer standing. True rheumatism occurs in much younger subjects than gout, and is a multiple fugitive arthritis chiefly attacking large joints, which are not red or oedematous and do not desquamate on resolution. The presence of cardiac complications and of profuse acid sweats will also help to settle the question. If the arthritis remains limited to the big toe joint the only mistake that is likely to occur is to attribute a pyæmic or gonorrhœal infection to gout. But in the former case the graver constitutional state and the rapidity of the pulse will lead to a careful search being made for evidence of a septic focus. Gonorrhœal infection is only likely to cause mistakes when it is monarticular. It will probably go on to ankylosis or hydrarthrosis, and the surrounding tendons and fascia are often involved. Once suspicion is aroused, threads will be looked for in the urine and the diagnosis established. Gout might be confused with rheumatoid arthritis when it attacks a number of joints and runs a very chronic course. The previous history, the presence of tophi and the effect of treatment will usually clear up the question. Heberden's nodes and ulnar deflection point to osteo-arthritis. Gouty swellings on the last joints of the fingers which might be taken for these nodes are, however, generally asymmetrical. The X-ray appearances characteristic

of these diseases are described to me by Dr. A. C. Jordan as follows:—In gout "punched-out" areas are seen in the affected bones; in rheumatoid arthritis there is a rarefaction of the cancellous tissues in the ends of the long bones of the forearms, metacarpals and phalanges, and in the corresponding bones of the leg. The wrist bones are rarefied and look as if they were fused together. There is thickening of the periarticular tissues. He does not attach diagnostic significance to Bruce's nodes. Osteoarthritis can be distinguished by the erosion of the ends of the bones and the presence of osteophytes. Difficulties may arise from the fact that gouty joints not infrequently show the changes of rheumatoid arthritis as well.

Treatment. 1. *Of the Gouty Paroxysm.* Besides the general treatment suitable to a febrile state, the affected joint should be raised and protected, and the following lotion applied quite warm: an ounce each of tr. opii, sod. bicarb. and glycerine in twelve ounces of water. Cold applications to, or leeching of, the joints is to be avoided. Internally nothing is so effective as colchicum; we do not understand its action, though it may be noted that it causes a temporary diminution in the number of leucocytes, and therefore in the production of endogenous uric acid. The subsequent return of the leucocytes would account for the failure of the drug to exert a prolonged influence. Ten minims of the vinum colchici or the tr. colchici semin. should be given every four hours for a few days. It is usually combined with ten grains of carbonate of magnesia or salicylate of soda. The action of the latter drug is discussed later. Caution must be exercised with colchicum, as it causes faintness or purging in some patients. Potassium citrate is often useful as a diuretic which also renders the urine less acid. If colchicum cannot be borne and salicylates are ineffective, a mixture of iodide and bromide of potassium may be tried. Citarin, a compound of formaldehyde and citric acid, in doses of fifteen to thirty grains three times a day, has been recommended. It is incompatible with alkalis. If the kidneys are sound ten to fifteen grains of Dover's powder may be given at night. It is well to avoid all meat, meat juices and alcohol during the acute stage.

2. *Of the Gouty State.* The gouty subject should be encouraged to take up some form of outdoor exercise and sufficient occupations to prevent the morbid introspection to which he is prone. Heavy dinners and late hours should be forbidden. As to diet, the amount of purin rather than the amount of protein should be taken into consideration in framing our restrictions. Milk, eggs, cheese, white bread, rice, cabbage, cauliflower and lettuce are practically purin-free. Potatoes contain very little.

The following contain a small amount, *i. e.* up to about four grains of purin per pound: asparagus, peas, beans and white fish. Ordinary meats and salmon contain from six to eight grains per pound, chicken nine, sirloin of beef or rumpsteak up to fourteen, liver nineteen, and sweetbread seventy. It is a common practice to cut a gouty patient off red meats, while allowing him to take white meat. The object presumably is to diminish his intake of purins, but it will be seen from the above figures, which are taken from Walker Hall's analyses, this is hardly achieved by substituting chicken and sweetbread for mutton. It has been asserted in justification, however, that white meats, such as veal, lose their extractives more readily on cooking than do red. Veal broth must therefore be loaded with purins! It is only reasonable to diminish the intake of substances that are not necessary for foods, and which tax the liver to metabolize them and the kidneys to excrete them. Possibly, as with carbohydrates in glycosuria, a restricted purin intake for a time leads to increased tolerance subsequently. Probably gouty subjects are better without alcohol altogether, but this is often a counsel of perfection. Whisky, gin, claret and hock are generally regarded as the least harmful forms of alcoholic beverages for them. They often take insufficient fluids, and should be encouraged to drink water. To achieve this it may be necessary to advise that it be taken in the form of some special mineral water. In that case a water which is not highly mineralized, especially with sodium salts, should be selected, such as Contrexeville, Evian or Vittel. The same principle should govern our selection of a spa. It is true that the therapeutic action of a mineral spring is mainly the water that it contains, but the change of surroundings and habits and the freedom from worry ensure benefits which cannot be obtained from drinking the waters at home. Moreover such places are provided with every convenience for external applications, such as baths, douches, shampooing of the joints and the like. In this country Bath, Buxton and Strathpeffer, on the Continent Gastein, Wildbad, Aix-le-Bains, Contrexeville and Vittel have perhaps the best reputation for the purpose. In addition the sulphurous waters of Harrogate should be mentioned for their further action on the alimentary canal.

Our modified conception of the source and history of the purin bodies should modify our ardour in trying to wash uric acid out of the system, and, as a matter of fact, most drugs have an insignificant effect in this respect. Lithium salts have been much vaunted, but it seems impossible that their claim can be justified. Chemical action is determined both by the mass and avidity of the various interacting bodies,

and also by the law that, in any mixture of acids and bases, if an insoluble salt can be formed it will be formed. What can be the influence of a few grains of lithia in combating all the sodium of the body, which, in addition to having the advantages of mass reaction, forms the less soluble salt? Piperazin has no solvent action even in full doses. Urotropin causes a very slight increase in the purin output. Salicylic acid and its derivatives definitely increase, and may double the output, even in the normal individual on a purin-free diet. This can scarcely be due to washing out of retained uric acid, for in view of its rapid destruction normally by the liver such retention can hardly occur. As there is not a marked loss of weight when salicylates are given, the doubled output cannot be due to doubled breakdown of the tissues. The remaining possibility is that it causes a synthetic production of purins, though there is no direct proof of this. It certainly would be curious if those who are ardently trying to "wash out" uric acid are really increasing its endogenous production. Thyminic acid (solurol) is a more recent addition to the list of "uric acid solvents." There is more theoretical support for this. Minkowski believes that the uric acid is combined with this substance in the blood; the quadriurate is now regarded merely as a mixture of uric acid and biurate of soda. The number of reported successes with the drug remains very small, however, and its use appears to be making but little headway. Atophan is a still more recent addition. That it will in some cases increase the uric acid output extraordinarily is certain, and it is warmly recommended by Weintraud for the treatment of gout. It is put up in 0.5-gramme ($7\frac{1}{2}$ grains) tablets, four to six of which should be given broken up in plenty of water. He advises fairly full doses of sodium bicarbonate at the same time; such as half an ounce on the first day and a drachm and a half on subsequent days. In view of the insolubility of the sodium salts and their abundance in the body, it would appear more rational to give some at least of the alkali in the form of potassium salts. For a similar reason Sir W. Roberts advised patients to restrict their use of table salt, substituting potassium chloride as far as possible. But the alkaline treatment of gout has little experimental evidence in its support. In severe diabetes there is often a definite diminution in the alkalinity of the blood, but this is not the type of glycosuria in which gouty symptoms occur. Sir William Roberts, although he said of himself that "few practitioners had employed alkaline remedies in gout with more determination," finally decided against their utility.

As to local applications, nothing must be

used which is likely to cause the skin to break down. Should this have already happened, warm baths should be employed for the purpose of dissolving out the urates from the exposed tissues. If not, ionization is in my opinion the best local treatment for the affected joints. Lithium salts may be used on the positive pole, and salicylate or iodine on the negative. Dr. Jordan tells me he prefers one to two and a half per cent. solution of sodium chloride on the negative pole, as being less irritating than iodine. A current of five milliamperes per square centimetre of surface should be applied for twenty minutes once a fortnight.

W. L. B.

OBESITY

An undue deposition of fat may be physiological or pathological. Simple or physiological obesity is spoken of as *exogenous* when metabolism is normal and the fat-deposition depends on a relative disproportion between food and work. The food ingested is in excess of the amount required to provide the energy consumed in the production of work, heat and general metabolic processes. It is called *endogenous* when there is no such obvious cause. In such cases there may be an obese diathesis existing as a disease, that is, a constitutional peculiarity consisting of an abnormal cellular activity, a defective protoplasmic metabolism, and inability efficiently to oxidize food.

The existence of endogenous obesity as a true disease is doubtful. It must not be confused with *pathological* obesity, usually acquired, in which the adiposity depends upon disease or some degenerative process. Undoubtedly there may be an endogenous tendency to the deposition of fat in excess, but it is impossible to differentiate as a separate class from simple obesity those cases in which the inherited tendency is particularly prominent.

It can be proved that there is a deficiency in metabolic activity in the obese. Their calorific requirements, and therefore their food supply, are less than those of the normal individual. This deficiency is easily explained by the diminished muscular activity ensuing on increasing body-weight. As the muscles become less active and weaker their metabolism is decreased. In addition, the superincumbent layer of fat acts as a conservator of body heat and reduces the metabolic activity of the heat-producing tissues. Experimental observations on the oxygen consumed and on the total exchange of gases in the obese do not indicate any diminution of cellular activity. Allowing for the bulk of fat, some of these experiments suggest that tissue metabolism is more active. Hence the evidence at present is in favour of

the view that there is no abnormal cellular activity in the obese, and that the deficient metabolism is the effect, not the cause, of the adiposity.

Heredity. In simple obesity heredity is a potent factor. Both racial and familial tendencies to adiposity exist. In quite half the cases of excessive obesity a familial tendency is present. The deposition of fat is not merely a question of diet. Some individuals get fat on a limited diet, while others eat largely and yet remain thin. This tendency is present in domestic animals and is further developed by selective breeding.

Sex. Normally the female exhibits a general deposition of fat. After the climacteric and after ovariectomy this may become extreme or excessive. Apparently the obesity depends on the lack of some constituent derived from the ovaries, for ovarian extract is sometimes beneficial in these cases, though not in other varieties. In the male sex testicular atrophy has a like effect. Animals and birds are castrated because they fatten more readily, probably because of diminished muscular activity, a placid existence and a liberal food supply. Monks and nuns are often fat, but, even assuming that the activities of their sexual organs are in abeyance, their obesity may be the result of a diet in excess of the needs of their sedentary life.

Age. A moderate degree of adiposity is normal in infants, for their food supply is good, their bodily activity small, and they are carefully protected from undue loss of heat. Excessive fatness in the breast-fed is generally due to an excess of lactose, occasionally of fat, in the milk. In artificially-fed babies it is due to excess of cream or carbohydrates, usually some malted proprietary food. Obesity of this type is injurious in that it predisposes to eczema and other skin diseases, bronchitis, and bowing of the legs from undue weight of the body. The vital resistance to acute disease is impaired and acidosis is liable to ensue on anaesthesia. Some of these babies are anæmic, others may be scorbutic. At the period of puberty, especially in girls, obesity is common. It shows that the food supply is sufficient for growth as well as nutrition. If excessive, it is the result of heredity, greediness, eating between meals and the consumption of sweets.

During the period of growth it is difficult to fatten animals. After full growth is attained fat is deposited, if an excessive intake of potential energy in the form of carbon compounds is not counterbalanced by the output of kinetic energy in the form of exercise or work. Up to middle age obesity is infrequent in adults, for life is strenuous and metabolism active. After forty years the adult tends to become less

energetic, more placid in his mode of life, and puts on fat because of reduced metabolism. Increasing age is often accompanied by increased worldly prosperity, greater luxury in diet, possibly more alcohol, and less expenditure of energy in moving from place to place. In old age there may be considerable loss of flesh because of the diminished powers of assimilation.

Occupation and climate affect obesity through the normal channels of metabolism. A diet sufficient in cold weather and for vigorous bodily exercise is too liberal during idleness and hot weather, and the extra food is liable to be deposited as fat. It is rare to see a fat agricultural labourer, for his diet is limited and his output of muscular energy large. Fat brewer's draymen are common, for their work is comparatively light and their consumption of beer excessive.

Pathological or morbid obesity is occasionally seen in children. Boys assume the "John Bull" or "Infant Hercules" type of figure, with deficient hair and enlarged mammae of somewhat feminine aspect. Girls look unduly masculine and have a blotchy skin, bloated cheeks and pendulous mammae. This blotchiness of the skin is not present in simple obesity. Many of these patients have adrenal tumours. The obesity is associated with signs of degeneracy, premature sexual development, precocious puberty, early menstruation, hirsuties and a tendency to gigantism. In "lymphatic infantilism," more common in boys, fatty degeneration is very marked. Up to ten years of age the child develops rapidly and is precocious. He then grows fat but not taller. The mammae enlarge, energy and testicular development are arrested, and the boy becomes a mere bag of fat.

In older subjects pathological obesity is seen in chlorotic girls, in myxoedema, and the fat anæmics of later life. The *thyroid gland* has a powerful influence on metabolism. Its extract causes oxidation generally, including that of proteins, and is consequently a dangerous drug. It increases the consumption of oxygen and the excretion of carbonic acid and nitrogen. Possibly the increased oxidation and wasting in fever is due to increased thyroid activity. In convalescence from infectious fevers and in myxoedema inactivity of the thyroid may be the cause of obesity, but in these states there is inertia, limited muscular activity, and perchance a liberal diet.

Clinically we can differentiate three types:—(1) pathological and degenerative; (2) plethoric; associated with high colour and good circulatory power; (3) anæmic, in which the circulatory powers have failed to a considerable extent, either as a sequel of the plethoric type or the result of disease. The anæmic type may

therefore be the termination of a simple obesity, or may be primarily pathological, as in chlorotic girls and the fat anæmics of later life.

Preliminaries of Treatment. Each case must be treated on its merits. No one system is suitable for every patient. Inquire into the family and past history, and ascertain the patient's habits as to food, alcohol, sleep, work and exercise. Weigh the patient. Make a thorough clinical examination, paying special attention to the circulatory and excretory organs, the general state of health and vigour, and the absence of disease. Examine the urine, for a deficient excretion of urea and uric acid contra-indicates a liberal protein diet.

Principles of Diet. The suitability of the diet depends on its caloric value and variability. Rübner's figures for the caloric value of food may be taken as a basis, viz. protein 4·1, carbohydrate 4·1, fat 9·3. On this basis 100 grammes of fat are equivalent to 227 grammes of protein or carbohydrate. He estimates that a man of seventy kilos (eleven stone) requires 32·9 calories per kilo when resting, and up to 68·4 calories per kilo according to the amount of daily labour; a daily total of 2303 to 4790 calories. Roughly we can allow a man of this weight forty calories per kilo, or 2800 calories daily, and this would be supplied by the subjoined diets—

Ordinary Diet

Calories.	Grms.	Food-stuffs.	Grms.	Calories.
410	100	Protein	120	492
837	90	Fat	150	1395
1640	400	Carbohydrate	170	697
..	..	Alcohol	30	210
<hr/>				<hr/>
2887				2794

Ranke's normal diet consists of meat 240, fat 100, bread 400, water 300-400 grammes; and yields from 2000 to 2500 calories. A diet supplying from 2500 to 3000 calories may be regarded as a normal one, though a smaller or larger amount is needed according to the physique, work and environment, and the effect on the body weight and health. These figures afford a useful basis of computation for the suitable diet of any particular case. Even an extra daily supply of 200 calories, taken in the form of about half a pint of milk, one ounce of butter, two of cheese, three of bread, three to four of meat, or three-quarters of a pint of beer may be stored up as fat. In order to regulate the diet a knowledge of the calorie value of food-stuffs is almost essential.

Diet. All food-stuffs, notably fat, contain carbon. That fat can be derived from protein food is shown by its deposition in carnivorous

Meat, fish and cereals are cooked; vegetables are boiled.

[illegible]

animals, by the fattening properties of nitrogenous foods in feeding cattle, and by the ripening of cheese. It is, however, from fats and carbohydrates that obesity develops, and its treatment consists chiefly in the reduction in these foods. The reduction need not be combined with an increase in the proteins. An excess of protein does not induce increased oxidation of fat, but it may give rise to disordered metabolism and pathological wasting.

No diet is suitable for every patient, or for the same patient under different conditions of life and environment. The rate of metabolism is by no means constant, and obesity is not merely a question of food supply. Considerable reduction of carbon-containing foods may actually increase obesity, through improved digestion, absorption and assimilation. This alone shows that fat-deposition can only take place at a certain rate, and that it does not vary directly with the amount of food. Some people fatten on less food and more quickly than others.

The diet can be limited according to two methods. Thus, the ordinary diet is weighed for a period of one week and the quantities of the various constituents taken in excess are reduced and the patient weighed weekly. In the second method the number of calories of heat suitable for the patient are calculated. Food-stuffs to supply this number of calories are given for a week, and the amount is reduced according to the effect on nutrition and general health.

Mild degrees of obesity can be treated on very simple lines. It may be sufficient for the patient to omit sugar from the diet, taking saxin or saccharin for sweetening purposes. Next reduce the amount of bread, potatoes and other starchy foods. Omit cream and other fats, and allow little butter. Prohibit or limit the amount of alcoholic drinks. Allow no fluids at meals. Finally replace white bread by wholemeal bread, dry toast or biscuit, or partly by gluten bread and other antidiabetic foods. Bulk for bulk toast and biscuits are more nutritious than bread, but they are generally taken in much smaller quantities. Wholemeal bread is less readily digested and assimilated than white bread.

This treatment is suitable for mild cases in people who can live an open-air life, take plenty of exercise, and do not need supervision; for those who must continue their usual avocations; if there is any morbid state which renders rapid reduction inadvisable; and as a preparation for more serious or stricter methods. Many patients are dissatisfied with such simple advice, and will not control their appetite sufficiently to carry it out. They must be given rigid directions as to diet, the nature and amount of

each meal, must weigh the food and keep a record thereof, and must visit the doctor weekly for weighing and for renewed instructions. A mental effect can be produced by greatly reducing the intake of fluid, so that the loss of weight may be considerable at first, though there is little actual reduction in fat and there are certain disadvantages. Payment in advance of a high inclusive fee for treatment generally induces patients to carry out the prescribed measures efficiently. Unfortunately favourable results are often temporary, for the obese seem less able than the ordinary individual to resist the pleasures of the table, particularly if they are self-indulgent members of the richer classes. Hereditary cases are least susceptible to dietetic treatment.

Special Diets. Many diets have attracted attention by their originality. Some are absurd, useless and even dangerous. In all the chief characteristic is the reduction in nutritive value. They are starvation cures of more or less severity. Among these may be mentioned more particularly Banting's diet and the Salisbury treatment, in which large quantities of meat are taken and a severe strain is thrown on the tissues, of protein metabolism and nitrogenous excretion. These are described in my article on "Obesity" in *A System of Diet and Dietetics*, edited by Dr. G. A. Sutherland. In urgent cases and in fat anæmic women complete rest in bed, milk and massage can be tried. Skimmed milk is added to the ordinary diet and gradually substituted entirely for it. The quantity is reduced until the patient loses about eight ounces daily. The pulse, temperature and weight are carefully watched, and the diet increased if necessary. Another *milk cure* can be carried out as follows. The normal weight for the patient is estimated as equivalent in kilos to the number of centimetres above 100 cm. of height. Thus a patient weighing 100 kilos and 170 cm. in height is estimated as having a normal weight of seventy kilos. The number of calories required per kilo in bed is sixteen to seventeen. One ounce of milk yields twenty calories. Therefore such a patient requires 70×16 or 17 calories, which is supplied by three to four pints of milk. The treatment is carried out for five to eight days. It is suitable in heart disease, nephritis, gout and glycosuria.

When special directions are needed for well-marked obesity I am in the habit of recommending the following diet. If the patient is put on to this without any previous reduction in his food supply he should be kept in bed.

A Special Diet

7.0-7.30. One orange, apple or pear. Half a pint of hot water or very weak China tea, without sugar.

8.0–8.30. Tea, five to eight ounces; milk, half an ounce; saccharin if desired. One or two boiled or poached eggs. Dry toast or bread, one to one and a half ounces. Butter, quarter of an ounce.

11.0–11.30. Clear soup or butter-milk, eight to ten ounces.

1.0–1.30. Cold fowl, game, lean meats, ham or tongue, hot lamb cutlet or sweetbread, three to four ounces; salad, one ounce; Dutch cheese, quarter of an ounce; celery, radishes, etc.; rye, brown, bran or gluten bread, one half to one ounce; butter, half an ounce; fresh fruit or water, four to six ounces.

4.0–4.30. A large cup of plain tea with a dessert-spoonful of milk; one piece of dry toast, or bread and jam, or eaten with lettuce, mustard and cress, or tomato.

7.30. Clear soup, four ounces; fish cooked without fat, or any kind of meat, game or poultry (except pork), four to six ounces; green vegetables of a caloric value under five per ounce *ad lib.*, or smaller amounts of those with a higher calorific value, say one to two ounces; farinaceous pudding, three to four ounces; water melon or the cooked unsweetened fruit out of a tart; dry toast or some kind of bread, one ounce; butter, quarter of an ounce; water, four to six ounces.

Bedtime. Half a pint of hot water.

If white bread is used in the above diet the caloric value varies from a minimum of about 1100 to a maximum of about 1500. The chief protein foods are rather high, varying from eight and a half to ten and a half ounces. Ranke's diet (p. 13) is simpler and is easy to regulate, but its sameness renders it unpalatable after a short time.

If eggs are disliked, they can be replaced by grilled fish. If nitrogenous excretion is defective, if the patient is not fond of meat or can do with less, or if satisfied with a more vegetarian diet, the meat is reduced in quantity at the evening meal and omitted at the midday meal, a liberal helping of cooked kidney beans, celery, onions, cabbage and such-like being given instead. Green vegetables and many fruits can be given freely, for they are comparatively innutritious and help to satisfy the appetite. The nutritive value of vegetables is lowest when they are boiled and the fluid drained away. This applies particularly to the tubers, many of them rich in carbohydrates, which are dissolved out by hot water or weak saline fluids. Fats and carbohydrates can be allowed more freely to the plethoric than to anæmic and hydræmic patients. Salads should be made with lemon-juice, without oil.

Alcohol and other Fluids. Except in hydræmic cases there is no rational reason for reducing the fluid ingesta. A drink of plain water ten

minutes before a meal helps to satisfy hunger. When a patient is taking a liberal amount of protein it is advisable to allow plenty of fluid. Aerated and other mineral waters are permissible. The omission of fluids with meals leads to more efficient mastication and more ready satisfaction of the appetite. *Alcohol* is a fat-sparer and should be avoided, unless necessary for other reasons. Malt liquors are very unsuitable, for they contain carbohydrates, e.g. five to eleven per cent. in Allsop's lager, cider, champagne, perry and stout. Dry hock, Moselle and claret are the most suitable wines.

General Directions. Meals should be small and numerous to prevent great hunger. The patient must satisfy his appetite with foods of little nutritive value, such as fruit and vegetables, picking out from the table (p. 13) those of small caloric value in preference to those yielding more heat units. He must masticate slowly, for hunger is thus more easily appeased. He must avoid sugar, an ordinary lump yielding fifteen to twenty calories, and must not use milk as a drink. Clear soups, meat extracts, tea and coffee are stimulating and innutritious. They may be taken freely, if there is no renal inadequacy or objection to purins.

After weighing the different foods for a few days an intelligent individual can estimate sufficiently accurately what are the amounts ordered. Rigid accuracy is not essential, for the conditions of life vary from hour to hour and day by day. It is advisable to keep to a simple diet with comparatively little variety, for variety stimulates appetite. A loss of four to eight ounces daily is quite sufficient, and as soon as the weight has reached to about two per cent. above the normal weight the strict diet can be modified. Subsequently the patient must keep within reasonable limits.

Exercise. Accumulated fat is got rid of by exercise. At first this must be moderate, because the heart is often enfeebled through being overloaded with fat. Rest in bed must be limited to seven to eight hours.

Purgation. Saline cathartics and the aperient waters of health resorts act chiefly as starvation cures. They are useful at the beginning of treatment of plethoric patients, many of whom keep well for years on an annual course of spa-treatment. The effects are temporary, if the patient feels weakened and builds himself up by liberal diet after the cure.

Drugs only reduce weight by impairing the digestive functions or disturbing metabolism. Thyroid extract is dangerous and should never be employed. Most advertised remedies are useless and harmless, containing bladder-wrack or common seaweed (*fucus vesiculosus*), citric acid, sulphur and pot. iod., and even thyroid extract.

The successful treatment of obesity can be summed up as consisting in a suitable diet, exercise and self-restraint. Up to the age of twenty years eat as much as you can; from twenty to forty years of age eat what you want; after forty years reduce the intake of food gradually to a minimum compatible with health.

E. C.

RICKETS

Rickets is one of the commonest diseases of early life. The chief age incidence is between the seventh month and the fourth year. It occurs in all ranks and classes of society, and is largely to be traced to a faulty diet in infancy. As a rule rickets develops at an earlier period amongst those who are artificially fed than amongst breast-fed infants. If the mother's milk is good and plentiful the risk of rickets arising during normal lactation is very small. Amongst the poor the cheap patent foods, tinned milks and other faulty methods of feeding due to ignorance or carelessness are largely responsible for the frequency of rickets. Among the well-to-do the pseudo-scientific methods of infant feeding, to be learned in the advertisement columns of the daily press and in pamphlets circulated broadcast by proprietary food manufacturers, and characterized by a total neglect of simple fresh food, have proved attractive to mothers.

While the food factor is undoubtedly the most important in the etiology of rickets, there are other causes to be reckoned with. One of these is the absence of fresh pure air and sunlight. In city life the infants suffer from the absence of sunlight and of fresh air in the crowded tenements. The infant gets little out-of-door life because there is no one to take it out. In the northern parts of Scotland, amongst the highlands and islands, there is a popular belief that an infant should not be out of doors until it is a year old. This means that for twelve months the infant lives in a room laden with peat smoke, with no ventilation, as the windows only admit light and not air, and with a crowded population consisting often of many of the domestic animals as well as the rest of the family. Under such surroundings it is not surprising to find that rickets of a most marked type is quite common. From his experimental work on animals Dr. Leonard Findlay came to the conclusion that confinement, with consequent lack of exercise, was the main factor in causing this disease. The absence of lime salts and of phosphorus salts from the diet has often been regarded as a cause of rickets, but this view does not now obtain much credence in England, although it is still held on the Continent. Acute illness in

infancy will certainly predispose to rickets, more especially illness injuriously affecting the alimentary canal. Even when the food is wholesome, if it cannot be absorbed and assimilated by an infant, rickets will probably develop. Constitutional disease like syphilis predisposes to rickets.

Rickets is much more than a disease of the bones. It is a disease of the whole system in which the bones, the muscles, the ligaments, the nervous system, the blood, the mucous membranes and the functions of various viscera are impaired. The manifestations of the disease vary in different cases; in some the brunt of the illness apparently falls on the nervous and in others on the osseous system. Possibly this may be due in part to the patient's individuality or the character of the soil, and in part it may be due to the predominance of one or other causal agent, whether absence of fatty or excess of carbohydrate food, or deficiency in fresh air and sunlight. It is important to remember that a rachitic infant is an enfeebled infant, of poor vitality, of lowered resisting power, liable to develop intercurrent diseases and badly fitted to throw them off.

The appearance of the patient will often belie this statement. Up to a certain point a baby with rickets may be a fat, rosy, smiling, and bright infant, the pride of its parents and the prize-taker at a baby show. Active symptoms of the disease are only in abeyance and appear later. Many rachitic infants are fat, but this is usually due to an excessive amount of carbohydrate food in the diet, which gets stored up as fatty tissue of a particularly flabby and useless character. Many others are thin and wasted and show marked signs of malnutrition. The muscular weakness which accompanies this disease is a striking and often an early symptom. A condition of amyotonia develops which may be mistaken for actual paralysis. The muscles feel soft and flabby and are incapable of any powerful movements, so that even sitting up is exhausting. At the same time the ligaments become soft and lax, and a condition of hyper-flexibility is present in the joints which allows of many abnormal movements. Thus one can frequently place the feet of a rachitic infant behind its head without causing any pain or discomfort. Skin eruptions are not specially marked, save in the form of sudamina from excessive sweating. Night sweats, especially about the head, are very common. The infant gets hot in bed, sleeps restlessly, kicks off the bedclothes, and tosses about a great deal. Dentition is usually delayed, often markedly so. At eleven or twelve months the child may not have cut a single tooth; or perhaps two have been cut, and then an interval of three or six months elapses before

another appears. The effect of rickets on dentition will vary with the acuteness of the affection and the age at which it occurs. Anæmia is usually present and in some cases is very marked. Blood examination shows a diminished amount of hæmoglobin and sometimes an increase of leucocytes. Dr. Leonard Findlay, however, regards such a condition of anæmia as being due to purely adventitious causes, as in cases of uncomplicated rickets he found the amount of hæmoglobin and the number of red cells in excess of the normal average. The general appearance of a patient suffering from fully developed rickets is very striking. The head is large, the abdomen is much distended—the so-called “pot belly” of rickets—the thorax is small and depressed laterally, the epiphyses at the lower ends of the forearms and legs are markedly enlarged, the long bones of the extremities are bent, and the spine is probably curved at the lumbar region. As the disease is essentially a chronic one, these changes take some time to develop, and in the present day diagnosis and treatment have usually been carried out before the patient has reached such an advanced stage of the disease.

In the diagnosis attention should be paid to the early signs of the disease, which are easily overlooked by parents. Perhaps the earliest changes are those associated with the alimentary system. A condition of gastro-intestinal catarrh is present, associated with fermentation of the bowel contents. This is often the result of overfeeding, of too frequent feeding, or of improper food. The stomach and intestines become distended with gas and the abdomen enlarges. Attacks of diarrhœa alternating with constipation tend to occur. The motions may be pale, offensive, and contain an excess of mucus and undigested matter. The whole process of digestion, of vital importance to a growing infant, is seriously interfered with, and the food materials which are absorbed and assimilated are not the normal products of digestion, and in time come to be actually toxic. The impaired organs may become incapable of dealing successfully with such parts of the dietary as are wholesome and nutritious. It may also be that the diminished amount of protein and fat in the food leads directly to imperfect function on the part of the liver and gastro-intestinal glands. The symptoms of chronic intestinal catarrh in an infant should always suggest the possibility of early rickets and lead to a careful examination as to the whole dietary employed. As regards enlargement of the spleen in rickets, a much-discussed point, there is no evidence that the disease *per se* directly affects the spleen. On the other hand, the spleen may be enlarged and palpable, as it is in many cases of gastro-intestinal disorder

in infants, or it may be displaced downwards from sinking in of the chest walls and thus appear to be enlarged.

The nervous system is particularly affected in rickets. Sometimes the children are remarkably bright and intelligent, even precocious, but this is but a temporary condition. It may be due to certain toxins of a stimulating nature absorbed from the alimentary canal. The tendency in rickets is towards a marked instability of the nervous system, which manifests itself in three characteristic forms, namely convulsions, laryngismus stridulus, and tetany. The great underlying cause of symptomatic convulsions in infancy is rickets. Some exciting cause of an attack is usually present, and this is most commonly found in an acute disturbance in the stomach or bowel. Children who cut their teeth with convulsions are usually rachitic. Any local source of irritation, such as cystitis or worms, may start a convulsion, and acute disease is much more frequently ushered in by a series of fits in rachitic than in healthy children. Attacks of spasm of the larynx, known as laryngismus stridulus, are not uncommon. They may occur at irregular intervals without definite cause, or may be constantly excited by the slightest disturbance, such as crying or feeding. In some cases they become chronic and will continue to recur for months. As a rule there is a definite inspiratory stridor with some dyspnoea and cyanosis. In severe cases the obstruction to the entrance of air into the larynx and the accompanying cyanosis may constitute a real danger, and deaths have occurred during an attack. Tetany is manifested by carpo-pedal contractions, swelling of the backs of the hands and the feet, and a varying amount of pain from the contractions. Sometimes the pain may be severe and persistent. Tetany is usually an intermittent form of attack, lasting for a few hours or days, but occasionally the attacks are more prolonged. It is specially associated with the dilatation of stomach and bowel to which reference has been made, and is usually ascribed to the absorption of certain toxins from the alimentary tract. These nervous phenomena of rickets may be present in slight as well as in severe cases, according as the nervous system happens to be affected. In all prolonged and severe cases of rickets the tendency is for the nervous system to become more and more enfeebled and delayed in its development.

The bone changes in rickets form a striking and important feature. There is an increase of growth in the cartilaginous and membranous parts, accompanied by a softening of the periosteal deposits and a diminished deposition of lime salts. The skull is large and somewhat

square in shape. There is frequently enlargement and bossing in the frontal and parietal regions, of a more diffuse character than the localized nodes which occur in the same regions in syphilis. Although thickened, the bones of the skull are softened, so that on palpation they may be depressed with a crackling sensation like that of parchment. This diffused softening is to be distinguished from the craniotabes of syphilis, in which small areas of bone become thinned out in the frontal and parietal regions. The anterior fontanelle is usually late in closing and may even be considerably larger than normal. Around the edges of the fontanelle the bone can be felt to be thickened, whereas in syphilis one finds the edges of the bone rather thinned out. The sutures may show delayed ossification or may even become loosened again by the softening of the skull bones. An angular curvature of the spine in the dorso-lumbar region is often present, due to the softening of the vertebræ and ligaments and the weight of the skull. There is no actual fixation of the vertebræ, and the curvature disappears on laying the child flat on its face. The ribs are markedly softened and become altered in shape. The thorax shows a definite sinking in on each side where the ribs have been depressed by atmospheric pressure, and the sternum appears to be more prominent than usual. The lower ribs are usually everted and prominent from the intra-abdominal distension present. This gives the thorax the appearance of having a circular constriction in the centre and an expanded portion above and below. As a result the capacity of the thorax is considerably diminished and the heart and lungs have to accommodate themselves to much-restricted surroundings. The ribs show marked enlargement at their anterior ends, producing the "rickety rosary," which is, however, much more marked internally than externally. Fractures of the ribs are easily induced by slight violence or even by pressure. The long bones of the extremities show considerable enlargement of the epiphyses and softening of the diaphyses. As the result of this softening the shafts of the bones easily become bent, and the process of bending is often accompanied by fracture of the greenstick variety. Deformities of the limbs follow from the bending of the bones. These deformities are most evident in the lower extremities, where bowing of the femora and the tibiæ is commonly met with. Genu valgum, genu varum, and genu recurvatum are usually the result of rachitic changes in the bones, along with laxity of ligaments and tendons and muscles. Although the long bones are markedly softened they are not painful or tender in pure rickets, and if this symptom be superadded it is probably due to scurvy

or to some local inflammatory condition. A rickety child may be able to walk up to a certain stage of the disease and then "goes off its legs," as the mother expresses it. This is due to the progressive muscular weakness added to the bony softening, and the weak pedestal has become unable to bear the weight of the superstructure. The deformities in the upper extremities are much less noticeable and are due chiefly to traction of the muscles on the softened bones, but if the child is crawling about and resting its weight on the arms the deformities may be much increased, the humeri, radii and ulnæ being greatly bent.

The preventive treatment of rickets consists in the employment of a proper diet, and of a plentiful supply of fresh air both when the infant is indoors and out of doors. The conditions in the dietary which call for special attention are that the carbohydrate element should not be in excess and that the fatty element should not be deficient. The various forms of condensed milk when diluted for use are notoriously deficient in the matter of fat. The tinned starchy foods contain an excess of carbohydrate material as commonly used.

The curative treatment of rickets will be considered under various headings.

1. *Home surroundings, dress and exercise.*

As fresh air is most essential the home ought to allow of thorough ventilation. The nursery and bedroom should be at the top of the house, as large as possible, and with windows which open well and are kept open. The sides of the cot should be open, so that the infant may always be breathing fresh air. The bedclothes should be warm and light. To check the profuse sweating about the head, a small, firm, pillow stuffed with horsehair should be used, on which the head rests without sinking deeply in. In order to avoid a chill from exposure on kicking off the clothes at night, a common act in rickety children, the patient should wear a long flannel nightdress, which is fastened round the neck and the wrists, and below the feet. During the day the abdomen and lower extremities should be specially protected from any danger of chilling. Baths and massage are very useful. For a rachitic infant under twelve months a bath temperature of 90° is suitable, and after that age 80°. Rickety children ought to be out of doors most of the day in fine weather. A perambulator in which they can lie at full length is the best means of locomotion, and in this a hot bottle may be placed in very cold weather. As plenty of sunshine is essential for rickety infants and is difficult to obtain in large cities, a prolonged residence in the open country or at the seaside will often be necessary to complete the cure.

2. Food and feeding.

Breast-fed babies do not develop rickets unless they are fed so frequently as to cause chronic indigestion, or the mother's milk is impoverished, or lactation is too prolonged. In hand-fed babies rickets is almost invariably associated with a deficient supply of fresh cow's milk and an excessive use of tinned foods. It is therefore advisable to order a diet containing from one to two pints of fresh cow's milk daily, according to the age of the child. This is suitably diluted with plain water or barley water, a pinch of salt is added to each feed, and half a teaspoonful of sugar or extract of malt. After the age of nine months some extra nourishment may be added, in very small quantity at first, and the motions must be carefully observed in order to see that the food has been thoroughly digested and absorbed. At the age of twelve months the dietary may contain the following: milk and egg, gravy and bread-crumbs, well-mashed potato with milk and salt, gruel and oatmeal porridge, stewed apple, and rice, sago or tapioca pudding made with milk. At eighteen months a little pounded fresh fish or chicken may be added. In all cases the addition of some fatty material in the form of cream (half an ounce thrice daily) or, in the case of older children, fat bacon, is distinctly beneficial. The regularity of the meals must be attended to; a child of from nine to fifteen months of age may be fed every three hours by day and once during the night; after that age every four hours by day and not at all during the night.

3. Medicinal treatment.

The chief drug, and in many cases the only one employed, is codliver oil, which ought to be classed amongst the food materials. It is usually prescribed in the form of an emulsion, each drachm of which contains half a teaspoonful of pure codliver oil, and half a grain of hypophosphite of lime and of hypophosphite of soda. The dose for an infant under nine months is half a drachm thrice daily, and after that age one to two drachms. Equal parts of codliver oil and malt extract make a palatable and useful mixture. The oil treatment must be prolonged for three or six months at least, with intermissions during very hot weather. Phosphorus in doses of $\frac{1}{160}$ grain in a drachm of codliver oil is recommended by continental writers. The loss of the lime salts from the tissues generally has led to the prescribing of these salts in rickets, but it is probable that a proper diet contains as much lime as an infant can assimilate. Before the employment of codliver oil can be successfully carried out the alimentary canal will often require attention, owing to the existence of catarrh and flatulence. One grain of grey powder may be given at night

for a few days and accompanied by the following mixture:—

Tr. Rhei . . .	℥ i ss
Tr. Nuc. Vom. . .	℥ i ss
Sp. Ammon. Arom. . .	℥ ii
Sp. Chlorof. . .	℥ ii
Aq. ad.	℥ i
	Sig. 5 i t.d.s.

4. Complications.

The more severe forms of *convulsions* are usually associated with prolonged intestinal disorder and the milder with some temporary local irritation, acting reflexly on the weakened nervous centres. All possible sources of peripheral irritation, such as diarrhœa or constipation, intestinal worms, inflammation of the middle ear, adenoids, dysuria, etc., must be looked for and relieved as speedily as possible. Lancing the gums for teething convulsions is seldom either necessary or beneficial. The bromides and chloral hydrate are useful in checking the convulsions, and in the more severe and prolonged forms the inhalation of chloroform may be called for. *Diarrhœa* is a frequent complication, especially in hot weather. A very spare diet is necessary during an attack; calomel and castor oil are useful in the early stages, and later a mixture containing bismuth and bicarbonate and sulphocarbonate of soda may be given. A warm flannel binder round the abdomen is very essential for rickety patients who are subject to diarrhœa. *Bronchitis* is the characteristic affection of these patients in the winter months. An acute attack is to be treated on general principles, but the tendency to recurrent attacks will not be eradicated until the patient is taking a full amount of fatty diet including codliver oil. The preventive treatment of *bony deformities*, while the bones are still soft, is very important. The patients should not be lifted by the arms, or carried about with their limbs doubled up, or carried at all by other children. If there is spinal weakness, the patient is to be kept lying on his back, and massage of the spinal muscles is to be employed twice daily. If he is beginning to walk, he must be kept entirely off his feet as long as the bones are soft. This is accomplished by the application of splints. Two wooden splints, well padded, are applied to each leg, one on the outside and the other on the inside, and firmly bandaged. The splints should extend to the top of the thighs and project for at least six inches below the feet. This will prevent the child's walking, but care must also be taken that he does not propel himself along the floor by means of his arms, or else they will become bent. The splint treatment is also to be employed for knock knees or bow legs as long as the bones are soft, but after they have become

hardened in a deformed position osteotomy is the only treatment. It is often very striking and surprising to observe deformed limbs restored to their normal outlines if efficient medical treatment and rest are employed while the bones are still soft—that is to say, during the first five years of life. The thoracic deformity cannot be remedied by direct treatment. For the improvement of this condition it is important to maintain the lungs in as healthy a condition as possible, and to remove any obstruction to the free entrance of air into the chest. Respiratory exercises cannot be taught to young infants, but by applying a firm bandage to the abdomen costal breathing may be encouraged.

Cases of “congenital” or “fœtal rickets” have been recorded in the past, but further evidence has shown that all such cases were really examples of achondroplasia or osteogenesis imperfecta. There is no reason to believe that rickets is ever congenital, although the signs may be developed in exceptional cases as early as the third month. Another form is known as “late” or “retarded rickets,” and appears between the ages of ten and seventeen years. The characteristic feature here is the bony change, which appears to be indistinguishable from that of ordinary rickets, but it is specially marked in the long bones of the extremities, and frequently appears as an isolated lesion. The affection may lead to extensive bony deformities calling for surgical treatment. In many cases rickets had been present in early childhood, and in others had never entirely passed off. So that there is really a recrudescence of disease. Along with the local surgical treatment the general health of the patient must be attended to and built up by a generous diet and tonics. G. A. S.

SCURVY (SCORBUS)

Since the introduction in 1795 of the use of lime-juice for the prevention of scurvy, this former scourge of seafarers has practically disappeared. Only under very exceptional circumstances does the disease ever arise now; it has become one of the rarest in English medicine.

Etiology. It appears clear that scurvy cannot be regarded as due to an infective agent (Berthenson), nor to the ingestion of tainted food (Jackson and Harley). The disease is certainly of dietetic origin and is due to some omission in the diet. The absence of vegetable food appears to be the chief cause of scurvy in the adult, and may be regarded as “the primary and in most cases the only cause” (Johnson Smith). As to the nature of the antiscorbutic element in vegetable food there are many views. Garrod regarded scurvy as due to potassium

starvation; Immermann attributed it to deficiency of potassium in the tissues, secondary either to potassium starvation or to faulty assimilation of food. Ralfe thought that the diet produced a diminished alkalinity of the blood, leading to dissolution of the red blood cells and hæmorrhage; a view further elaborated by Wright, who regards an acidosis as the basis of the disease. Holst and Frölich hold that the antiscorbutic value of vegetables is due to their freshness, and regard some “fresh element” of the diet as all-important, neglecting the chemical constituents of the food. Some of these theories, none of which is entirely satisfactory, reappear in the discussion of the causation of infantile scurvy (*q. v.*).

Symptomatology. The disease commences with the gradual development of wasting, weakness and pallor. Soon the gums become swollen, spongy and bleed easily; the teeth may become loose. The tongue is red and swollen, the breath offensive, and hæmorrhages appear beneath the mucous membrane of the mouth. Hæmorrhages occur also in the skin, particularly of the legs. These may be petechial, but may be so extensive as to cause swelling. In severe cases subperiosteal hæmorrhages occur, which may break down and ulcerate. “Scurvy sclerosis” is the term applied to a brawny indurated condition due to an infiltration of blood into the muscles and subcutaneous tissues. Oedema of the ankles is common. The tendency to bruising on slight injury is marked. Bleeding from the mucous membranes, apart from that of the gums and epistaxis, is uncommon; hæmoptysis, hæmatemesis, *melena* and hæmaturia may occur. Albuminuria is frequent. The joints may become swollen and tender. Necrosis of the bones may occur in very severe cases.

The cardiac action is enfeebled and irregular; syncopal attacks are common. Mental depression and (in the last stages) delirium occur.

Diagnosis. Except for its extreme rarity scurvy in adults is easily diagnosed by the history, appearance of the patient and the reaction to treatment. It may be mistaken for some form of purpura.

Prognosis. With accurate diagnosis and correct treatment the outlook in scurvy is favourable and the disease is now seldom fatal. Cardiac failure, gradual or sudden, is the greatest danger, while a few cases die from bleeding into serous cavities, or meningeal hæmorrhage.

Treatment. The regulations requiring all vessels to carry a supply of antiscorbutic substances have abolished scurvy from the Royal Navy and mercantile service.

The curative treatment of scurvy consists in the administration of the juice of two or three lemons daily, together with a diet rich in

fresh meat and vegetables. In severe cases scraped meat, milk and lemon-juice should be given, and as the appetite improves more food allowed. The stomatitis may be treated by a

mouth-wash of potassium permanganate or dilute carbolic acid. The gums may require to be painted with a strong solution of silver nitrate.
R. M.

DISEASES CAUSED BY OTHER THAN BACTERIAL AGENTS

HEATSTROKE, SUNSTROKE AND EFFECTS OF HEAT

LEONARD ROGERS has greatly simplified our ideas on this subject by dividing the cases into two main classes—

1. Those in which a syncopal attack occurs as a result of direct exposure to the rays of the sun, or to hard labour during great heat. In these cases there may be no marked elevation of temperature, and recovery nearly always takes place under suitable treatment, with or without some permanent mental injury, this occurring particularly in those produced by the sun's rays.

2. True heatstroke, in which hyperpyrexia, with acute congestion of the lungs, comes on suddenly, usually without actual exposure to the sun's rays. This is due to exhaustion of the heat-regulating centre, which has to strike the balance between the heat produced or received and the heat lost by the body. An objection to this simple explanation has been raised that the incidence of heatstroke does not vary directly with the actual temperature, and an unknown microbic infection has been postulated. But there is another important factor to be considered, and that is the humidity. It is well known that a moist heat is more trying than a dry heat of even higher temperature, because evaporation does not occur nearly so readily in the former condition.

Fatal cases of heatstroke scarcely ever occur until a maximum air temperature about equal to that of the human body is reached, and then only when a high degree of moisture is present. If we take into account the degree of saturation of the air with moisture as well as the actual temperature, the incidence of heatstroke is simply explained without reference to any more recondite factor. In India, Rogers states that the absence of cases reported from certain exceptionally hot districts is merely due to the absence of the British army from those districts, for if during a war troops are sent there, severe and fatal cases of heatstroke occur. The prevalence of cases during heat-waves and their onset during the hot afternoon are additional evidence in the same direction. The liability of unseasoned people is simply due to lack of prudence from inexperience; long residence in the tropics does not lessen the

predisposition to the disease. Indulgence in alcohol increases the liability to it and the mortality from it. Any previous debilitating illness markedly increases the chances of contracting it.

Signs and Symptoms. At first there may be headache, listlessness and drowsiness. Longmore called attention to a desire to micturate freely as a premonitory sign, the kidney apparently taking on a function relinquished by the skin, which at this stage becomes hot, dry and burning. Then faintness, oppression and giddiness come on, and the temperature rises rapidly, reaching 109° or 110° F. The pulse is rapid and feeble, respirations are increased in frequency and are often stertorous. In severe cases there is cyanosis, which is of bad prognosis. Signs of oedema of the lung come on rapidly. Consciousness is lost, as it always is with so great an elevation of temperature. There is usually incontinence of faeces, and vomiting is likely to occur either in the early stages or during the recovery of consciousness. If rigidity or convulsions occur the outlook is grave. Recovery may take place after hyperpyrexia reaching 108° or 109° F., as a result of suitable methods of heat abstraction, but a very important factor in prognosis is the time at which treatment is begun. Thus, in Rogers's statistics the average duration of unconsciousness before treatment was begun was 3·5 hours in the fatal cases and 1·3 hours in those that recovered. After the temperature has been brought down by cold applications a low form of fever is commonly seen for a few days, as the heat-regulating mechanism requires time to recover completely.

Treatment. The two indications are (1) to lower the body temperature, and (2) to stimulate the flagging circulatory and respiratory systems. This is accomplished by the cold bath, accompanied by cold affusions to the head and chest, which also help to stimulate the affected centres. Or the ice-pack may be used instead of the cold bath. As soon as the rectal temperature falls to 103° or 104° F., cold applications should be discontinued, the patient dried and put to bed with warm bottles to lessen shock. If the temperature continues to fall, and especially if sweating starts, a favourable issue may be expected. If, on the other hand, the temperature rises again the

affusions must be repeated, and the prognosis becomes much more grave. Cold water enemata may also be of value, and artificial respiration should be resorted to if necessary. Digitalis is a better drug than strychnine as a stimulant, because of the liability to convulsions in this condition. Ether may be injected over the heart in bad cases. Cautious intravenous injection of ten grains of the bihydrochlorate of quinine, guarded by cardiac tonics, is recommended by Leonard Rogers as likely to help in restoring the control of the heat-regulating mechanism. He also suggests that the rubbing of ten to fifteen minims of creasote into the axillæ, which causes profuse sweating in fevers, should be tried here also. Much may be accomplished also in the way of prophylaxis by the issue of warnings from meteorological stations on the approach of heatstroke weather, and keeping a careful look-out on troops during the heat of the afternoon, so that cold affusions may be begun at once even without waiting for the arrival of the medical officer.

The Effects of Cold

It is not intended to deal here with the local results of cold, but only with the general effect of a very low temperature on the body as a whole. The normal reaction to cold is a constriction of all the surface blood-vessels, while a more vigorous internal circulation is maintained and more heat is produced. The effect of clothes is to produce a temperature immediately surrounding the skin of one degree below that of the body. Instinct directs us so to modify our dress in different climates as to approximate to this condition. The great danger of alcohol in extreme cold is that by flushing the superficial vessels it prevents the normal protective mechanism against too great a loss of heat from acting. Alcoholics notoriously stand exposure to cold badly. Children are also intolerant of great cold, because the superficies of their bodies is greater, compared with the bulk of the internal organs, than in adults. For obvious reasons fatigue and cold also increase the intolerance to cold.

As the prolonged action of cold exhausts the heat-producing mechanisms of the body, the limbs become numb, there is a sense of general lassitude and an overpowering impulse to sleep. This is, of course, a normal response in the hibernating animals. Both the special senses and the general sensibility become impaired. Respiration and the heart's action become slow, and syncope ensues. Death usually occurs during sleep, the muscles of the neck and limbs becoming rigid, which accounts for the extraordinary attitudes in which the bodies are often found. Exceptionally, the very cold

air entering the lungs may induce a fatal spasm of the larynx, or delirium with suicidal impulses may develop. People have been found alive after being buried under snow for four, five or even six days, but it must be remembered that the loss of heat will not be so great under these conditions as when exposed to a very cold wind.

Diseases Caused by Alterations of Atmospheric Pressure

1. *By Reduction of Pressure (Mountain Sickness).* The height above sea-level at which respiratory distress begins differs in different individuals, but at 16,500 feet every one suffers. Some become distressed on slight exertion at 8000 or even 7000 feet. Such people are usually delicate or out of condition, and training has a great effect in preventing it at such levels. A deep breather, by reason of his better pulmonary ventilation, is less likely to be affected. But the chief cause of the trouble is the difficulty encountered by the heart, which is adjusted to work against a certain pressure. The metabolites produced by fatigue must also play a part in embarrassing the heart; it is a striking fact that with the increase in the number and comfort of the hotels and huts, we hear less of mountain sickness at moderate levels. Extremes of temperature play a part also. Thus at the head of the Stelvio pass, about 9000 feet, few people experience any discomfort during the day in the summer-time, but at night, as the thermometer falls rapidly, dyspnoea may come on. On the other hand, walking in the hot sun, especially in the absence of a breeze, is apt to provoke an attack.

Prolonged residence at a high altitude leads to an increase in the number of red corpuscles, and this no doubt compensates to some extent for the difficulty of getting enough oxygen to the tissues. The anæmia and poor physique of many mountain dwellers is probably due to low diet rather than to high altitude.

Interesting observations have recently been made by Haldane and Douglas at the top of Pike's Peak, 14,000 feet. They found that the tension of oxygen in the arterial blood was only about 10 mm. below that at sea-level. The respiratory quotient remained constant until a speed of five miles an hour was attempted, at which pace 2000 c.c. of oxygen per minute are required by the blood. Then in addition to being breathless they were distinctly cyanosed. They concluded that the main factor was the inability of the oxygen to get through the lining of the lung quickly enough, while at lower levels it was the means of transport of the oxygen, *i. e.* the heart, that was likely to break down.

It is now recognized that the great stimulant to the respiratory centre is the tension of CO₂

in the blood, which depends on its pressure in the alveoli of the lungs. At high levels the respiratory centre appears to become more sensitive to CO_2 , for the amount of it present in the lungs falls, and remains subnormal after the return to the sea-level for a considerable time, varying directly with the time spent at the high altitude.

At a height of about 16,000 feet the oxygen tension falls to such a point that metabolism becomes deranged, and by no amount of training can mountain sickness be avoided. Conway's coolies, who came from a region 10,000 feet high, were affected as much as the rest of the party at 17,000 feet and upwards. Kennedy and Fischer, camping for several days at 18,000 feet in the Nepaul Himalayas, found that the disinclination for exertion and the rapidity of breathing was never mitigated except at night and in repose. But this shows that muscular exertion must play some part in the process even at this height, which is supported by the observation that aeronauts do not, as a rule, suffer much before an altitude of 19,500 feet is reached; although the time for adjustment to new conditions is very short, on the other hand they are not called upon to perform muscular work. It remains true, however, that at 16,500 feet mountain sickness is a permanent disability, for the slightest exertion causes it to recur. Despite it, Conway was able to reach the summit of Pioneer Peak, 23,000 feet, and he thinks that even higher altitudes will in time be reached. The difficulty and the danger involved in attaining extreme heights is shown by the fact that in a balloon ascent to nearly 28,000 feet two aeronauts lost their lives.

Signs and Symptoms. The symptoms of mountain sickness have been vividly described by Whympers thus:—"When we arrived at 16,664 feet we ourselves were in good condition, which was to be expected, as we had ridden most of the way; but in half an hour I found myself lying on my back along with the Carrels, placed *hors de combat*, and incapable of making the least exertion. . . . We were feverish, had intense headache, and were unable to satisfy our desire for air, except by breathing with open mouths. This naturally parched the throat and produced a craving for drink which we were unable to satisfy, partly from difficulty in obtaining it, and partly from trouble in sipping it. Before a mouthful was down we were obliged to breathe and gasp again until our throats were as dry as ever. . . . We found it impossible to sustain life without every now and again giving spasmodic gulps, just like fishes when taken out of water." It will be noted that nothing is said in this account of nausea and vomiting, which do not form

part of the characteristic symptoms, but are complications due to fatigue or indigestion. The increased rate of respiration, which reaches forty on the slightest exertion, is the outstanding feature. Cheyne-Stokes rhythm is not uncommon, and is probably due to the presence of lactic acid in the blood, from incomplete oxidation. The urine is said to contain diacetic acid and acetone, another evidence of defective oxidation. Vertigo and tinnitus are not uncommon. Hæmorrhages were frequently described by the early observers, but are ordinarily absent. Feverishness is often mentioned as a subjective sensation, but this is not substantiated by exact thermometric readings. In animals under diminished atmospheric pressure fatty degeneration of the organs is found, this again being due to the imperfect supply of oxygen to the tissues.

2. *By Increase of Pressure (Caisson Disease or Diver's Palsy).* The continued action of an atmosphere of pure oxygen acts as a protoplasmic poison, producing a catarrhal inflammation of the lungs, depressing the output of CO_2 and lowering the body temperature. This suggests caution in the use of undiluted oxygen in the treatment of pneumonia. On approaching two atmospheres of oxygen, the power of active absorption of this gas by the pulmonary epithelium is interfered with. Exposure of mammals to three to five atmospheres of oxygen produces in ten to twenty minutes tetanic convulsions, dyspnoea, coma and death. But the symptoms of caisson disease are not due to excessive pressure of oxygen; the bad effects in workers in compressed air occur, not during compression, but on decompression. At 100 feet under water the pressure is equal to four atmospheres (of air, not oxygen), and at 200 feet seven atmospheres. In working at the foundations of the St. Louis bridge 600 men were employed, of whom fourteen died from caisson disease and 119 were more or less affected. It was noticed that the controllers of the air-lock, who were subjected to compression and decompression every few minutes, were never affected. The minor symptoms are severe pains in the joints and muscles on returning to the surface. Of the more serious symptoms the commonest is paraplegia. There may also be vomiting, respiratory embarrassment, vertigo, sudden loss of consciousness and death.

Experiments on animals have clearly proved that these symptoms are due to gas evolved from the blood and fat on removing the pressure. The more delicate tissues naturally suffer the most, and actual holes may be seen in the grey matter of the brain and spinal cord, which have been made by the bubbles of gas evolved; for the excess of gas has been held in simple

solution by the increased pressure. Now, as the tissues have an almost unlimited capacity for oxygen at ordinary pressures, we should not expect that these mechanical injuries were produced by the evolution of that gas, and, indeed, analyses of the bubbles have shown them to be composed of the nitrogen of the air. Gas bubbles may also be found in the auricles of the heart. The importance of fat as a solvent of gas under high pressure, which was first pointed out by Vernon, is further evidenced by the fact that spare individuals suffer less than the stout.

Treatment. Caisson disease may be entirely prevented by taking sufficient time over decompression. The impatience of the workers leads them to take unnecessary risks. Twenty minutes should be occupied in the reduction of each atmosphere of pressure. The first exposure to high pressure should not exceed an hour, and for those accustomed to the work the number of hours of exposure should decrease as the pressure increases. Thus four hours can be spent in a pressure of three atmospheres, and only three hours under four atmospheres of pressure. If through neglect of the proper precautions symptoms arise, the only treatment is to recompress the patient as rapidly as possible, so as to cause the gas bubbles to be dissolved again.

Diseases Produced by X-Rays

When X-rays were first introduced into medicine their risks were not appreciated. To-day both X-ray dermatitis and the resulting cancer can be prevented, though the lesson has cost the lives of some and the crippling of others.

It is the active proliferating, more embryonic cells which are most sensitive to the X-rays. Thus in the skin it is the deeper layers of the epidermis, the glands and the hair follicles which are mainly affected, the horny layer hardly being involved at all. The lymphoid tissue of the spleen, the lymphatic glands, the mammary gland and the testis are the other structures that are most easily affected.

In the testis the same rule applies to the individual tissues; the spermatoblasts readily succumb, while fully developed spermatozoa are highly resistant.

X-Ray Dermatitis.—This is always the result of the absorption of an excessive dose, whatever the tube employed and whatever the character of the skin.

1. *Acute.* There is usually a latent period of from one to two weeks between the exposure and the onset of the dermatitis; the larger the overdose the shorter the interval. The following degrees have been described:—First, an erythema appearing about the twelfth day after

exposure and disappearing in six to eight days; second, a more intense erythema appearing about the tenth day and leading to a separation of the epidermis about the seventeenth day; third, the epidermis becomes detached, large blisters form about the eighth day, and superficial ulceration takes place which heals in two or three months. The fourth degree is characterized by ulceration with little tendency to repair, healing only after many months with a fine atrophic scar.

2. *Chronic.* While in the early days patients sometimes contracted acute dermatitis, the chronic form has been entirely confined to workers with the rays. It is the remote sequel of the acute form, and does not occur simply from repeated small doses which are inadequate ever to have produced acute dermatitis. First redness, itching, swelling and numbness of the hands is noticed. The cuticle becomes detached with the slightest injury, or bullæ form spontaneously. There is loss of hair and breaking off of nails, which though sometimes only temporary, is occasionally permanent. Hyperkeratosis under the nail, raising it from its bed, may occur. Then follows pigmentation and wrinkling of the skin. Chronic dermatitis takes two or three years to become fully developed. By that time a number of quite deeply pigmented warts have appeared, which when removed reveal very painful and intractable ulcers. Telangiectases form over the scarred areas, and severe, constant, boring pain, often worst at night, is a distressing feature. The distribution is naturally on those parts which are most exposed to the rays, particularly in holding the screen. It is noteworthy that the thumb, which is protected by the screen and by the rest of the hand, usually escapes almost entirely.

X-Ray Carcinoma.—There is no special peculiarity about this which differentiates it from ordinary epithelioma. X-ray dermatitis is a precursor, like other pre-cancerous conditions, such as leukoplakia of the tongue and xeroderma pigmentosa. So long as the production of destructive lesions of the skin by the X-rays is avoided, there is no danger of the subsequent development of carcinoma there. But any X-ray ulcer may become malignant, whatever its situation, provided that the irritation be sufficiently prolonged. The ulcer develops a raised and everted edge with surrounding induration. Unless radical means are adopted at this stage the epitrochlear and axillary glands become involved. If the latter group become implicated the prognosis is absolutely unfavourable. All such cases have died after operation from early recurrence and internal metastases.

Articular and Osseous Changes.—Thickenings

occur round the joints in the neighbourhood of the affected skin which may go on to fibrous ankylosis. On the skin crater-like holes with clean-cut edges can be seen in the bones underlying X-ray ulcers. There is no ground for the fear that harmful effects may be produced through the skull on the brains of children treated for ringworm by the X-rays.

Sterility.—It has been noted that unprotected workers with X-rays suffer from azoospermia, but not from impotence. Occasional exposure to the rays does not produce azoospermia, but it may occur as a result of treatment for pruritus ani if the scrotum is not screened. It takes about five months for living spermatozoa to be produced again, though in some cases as long as two years have been required. In women sterility is not produced so easily or accidentally owing to the deeper situation of the reproductive glands. The ovaries are most sensitive to the X-rays at a very early age, and later as the climacteric approaches, when permanent sterility may be produced. Between these ages sterilization is not likely to be permanent, but the menses may be delayed, diminished or prevented for a time as the result of X-ray treatment for acute eczema and psoriasis, or for uterine fibroids or hæmorrhage.

Treatment. It is now quite possible to avoid all these bad results. By enclosing the X-ray tube in an impervious box, so that the rays only

escape through an aperture towards the part to be examined or treated, the risks are greatly limited. The operator can further protect himself by lead-glass spectacles, gloves, aprons and screens; the patient can be protected by accurate dosage. In treatment work the pastille of barium platinocyanide, which turns green with a known dose, has reduced the risks to a negligible point. If dermatitis occurs the rays will naturally be avoided altogether and the condition treated on the usual lines of a dermatitis. Ulcers should be freely excised and the raw surface covered with skin grafts. Any warts should be picked away with the point of a knife, and any resulting ulcers treated as above. The nails should be kept short and the thickened matrix peeled away. All such procedures should be carried out with antiseptic precautions, because of the great liability for suppuration to occur. Nепenthe in doses of from five to thirty minims seems to be the best anodyne for the relief of pain. Radium appears to have benefited X-ray cancer sometimes, but as the affected parts are from the nature of the case freely accessible, radical removal of the disease is the best course. Even then the mortality at the lowest estimate is about forty per cent. Fortunately we can look forward with confidence to the complete disappearance of all these untoward results in the future by proper precautions.

W. L. B.

DISEASES CAUSED BY CHEMICAL AGENTS

CHRONIC LEAD POISONING

METALLIC lead in finely divided particles and all the salts of the metal are poisonous, with perhaps the exception of the sulphide and sulphocyanide. The principal salts met with as poisonous agents are the neutral acetate or "sugar of lead," the basic acetate, the carbonate or white lead, the tetra-oxide and the chromate or "chrome yellow." All the salts are mild irritants. Acute poisoning is generally due to the acetate when taken in large doses, either by accident, with suicidal intent, or when administered maliciously. A subacute form follows repeated small doses of a soluble salt.

Chronic poisoning is generally due to (1) *injurious industries, e.g.* lead-workers, file-makers, plumbers, painters, glaziers, smelters, typefounders, compositors, shot-makers, lead-foil-workers, potters, glass-workers, copper-workers, coach-makers, gas-fitters, cutlers, wool-manufacturers, enamellers of iron and porcelain, and in the making of vulcanized rubber and electrical accumulators; (2) *accidental causes,*

such as food and water contamination, from lead in vessels used for food storage or cooking, and in drinking water from cisterns, boilers and lead pipes, and from wine bottles cleaned with lead shot. Beer and cider become contaminated from leaden vessels and pipes, spirits from lead worms in the stills, and aerated waters when kept in siphons with lead caps and valves. Confectionery coloured with lead chromate, edibles packed in lead foil, cosmetics and hair dyes containing lead produce symptoms of poisoning. Many cases have occurred from the taking of diachylon in the form of pills, by women, as an abortifacient.

Illness caused by the vapour given off from newly painted rooms has been shown by Prof. Bailey to be due largely, if not wholly, to the action of the hydrated oxide upon the linseed oil and "dryers" with which it is mixed giving off deleterious aldehydes.

Idiosyncrasy has much to do with the severity of the action of lead, and alcohol increases its action.

Symptoms. The early symptoms are those

of indigestion, loss of appetite, pains in the stomach and abdomen generally, colic, constipation, metallic taste in the mouth, offensive breath, icteric tinge of the skin, pallor, anæmia and general interference with nutrition, a blue line on the gums in the neighbourhood of carious teeth; later arthralgias, peripheral neuritis and cerebral symptoms (encephalopathy). Colic is a predominant symptom, with pain about the umbilicus, retracted abdomen with rigidity of the muscles, associated with a slow and tense pulse and absence of pyrexia. Arthralgia is usually in the neighbourhood of the large joints and in the lumbar region.

The neuritis causes paralysis in the extensors of the hand and fingers, with wrist-drop. The supinator longus escapes. In some cases the paralysis may affect the muscles of the shoulder girdle and upper arm when the supinator longus is affected. Both arms may suffer, but it generally occurs first in the one which is most used. The legs may be affected, the tibialis anticus escaping. There is little or no disturbance of sensation, but there is marked muscular atrophy and R.D. Changes have been found both in nerves and anterior ganglion cells of the spinal cord.

Encephalopathy is evidenced by headache, insomnia, vertigo, blindness, stupor, drowsiness, excitement, hallucinations, delirium, eclampsia and optic neuritis. Lead is cumulative, causes interstitial nephritis and gout, and forms a stable combination with the substance of the nervous system, resulting in disturbance of function and local destruction.

One of the earliest and characteristic symptoms of lead poisoning is the anæmia, which may become pronounced and associated with marked punctate basophilia of the erythrocytes.

Lead produces tissue sclerosis, and this is especially seen in the kidneys, with albuminuria and the general symptoms of contracted granular kidney, with marked cardio-vascular changes. Gout is common in lead-workers, and if present before is always aggravated by absorption of the metal.

Lead can be detected in all the tissues of the body. It is excreted partly in the urine, but especially by the liver, which passes it in the bile to the intestines.

Prognosis. This depends upon the chronicity and intensity of the affection. Where there is disease of the kidneys and profound malnutrition improvement is slow and incomplete. Lead palsy may recover slowly and not return unless re-exposure takes place. Lead encephalopathy is always serious.

Treatment. This must be preventive, by the careful attention to cleanliness of those who work in lead, and special measures in industrial occupations to procure good ventilation and the choice of wet processes in manufacture.

Weak sulphuric acid lemonade is useful, with occasional doses of sulphate of magnesia or soda, for those who work in lead.

The affected person should be removed from further chance of contamination. In the general treatment the bowels should be kept freely open with Epsom salts and the colic relieved by atropine and morphine; joint pains require local sedatives; neuritis may be relieved by massage and electricity, anæmia by sulphate of iron. Iodide of potassium is given with a view to increasing the elimination, but its value has been doubted.

Sulphur preparations seem to have a more definite effect, and to this end sulphur baths and waters may prove very beneficial.

A sulphated chalybeate water, such as is to be had at Trefriw in North Wales, is to be recommended because of the sulphur and iron it contains. Prolonged attention to the general health is imperative.

R. J. M. B.

CHRONIC ARSENICAL POISONING

Metallic arsenic, if in a finely divided state, is poisonous. The preparations in common use which are poisonous are arsenious oxide, arsenic acid, arsenious sulphide, copper arsenite or Scheele's green, realgar or red arsenic, cacodylic acid and the cacodylates.

In whatever way the poison is absorbed into the system in small and repeated amounts, whether medicinally, by dust or vapour, commercial articles—*e.g.* sheep-dip, pigments, dyes—external application, the contamination of food-stuffs or the "arsenic habit," etc., arsenic gives rise to a peculiar train of symptoms comprising changes of nutrition and facial appearance, gastro-intestinal disturbance, skin eruptions and implication of the nervous system.

There is gradual emaciation, raggedness of the nails, falling of the hair, œdema and jaundice in some cases. The eyes become suffused and reddened, and there may be coryza. The digestive disturbance is manifested by dryness of the mouth, ulceration, excoriated or silvery tongue, sometimes salivation, throat irritation, anorexia, gastric pain, nausea, and vomiting, diarrhœa, or alternating constipation and diarrhœa.

The skin eruptions comprise eczema, herpes, erythema, urticaria, keratosis and marked pigmentation, either in local patches or diffuse, resembling Addison's disease. Occasionally pemphigoid eruptions take place, or exfoliation, and the keratosis is most marked on the palms of the hands and soles of the feet and under the nails. The nervous symptoms are those of peripheral neuritis with numbness, paræsthesia, hyperæsthesia and great tenderness, especially

of the soles of the feet. The feet may present appearances like erythromelalgia.

The affected muscles atrophy, are tender, the knee-jerk is lost, the paralysis may be complete, and there is R.D. (Edema of the legs occurs.

The pulse is rapid and the heart sounds embryocardial. There are seldom any mental symptoms.

Arsenic is eliminated principally by the kidneys and the bowels. It may be present in all secretions, the skin, nails and hair, liver, kidneys, spleen, brain, bone and other structures.

Treatment. When the condition has been diagnosed the removal of the cause is necessary. The diet should be nourishing and easily digested. The general health must be attended to. Iodide of potassium in small doses has been recommended. General treatment for the gastric and intestinal symptoms is required. The neuritis demands perfect rest in bed, sedative applications to relieve pain, with antineuralgic drugs internally. Later massage, electricity and strychnine are useful. The heart condition calls for small doses of strophanthus, digitalis, and general tonic treatment. R. J. M. B.

CHRONIC MERCURIAL POISONING

In a finely divided state mercury acts as a poison, whether taken internally or applied, or from inhalation of the vapour. Among its poisonous salts are mercuric chloride or corrosive sublimate, the black mercurous oxide, red and yellow mercuric oxide, red and yellow mercuric iodide, ammonio-chloride or white precipitate, mercuric nitrate, cyanide, and in some cases the mercurous chloride or calomel.

When taken in small and repeated doses the symptoms of chronic poisoning arise. Apart from the prolonged use of mercury as a therapeutic agent, poisoning generally occurs among workers in the metal, or its salts.

The symptoms comprise anorexia, dyspepsia, nausea, colic, diarrhoea, emaciation, anaemia and asthenia, salivation, foetor of the breath, stomatitis and gingivitis. The teeth loosen and there may be periostitis of the jaw. There may be glycosuria and albuminuria. The nervous system becomes affected; there is fine tremor of the muscles of the tongue and face, spreading later to the arms and legs. At first it is of the "intention" type; later it becomes constant, only lessened by sleep. The speech is stammering, and more or less paralysis follows; there is no R. D. There may be alteration of sensation, e. g. anaesthesia, paraesthesia, neuralgia.

Mental symptoms arise: excitability, insomnia, depression and hebétude, headache, and even hallucinations and mania. Erythema, eczema and pustular eruptions may occur on the skin.

The *treatment* consists in the removal of the cause and the administration of potassium iodide. The bowels should be regulated, the general nutrition sustained, the gastro-intestinal symptoms relieved by bismuth and opium if necessary, the mouth with mild astringent and antiseptic mouth washes, and the nervous system by massage and electricity and general tonics. Atropine may be useful in allaying salivation.

R. J. M. B.

PHOSPHORUS POISONING

Phosphorus is a powerful poison; the yellow phosphorus is poisonous, the red is not. It is generally taken suicidally in the form of match heads or phosphorus paste. Children may suck match-heads, and women have used phosphorus as an abortifacient. Phosphorus may cause poisonous symptoms if applied externally, and workers in it may suffer from chronic effects. Finely divided phosphorus is the most poisonous. Safety matches made of the red or allotropic form are not poisonous.

In *Acute Poisoning* there is marked gastric irritation, with nausea and vomiting; the vomit is luminous in the dark; it may contain blood. There is marked thirst, a burning sensation in throat and stomach, eructations, and a garlic odour of the breath. There may be diarrhoea. The abdomen may be distended. The pulse is feeble, and the patient may die in collapse or during an attack of convulsions.

These symptoms, however, may pass off, and for a period of three days or more there may remain some malaise only; but the *respite* is generally followed by the third stage, ushered in by the onset of jaundice, with tenderness and enlargement of the liver, epigastric pain, tympanites and vomiting of altered blood. Hæmorrhages from the mucous membranes and under the skin may occur. The urine is diminished, contains bile pigments, blood and casts, and there may be leucin and tyrosin. Collapse, rapid feeble pulse, sweating, convulsions and coma may precede death. The liver may atrophy before death. It is rare for recovery to take place after jaundice and enlargement of the liver have set in. The symptoms of this stage closely resemble those of acute yellow atrophy of the liver; as a rule the gastric symptoms are more severe, and there is an interval between these and the onset of the jaundice in phosphorus poisoning, and the leucin and tyrosin are generally found in the urine voided just before death.

Treatment. The stomach should be emptied with the siphon tube or pump, and washed out with warm water containing a drachm of old oil of turpentine to the pint, or, what is

more easily obtained, "sanitas" solution. Potassium permanganate in one per cent. solution is advocated for lavage and drinking. Peroxide of hydrogen solution (three per cent.) has been recommended, but oils or fats must be avoided. Magnesia may be given in demulcent drinks, and opium for the pain. The turpentine may be given in mucilage for several days to keep the bowels acting.

Chronic Poisoning.—Workers in phosphorus who inhale the fumes are liable, especially if in ill-health, to suffer from "lucifer disease," phosphorus necrosis or "phossy jaw." The improved hygienic conditions of match factories, periodical dental examination and the increasing use of the red phosphorus have done much to lessen the occurrence of this form of poisoning. The fumes lessen the nutrition of the periosteum and bone; the disease commences in the neighbourhood of decayed teeth, affecting mostly the lower jaw, causing gingivitis, periostitis and necrosis; the teeth fall out, and the septic condition which arises in addition to the general action of the phosphorus materially undermines the health, causing anæmia, dyspepsia, diarrhoea, purpura, albuminuria and hectic fever. Tubercle of the bone may be associated with the necrosis. Fragilitas ossium also is caused by chronic phosphorus poisoning.

Treatment. The local treatment is surgical. Free ventilation of factories is essential, only those with sound teeth should be employed in the factory, and the teeth should be regularly and carefully examined and kept in good condition.
R. J. M. B.

CARBON MONOXIDE POISONING

The gas carbon monoxide, CO, is formed in a variety of ways, one being the oxidation of carbon at a high temperature in the presence of oxygen. Carbon burns directly to CO at 1000° C. It is produced at the electrodes or from the charges of electric furnaces, in blast furnaces, from brick kilns, coal fires in grates, stoves and furnaces, burning charcoal, burning of "briquettes" of "smokeless fuel" which are used as foot-warmers and for heating closed carriages; from the use of "geysers" in bathrooms, when gas flames come in contact with be-sooted surfaces, in lamps turned low, after blasting operations, and from the slow combustion of wood in burning buildings. It is responsible for the poisonous properties of illuminating gas which contains it; coal gas contains 7.5 to 9 per cent, and water gas 40 per cent.; after carbureting and before addition to coal gas it contains 20 per cent. The gas has no odour and leakage cannot thus be detected. It is freely respirable, causing no irritation of the air passages. It replaces the oxygen of the blood volume for

volume; its affinity for hæmoglobin is 200 times that of oxygen. Air containing .05 per cent. is distinctly toxic, 0.2 per cent. causes urgent symptoms and 1 per cent. is accepted as fatal.

When mixed with air it is poisonous before the explosive point is reached. Death occurs before the whole of the hæmoglobin is saturated; one-third saturation causes characteristic symptoms, with half saturation they are urgent. When the capacity of the blood to take up oxygen is reduced 30 per cent. below normal death occurs. Death may take place before the hæmoglobin is sufficiently charged to give the spectrum of COHb.

The poison may act instantaneously.
Acute Poisoning.—*Symptoms.* These comprise excitation, headache, vertigo, throbbing of the temples, nausea and vomiting, red patches on the skin, red face, relaxation of voluntary and involuntary muscles, anæsthesia and lost reflexes. The anæsthesia and paresis commence in the lower extremities and spread to the trunk. The pulse becomes feeble or imperceptible; drowsiness, coma and even convulsions precede death. The eyes are staring, suffused, hyperæmic, the pupils dilated and insensible; the skin becomes cold and cyanotic and the lips covered with froth; the temperature is subnormal. The urine contains a reducing substance, glycuronic acid; there may be albuminuria. Death follows paralysis of the respiratory centre. Many of those who recover have no remembrance of symptoms, others claim to have suffered acutely. Certain sequelæ of an acute attack may occur; Becker and Schwerin place them in four groups:—(1) Primary gangrene, blisters and decubitus; (2) primary hæmorrhages, pulmonary, and cerebral; (3) persistence of redness of the skin; (4) secondary hæmorrhages into the nervous system, idiocy, imbecility, chorea, paralysis, dementia.

Chronic Poisoning.—Repeated inhalation of the gas in small amounts produces symptoms comprising headache, neuralgias, anæmia, dyspnoea, emaciation, peripheral neuritis and mental impairment. The milder symptoms occur in those who occupy ill-ventilated rooms heated with a close stove, or gas stove, or from imperfect gas fittings; the last are especially dangerous if water gas is used for illumination.

The Blood. This gives a characteristic spectrum. Two bands are visible between the D and E lines of the spectrum, slightly nearer to the violet end than those of O₂Hb. These bands are not altered by the usual reducing agents. The blood has a characteristic cherry-red colour which it retains for a long time, and when mixed with water gives a decided pink colour.

Treatment. The patient should be removed

to the open air and artificial respiration carried out with perseverance. Oxygen inhalation is the surest and quickest remedy. Nitro-glycerine hypodermically, ether also, and stimulants by the bowel are desirable. Electrical stimulation of the phrenics may be necessary. Venesection may be done, followed by intravenous injection of defibrinated blood. R. J. M. B.

COAL GAS

Coal gas contains hydrogen and methane principally, along with carbon dioxide and monoxide, ammonia, hydrogen sulphide and sulphides of carbon. Its poisonous property is the CO which it contains. It has a peculiar and characteristic odour, which allows its detection in case of leakage. It becomes a dangerous explosive in the proportion of 1 in 10 of air. It is toxic before this is reached. It may percolate through soil and lose its odour.

Symptoms. These are giddiness, headache, weak pulse, vomiting, stertor, contracted pupils, unconsciousness, cyanosis of the face with froth at the mouth, subnormal body temperature, convulsions, coma. The blood changes are those of CO. Red patches may occur on the thighs. *Vide* poisoning by CO.

Treatment. As for CO. R. J. M. B.

COMBUSTION PRODUCTS

Toxic effects have been produced by inhalation of the gases generated by explosives. The principal gases are carbon dioxide and nitrogen.

Gunpowder yields a considerable amount of CO and sulphuretted hydrogen. Nitroglycerine, dynamite and gun-cotton yield a large amount of CO. Tonite yields very little CO, and roburite none. Smokeless powders give off CO.

The manufacture of "roburite" and "sicherheit," which contain dinitrobenzine, is fraught with danger from this substance, causing in acute cases cyanosis of the face or the whole body, headache, vertigo, paresis, coldness, quick pulse, dyspnoea, shallow breathing with long intervals, and coma. Vomiting may occur, and the blood becomes a chocolate colour.

A chronic form of poisoning produces lividity and cyanosis, with gastritis, hepatic enlargement and jaundice, numbness, paræsthesia, numbness and cramps in the muscles, amblyopia with concentric contraction of vision fields and central scotoma. The blood is like that of pernicious anæmia, and the urine brown or blackish. R. J. M. B.

SULPHURETTED HYDROGEN

Sulphuretted Hydrogen Poisoning may occur in laboratories or from the inhalation of sewer gas which contains it.

Symptoms. When the gas is moderately

diluted there are giddiness, throbbing headache, pain in the stomach, nausea and vomiting, diarrhoea, dyspnoea, irregular pulse, and sometimes delirium and coma. If recovery take place mental symptoms may follow, also bronchitis and broncho-pneumonia. If slightly diluted, sudden weakness, with great collapse, cyanosis, heart failure, dilated pupils, delirium, convulsions and coma precede death.

The gas combines firmly with hæmoglobin. The spectrum shows two bands of O_2Hb , and a third in the red between C and D, which remains when a reducer is added.

Treatment. Artificial respiration, oxygen inhalations, warmth. Inhalations of chlorine well diluted with air have been recommended.

R. J. M. B.

CARBON BISULPHIDE

This substance is used in certain industries for the solution of fats, oils, gutta-percha and india-rubber. It has a very disagreeable odour.

Acute Poisoning is rare, and causes laboured breathing, cyanosis, tremors, coldness, dilated and fixed pupils, collapse and unconsciousness. The odour of CS_2 is present in the excreta.

Treatment. If taken internally the stomach tube must be used. Warmth and stimulants are called for, and artificial respiration should be carried out.

Chronic Poisoning.—There are two stages, one of excitement and one of depression. In the former there are persistent headache, colic, nausea and vomiting, irritability, tinnitus aurium, insomnia and even mania; in the latter anæsthesia of skin and mucous membranes, neuritis and paralysis. Amblyopia and scotomata are common, and optic atrophy may occur. Anæmia is common. R. J. M. B.

POISONING BY CARBON DIOXIDE, CO_2

This gas, known as "choke damp," occurs in mines after explosions, in deep wells, old caves, cisterns, brewers' vats, and in the vicinity of active lime and brick kilns, also in aerated water factories. Workers in these situations are liable to be poisoned by the gas. Twenty per cent of CO_2 in the air would prove fatal, while five per cent. is dangerous and may cause death. To test the atmosphere a lighted candle is placed in it; if the flame go out the atmosphere is dangerous. However, a candle will burn in twenty-five per cent. of CO_2 in air, so that the atmosphere must not be accepted as safe if the candle still remains alight. The burning of the candle is no test of security from danger in a suspected atmosphere.

Symptoms. If the gas be pure or concentrated, such as is found in wells or vats, it

causes spasm of the glottis, loss of consciousness and muscular power, and death may take place at once. When diluted with air and breathed it causes weight and fullness in the head, vertigo, distress in breathing, palpitation and drowsiness. Later there is loss of muscular power, cyanosis, gradually increasing insensibility and stertor; convulsions and delirium may occur. The victim dies of asphyxia, the gas not only acting directly but also preventing the excretion of physiologically formed CO_2 . Death follows when it is respired long enough, even when mixed with a normal amount of oxygen.

Chronic exposure in ill-ventilated apartments produces anæmia and malnutrition.

Treatment. Removal to fresh air, venesection, artificial respiration, oxygen inhalations, stimulants and warmth. Galvanism may be useful.

R. J. M. B.

ACETYLENE GAS

This gas has a peculiar odour of geranium. It is a product of the incomplete combustion of hydrocarbons, and is formed when lamps or gas jets are burned with insufficient air, e.g. a Bunsen burner which has "lighted back," also from the use of oil stoves, and gas cooking and heating apparatus. It is used for illumination, and formed by the action of water on calcium carbide. It forms a highly explosive mixture with air. It is not a potent poison. Continued exposure to it produces anæmia, malnutrition and nervous symptoms. On animals it produces narcosis. It does not combine with hæmoglobin, but acts as an indifferent gas.

R. J. M. B.

NITROGEN MONOXIDE, NITROUS OXIDE

This is known as "laughing gas"; it has a sweetish taste and smell.

Symptoms. When breathed in small quantities it produces tingling sensations and induces laughter, hence its name. When breathed for anæsthetic purposes the skin becomes livid, the blood pressure raised, and unconsciousness follows. It acts first upon the higher nerve centres, then upon the spinal cord, medulla and heart. If pushed too far it causes death from asphyxia. In ordinary use for anæsthesia, the latter is rapidly procured and recovery follows quickly when the administration is stopped. It has peculiar effects upon certain people, and they may not only show the symptoms of hilarity, but in some cases become extremely violent.

R. J. M. B.

PETROL FUMES

Petrol fumes produce toxic effects upon those who inhale them.

Symptoms. The following symptoms have

been produced: perverted taste, dysphagia, headache, giddiness, cyanosis, insensibility, mania and imbecility. The maniacal outbreak occurs during recovery. Peripheral neuritis may follow.

R. J. M. B.

NAPHTHA, BENZOL OR BENZENE

This causes poisoning when swallowed or from the inhalation of the vapour, as occurs in glove-cleaning, waterproofing, etc. A number of deaths have taken place from the poison having been swallowed and also from inhalation of the vapour.

Symptoms. In acute poisoning there is excitement, flushing of the face and cyanosis, dilated pupils, headache, slow breathing, stupor and coma, with gastro-intestinal irritation. There may be hallucinations and delirium.

Some people are more susceptible to the vapour than others and are obliged to desist from working in it. Women become intoxicated, excited and hysterical; it causes headache, vertigo, narcosis and inability to walk, and occasionally vomiting. In some cases numerous small hæmorrhages occur.

When the vapour is concentrated there may be rapid coma and death.

Treatment. When swallowed, the stomach tube should be used and ether and strychnine given hypodermically.

In case of vapour effects, removal to the open air, artificial respiration, inhalation of oxygen and restoratives are required.

R. J. M. B.

SULPHUR DIOXIDE

This is an irrespirable gas with the odour of burning sulphur. It is a preservative and bleaching agent, is used for disinfection, and occurs in certain industries.

Symptoms. Inhalation causes a feeling of suffocation, with spasm of the glottis and marked irritation of the nose, trachea and bronchi, causing coughing and sneezing. Opacity of the cornea, dyspnoea, cyanosis and convulsions may occur.

R. J. M. B.

CHLORINE

This gas is used as a bleaching agent and disinfectant. In chemical works a form of chronic poisoning occurs, in which the symptoms comprise anæmia, emaciation, gastric catarrh, dental caries, bronchitis and emphysema. If concentrated it causes dyspnoea, violent cough and hæmoptysis, stupor and syncope.

Treatment. Fresh air, ether or steam inhalations, and the general treatment of bronchitis and other lung complications.

R. J. M. B.

PHOSPHORETTED HYDROGEN

This is a very poisonous gas. Deaths have occurred on board ships carrying cargoes of electrolytic ferrosilicate containing calcium phosphide. It reduces the oxyhæmoglobin. It may produce rapid, followed by slow and laboured, breathing and convulsions. R. J. M. B.

ARSENURETTED HYDROGEN

This gas has proved fatal in several cases. It is the most poisonous of the inorganic com-

pounds of arsenic. It has an odour of garlic. It proves fatal in minute quantity.

Symptoms. They comprise malaise, shivering, headache, vomiting and epigastric pain, lumbar pain, disintegration of the blood, with profound hæmolytic, anæmia and hæmorrhages from mucous membranes and kidneys. There is profound jaundice even to mahogany colour. Suppression of urine and coma follow. Death may not take place until the fifth day.

Treatment. Inhalations of oxygen. Venesection followed by transfusion of blood may be of value. R. J. M. B.

DISEASES CAUSED BY ORGANIC AGENTS**ALCOHOLISM AND DRUG HABITS**

Alcoholic Intolerance. There is considerable individual difference in the susceptibility to drugs such as strychnine, atropine and morphine. The same is true of alcohol. Some persons are intoxicated, and even rendered violent and refractory, by very small quantities. Most police cases entered as "drunk and disorderly" belong to this class. The condition induced is known as hysterical, or maniacal drunkenness (mania à potu) according to the degree of violence of the outbreak. Such cases always show some mental defect, and they constitute the bulk of the chronic alcoholists who eventually come under the care of the State.

Branthwaite classifies these latter as (a) degenerates, imbeciles, and epileptics; and (b) moral and social defectives, and he emphasizes the fact of their extreme susceptibility to alcohol. Cases of insanity entered in asylum records as due to drink belong to one or other class. It should be noted that these congenitally defective persons are never systematically heavy drinkers, their great susceptibility preventing this; hence they rarely display the degenerative changes met with among chronic drinkers. Thus among 30,300 congenitally degenerate inebriates under the Inebriates Act, but one case of cirrhosis of the liver was recorded; and Mott has seen but a single example of this condition in his extended experience at Claybury Asylum.

Extreme susceptibility to the intoxicating action of alcohol indicates nervous instability; and, contrariwise, non-susceptibility to its influence generally goes along with a stable nervous organization.

Tolerance. Just as some are intolerant of alcohol, so others are highly tolerant of it, *i. e.* they can consume a considerable quantity without getting intoxicated. Such tolerance is partly congenital, but a considerable degree

of it can be acquired by systematic drinking. Those, however, who are highly intolerant of alcohol are prevented from systematic drinking by this very susceptibility, and thus cannot acquire tolerance.

The tolerance (whether congenital or acquired) of the chronic drinker always, as Francis Hare insists, implies a corresponding intolerance of a sudden reduction in the quantity of alcohol circulating in the blood: the reduction leads to such phenomena as anorexia, vomiting, insomnia, tremor, restlessness, delirium tremens, and alcoholic epilepsy. Hare has shown that delirium tremens only occurs in chronic heavy drinkers in whom a large reduction in the quantity of circulating alcohol has occurred. Alcoholic vomiting may in this way induce the delirium. When delirium tremens follows upon operations and complicates acute diseases, *e. g.* pneumonia, it is largely, if not entirely, because the patient is allowed much less than his wonted quantity of alcohol. Hence the importance in all cases of emergency operations of making sure that the patient is not a heavy drinker, and of remembering that many heavy drinkers regard themselves as strictly temperate. Patients of this kind should have their alcohol gradually tapered off.

These remarks apply to all drug habits. When a high degree of morphine tolerance has been acquired, sudden withdrawal of the drug may cause delirium, diarrhoea, and collapse which may be fatal. The withdrawal of veronal from one who has been accustomed to large quantities of it may give rise to very similar symptoms (Hare), and the same is true of chloral. Less serious symptoms appear to follow the sudden withdrawal of cocaine in the case of the cocaineist. In the case of the habitual smoker the sudden deprivation of tobacco causes little more than discomfort.

It should be noted that the tolerance, both of

alcohol and of drugs, diminishes if they are abstained from for a time, so that much smaller quantities than were easily tolerated before, may then prove dangerous.

Causation. The great predisposing cause of alcoholism is the tendency, congenital or acquired, to be agreeably affected by it—the capacity for alcoholic euphoria. It is this which begets the desire for alcohol, amounting often to actual craving. With some people alcohol has no power to produce euphoria; with others it engenders it to an intense degree, and in such desire is correspondingly great. The craving may be continuous, or it may come on paroxysmally, as in dipsomania. A strong will may overcome it, but the strongest may be powerless against it if it is intense. On the other hand, moderate desire may lead to constant excess if the will is weak. In short, the tendency to alcoholism varies directly with the desire for alcohol, and inversely with strength of will and force of character. In the absence of desire a weak-willed person remains sober. Among the exciting causes are early training and example, grief, worry, jealousy, loneliness, ennui (*e.g.* from lack of occupation), life in the tropics (where lassitude may co-operate with ennui), free accessibility (as in the case of publicans, barmaids and commercial travellers) and mental depression (periodic depression may give rise to periodic alcoholism).

The habit may be initiated by the taking of alcohol to overcome shyness, or to avert "stage" or "speech" fright; to alleviate pain (*e.g.* neuralgia, dysmenorrhæa); or to relieve a feeling of sinking (such as may occur in women at the climacteric). The medical man may unwittingly start the habit by prescribing alcohol for disease, *e.g.* in fevers, or in the convalescent stage of exhausting or depressing disease.

The Varieties of Alcoholism. The following four types are distinctive. Intermediate varieties are, however, met with—

- | | |
|-------------------------|---------------------------------|
| 1. Recurrent Alcoholism | { (a) Dipsomania |
| | { (b) Pseudo - Dipsomania. |
| 2. Chronic Alcoholism | { (c) Chronic Inebriety |
| | { (d) Chronic Sober Alcoholism. |

1. (a) **Dipsomania.**—This is a recurrent drink monomania. Between the attacks the patient has no strong desire for alcohol and may even dislike it; if he drinks it at all it is in moderation and his tolerance of alcohol is small. Though the attack may come on suddenly, it is generally preceded by a premonitory stage during which character is profoundly altered: a craving for alcohol develops and the patient is apt to

become secretive. It is this *spontaneous* craving which initiates the drinking bout. During the paroxysm the tolerance of alcohol increases, and enormous quantities may then be imbibed without intoxication.

(b) **Pseudo-Dipsomania.**—In this there is no premonitory stage and the attack does not begin spontaneously: the craving is induced by the taste of alcohol; as in chronic alcoholism, it is the fatal "first glass" which begets it. Once this is taken, in ninety-nine cases out of a hundred the strongest will is powerless to prevent excess.

The periodicity of pseudo-dipsomania depends upon the periodicity of circumstances, *e.g.* menstruation, worry, boredom, accessibility, overwork, recurring illnesses (influenza, neuralgia, asthma, palpitation).

2. In Chronic Alcoholism there is steady drinking, and the patient manifests a considerable degree of alcoholic tolerance, and a corresponding intolerance of its sudden withdrawal. This is the form in which widespread tissue changes (*e.g.* fibrosis, fatty heart, peripheral neuritis) occur. There are two varieties of chronic alcoholism—

(c) **Chronic Inebriety.**—In this intoxication is produced before satiety occurs. The chronic inebriate does not as a rule, however, become more than mildly intoxicated: his intoxication, *e.g.*, rarely brings him into conflict with the law.

(d) **Chronic Sober Alcoholism.**—In this satiety is reached before intoxication occurs. Sober alcoholists are far more numerous than is generally known. They form a large proportion of the patients entering sanatoria. Most of them have never been intoxicated and would indignantly resent the imputation of drunkenness. Many, indeed, continue to manage their business affairs successfully for years.

Symptoms and Complications. Though the contrary belief prevails, the drinker does not usually betray his failing in his countenance. The Norwood Sanatorium patients look just like ordinary people. Occasionally the face and eyes are congested, but this congestion generally disappears after a few days' abstinence.

Acne rosacea is rare and is, moreover, by no means confined to drinkers. Skin eruptions, *e.g.* acne and eczema, may break out after the alcohol has been abandoned, owing to excess of food which the returning appetite prompts the patient to take.

Chronic alcoholism diminishes the resistance to infectious disorders, such as tuberculosis and pneumonia, and renders the prognosis correspondingly grave.

Alcoholic peripheral neuritis is much more

common in slight and subacute forms than in the acute. The prognosis is good if abstinence can be assured.

Alcoholic albuminuria, as Francis Hare has shown, is a common complication. Of forty-seven patients who had ceased drinking before entering the Norwood Sanatorium, seventeen showed albumin; of one hundred and six who were drinking at the time of admission, in ninety-six there was albumin. In most the quantity varied from a trace to two per cent.; in nearly all it rapidly disappeared after the alcohol had been cut off. A high percentage of albumin is generally indicative of prolonged drinking, and the need for cautious tapering, lest delirium tremens or alcoholic epilepsy supervene.

The most common hepatic complication is slight congestion of the liver, with tenderness. Atrophic cirrhosis is rare.

Morning dry retching is frequent. It appears to be excited by the efforts to cough away the dried mucus which has collected on the fauces and pharynx overnight. Alcoholism causes a congested state of the nasal mucous membrane, and this often leads to mouth-breathing during sleep, with the result that the patient wakes up with a dry mouth and throat. Severe vomiting may also result from irritability, sometimes amounting to catarrh, of the gastric mucous membrane. This compels the dipsomaniac to desist from drinking and not infrequently puts an abrupt end to his bout. In the case of the chronic alcoholic it may precipitate an attack of delirium tremens or of alcoholic epilepsy, by causing a sudden reduction in the amount of circulating alcohol. The vomiting may be checked by getting the patient to drink a large quantity of alkalized water. The fauces should be titillated if vomiting is not immediately produced.

Among the nervous symptoms from which the drunkard is apt to suffer are tremor, restlessness, insomnia, delirium tremens, alcoholic epilepsy, and mania à potu. This last occurs only in the "drunk and disorderly" type of nervous degenerate; the others only in the chronic drinker who is highly tolerant of alcohol. Any sudden large reduction in the usual supply may induce them, and only under such conditions do delirium tremens and alcoholic epilepsy arise. Hence the need to taper off the chronic alcoholic carefully. Delirium tremens shows itself in from forty to seventy hours after the reduction. Alcoholic epilepsy generally occurs sooner, and is less frequently preceded by fear, tremor, and restlessness; moreover, it is not confined to those who have acquired a high grade of tolerance. Delirium tremens generally terminates within four days by crisis, the patient falling into a long sleep. If prolonged beyond this, death or protracted insanity may result.

The preventive treatment consists of careful tapering. A full dose of veronal or paraldehyde should be given for the first few nights, and a drachm of sodium bromide thrice daily. The attack may occasionally be aborted in its earliest stages by giving alcohol in doses just short of the customary amount. Once fully developed the attack must run its course. If alcohol is then given at all, the quantity should be small. Hyoscine in doses of $\frac{1}{150}$ gr. to $\frac{1}{80}$ gr. may be given every six hours for some days.

Affections which arise during and after Convalescence from Chronic Alcoholism. As a rule the appetite returns and the patient recovers his digestive powers very soon after his alcohol is cut off. As the result of the large amount of food which is wont to be consumed then, he is apt to suffer from morning headache, or from recurrent attacks of anorexia, diarrhoea, or sick headache. These generally yield to a proper regulation of the diet.

Treatment. In all cases of alcoholism the best treatment is the institutional. For the degenerate class of spasmodic alcoholists, who are highly intolerant of alcohol, prolonged seclusion is required (under the Inebriates Act, if necessary; patients can be received into private retreats under the Act). The same is necessary for the more inveterate cases of chronic drinkers. In cases of true dipsomania the patient should be placed in a sanatorium or home directly he observes the symptoms of the attack coming on. Unfortunately, he rarely reveals them to any one, so intent is he upon satisfying his craving.

In ordinary cases of chronic alcoholism, whether the sober or the inebriate variety, a course of treatment in a voluntary sanatorium lasting from six weeks to three months suffices. This in the vast majority of cases insures a period of abstention varying from weeks to years after discharge. If the patient relapses he should re-enter the sanatorium for a further course of treatment. This plan has several advantages. Many, on account of the expense and for other reasons, are prevented (or frightened away) from undergoing a long course of treatment; moreover, a short treatment enables the patient to return soon to his home and business, and is correspondingly inexpensive.

In the Norwood Sanatorium the patient is not as a rule suddenly cut off his drink, and after the first week or ten days he is allowed to leave the grounds. There is no compulsion; the patient is simply put upon his honour, and this plan is found to work admirably. Hundreds have been prevented from entering sanatoria and driven into the hands of undesirable people, in the belief that they would there be suddenly cut off their liquor and subjected to intolerable restraints.

The details of the treatment carried out in the Norwood Sanatorium are given in Francis Hare's work (*Alcoholism and its Treatment*). It is partly medicinal and partly moral; and it should be observed that in no kind of sanatorium other than the strictly voluntary, where the patients are put upon their honour and allowed a considerable degree of liberty, can moral influence be fully brought to bear upon them.

As regards the administration of alcohol, in most cases of true dipsomania it should be stopped at once. If left to himself the dipsomaniac drinks to prostration. In chronic alcoholism, inebriate or sober, the alcohol should be tapered off, the period of reduction lasting about a week. During rapid tapering the patient should be kept in bed.

Morphinism.—The chronic morphinist is wayward, disorderly, plausible, and apt to be talkative. Other salient features are: myosis, emaciation, sallowness, dryness of the mouth, loosening of the teeth, gastric catarrh (causing nausea, vomiting, and pain), constipation, insomnia, impotency, albuminuria, irregular fever.

The symptoms of sudden withdrawal are: restlessness, anxiety, rigors, profuse perspiration, sneezing, nausea, vomiting, diarrhoea, hiccough, mydriasis, visual hallucinations, delirium (sometimes violent), and collapse, which may be fatal. These symptoms yield to an adequate injection of morphine.

Morphine is excreted chiefly by the bowel, only in small degree by the kidneys. In the chronic morphinist most of it appears to be oxidized in the tissues.

Prognosis. Relapses are less common than in the case of chronic alcoholism. Recovery may occur after the habit has lasted twenty or even thirty years. The prognosis is worst in old patients. If abstinence causes a recurrence of the pain which led to the habit, a return to the injection may be the less of two evils.

Treatment. The withdrawal symptoms, if pressing, may demand free morphia injections. Subcutaneous injections of caffeine are helpful for the collapse; hot water enemata are useful for the diarrhoea.

The successful treatment of chronic morphinism requires that the patient should be removed to a home or sanatorium. The utmost care is needed in cutting off all access to the drug.

While the patient is being weaned from the habit the general health should as far as possible be improved. After the initial difficulties have been overcome he should be put through a species of Weir-Mitchell treatment, consisting of liberal dieting, massage, etc.

The customary plan of breaking the morphine habit is by tapering off the drug. We may begin by reducing the dose to nearly one-half, but after this the reduction should be gradual. The chief difficulty is at the end of the tapering, when the patient is taking a grain, or less, daily. It may be some time before we succeed in getting him to forego this allowance.

Another plan is to excite distaste for the drug by inducing hyoscine poisoning. The patient is put to bed in a home, and injected with $\frac{1}{100}$ gr. of hyoscine, and hourly thereafter with $\frac{1}{200}$ gr. until intoxication (mild delirium, visual hallucinations, choreic movements, picking at the bed-clothes, dilatation of the pupils, dryness of the mouth and throat) is produced. This occurs in from twenty-four to forty-eight hours. The patient is maintained in this condition for from thirty-six to forty-eight hours, by injecting from $\frac{1}{200}$ gr. to $\frac{1}{100}$ gr. every two or three hours. On coming out of the delirium he no longer has a craving for morphine. Pilocarpine injections ($\frac{1}{8}$ gr. every hour) are now given to produce sweating and thus to help the elimination of the hyoscine. Joint pains, backache, and diarrhoea are at this stage apt to develop, and are treated by astringents, hot baths, and massage. For the succeeding two to three months ten drops of bromaurum should be given thrice daily.

On leaving the home the patient should go away for at least three months, preferably for a sea-voyage with a companion having the necessary tact and ascendancy. For a year, or even longer, after the weaning recurrent cravings may occur and have to be guarded against.

Chronic Cocainism.—The cocaine habit is generally started by local application of the drug to the nose or throat. As much as forty grains daily have been taken. The euphoria is more fleeting than that produced by morphine, and the process of weaning more difficult. As in the case of chronic morphinism, the patient is apt to get sallow and emaciated. Withdrawal may be followed by nausea and collapse.

Ether Drinking.—This is practised in some parts of Ireland. An ounce, costing about fourpence, is sufficient to intoxicate those unaccustomed to the drink.

Tobacco Poisoning.—The worst form of tobacco poisoning is that produced by chewing strong tobacco; cigar or pipe smoking is less injurious; cigarette smoking the least, although the cigarette offers a greater temptation to excess than either cigar or pipe. It is a significant fact that no case of tobacco amblyopia from cigarette smoking has yet been recorded. The excessive smoker should be limited to a moderate supply of cigarettes, which he should make himself. Camphor is the best antidote.

H. C.

FOOD POISONING

Animal Food Poisoning

Meat poisoning, although sometimes due to the ptomaines generated by putrefaction, more frequently results from the toxins of non-putrefactive bacteria, *e. g.* *B. enteritidis*, *B. typhosus*, and *B. botulinus*. Of meat-foods, pork, veal, beef, and horseflesh are the most liable to be infected by such bacilli. The *B. botulinus* is chiefly met with in sausages. Its toxin resembles the tetanus toxin, and like the latter is readily fixed by the cells of the central nervous system.

Scurvy is by some attributed to the action of toxins present in meat-foods.

Milk may be infected with various pathogenic organisms, and in this way may spread tuberculosis, enteric fever, summer diarrhoea, and other diseases.

Epidemics of poisoning by bacterially infected cheese occasionally occur.

Poisoning may be caused by infected fish. The roes of certain fish may be poisonous at the spawning season.

Shellfish, especially mussels, frequently give rise to toxic symptoms. Oysters may convey the poison of enteric fever.

Symptoms. Those due to *B. enteritidis* and its congeners result from gastro-intestinal irritation: vomiting, diarrhoea, colic, thirst, rigors, faintness, or actual collapse. In the worst cases the patient may sink into the typhoid state.

The poisons of putrefaction (such, for instance, as may be present in high game) may cause vomiting, diarrhoea, and cutaneous eruptions.

The toxin of *B. botulinus* causes dryness and redness of the mouth and pharynx. The main symptoms, however, are nervous, *e. g.* ptosis, diplopia, paralysis of accommodation, dilatation of the pupil, and bulbar paralysis.

The symptoms of mussel poisoning are largely those of gastro-intestinal irritation; serious nervous symptoms, *e. g.* paralysis and coma, may also occur, and the patient may succumb within a few hours.

Diagnosis. It is well to remember that obscure epidemics may owe their origin to food poisoning. Durham has shown that the blood of patients suffering from meat poisoning gives a specific agglutination reaction by means of which poisoning by the various kind of meat organisms may be identified.

Prognosis. The mortality varies from five to thirty per cent. It is highest in mussel poisoning and in botulinus.

Treatment. Efficient cooking is a preventive against bacterial infection. A temperature

of 80° C. suffices to destroy the *B. botulinus*. In this connection it has to be remembered that rapidly cooked sausages, although burned externally, may be raw in the centre.

If after poisonous food has been taken there is not free vomiting, an emetic should be given, or the stomach washed out. An ounce of castor oil and ten to fifteen drops of laudanum should be administered, even though diarrhoea be present. Severe diarrhoea should be treated by morphine injections. Collapse may require stimulants, or even subcutaneous (or intravenous) injections of normal saline solution.

Vegetable Food Poisoning

Ergotism is due to some poison, or poisons, generated by the fungus *claviceps purpurea* which grows on rye, especially when a dry summer is followed by a rainy spring; the affection is still endemic in Russia. The poison causes contraction of the arteries through the central sympathetic system, and may in this way set up gangrene of the extremities and even of the body and viscera. Violent burning pains may be felt in the affected parts. Rapid death may result with choleraic symptoms. The mortality ranges in different epidemics from ten to sixty per cent. Spartein and the nitrites have been recommended to counteract the arterial spasm in this affection.

Pellagra is produced by poisons generated in maize, apparently as the result of simple putrefaction. The symptoms start in the spring and subside in the autumn, and may in this way affect the patient year after year. The skin, especially the part exposed to the sun, becomes swollen, red, shiny and tense, and is the seat of an itching or burning sensation. After a few years palsies (especially spastic paraplegia) and dementia are apt to supervene. At this stage there is little hope of recovery.

Lathyrism is produced by a poison found in certain pulses, *e. g.* the chickpea. The disease occurs chiefly in India. It breaks out in the rainy season and affects males ten times more frequently than females. A few hours after taking the poison the limbs become rigid, tremulous and weak. The rigidity may involve the muscles of the back. There may be considerable hyperæsthesia followed by anæsthesia.

Mushroom poisoning results from the action of such substances as muscarine, phallin, and helvellic acid.

The symptoms vary considerably with the variety of mushroom consumed. There is often considerable gastro-intestinal irritation.

H. C.

FOOD POISONING (Probably Bacterial)

Many forms of disease are caused by the consumption of infected or unsound food. In some instances the illness is brought about by parasites (e. g. trichinosis); in others it is due to such organisms as the tubercle bacillus. These diseases are dealt with elsewhere. There is, however, a well-known form of acute gastro-enteritis, which follows the consumption of food and is known as *meat poisoning*. The term includes the illness caused not only by meat of all kinds, but also by fish, and by other food of animal origin, such as cheese and milk. Most of the cases are sporadic, though large outbreaks occur from time to time.

Apart from the clinical features, the characteristics of an outbreak of meat poisoning are the following—

1. The practically simultaneous onset of symptoms among those who have eaten some given article of food.

2. The limitation of the illness (with rare exceptions) to those who ate the food.

Etiology. 1. *Infection.* The majority of outbreaks are caused by meat infected with either *B. enteritidis* (Gaertner) or *B. suipestifer*. These bacilli have frequently been isolated both from the patients and from the food which gave rise to the illness. In outbreaks caused by *B. suipestifer* the food is usually, though not invariably, derived from the pig; pork pies, brawn and sausages have been responsible for most of the cases. In outbreaks caused by Gaertner's bacillus the food has as a rule been derived from cattle; one such outbreak was due to cow's milk. The organisms obtain access to the food in one of two ways.

- (a) They may set up illness and septicæmia in an animal and make their way into its viscera and muscular tissues during its life (intra-vital infection).

- (b) The meat may be contaminated with these organisms either in the slaughter-house or during its preparation for consumption (post-mortem infection).

Whether the infection of the meat be intra-vital or post-mortem, the bacilli are derived from the lower animals. Human carriers of these organisms are practically unknown, and there is no evidence that they have ever been the cause of meat-poisoning. An important fact is that if the meat is uniformly infected the ordinary process of cooking will not kill the organisms in the centre of a joint or even of a sausage.

2. *Ptomaines.* The term ptomaine poisoning is often, though quite erroneously, used as synonymous with meat poisoning. Ptomaines are definite chemical substances formed during the disintegration of protein by autolysis or putrefaction; they are *not* specific toxins.

Ptomaine poisoning appears to be infrequent, and of little practical importance. Very few, if any, outbreaks of meat poisoning have been definitely proved to be caused by ptomaines, although they have frequently been sought for in such cases. Possibly mussel poisoning and some cases of illness caused by the consumption of corned beef are due to ptomaines.

No outbreak of meat poisoning, however, should be attributed to ptomaines unless infection of the meat with *B. suipestifer* or *B. enteritidis* (Gaertner) has been definitely excluded by bacteriological examination of the meat and of the patients.

Symptoms. The latent period before the onset of symptoms is usually twelve to thirty-six hours, but varies from two to seventy-two hours in different outbreaks. If the meat is intensely infected, and the amount eaten be considerable, the latent period may be extremely brief. The illness often begins with a severe headache or a rigor, speedily followed by acute gastro-intestinal disturbance—nausea, vomiting, diarrhoea and abdominal pain. In the more severe cases restlessness, extreme thirst and nervous symptoms become prominent, and death may be preceded by coma. Fever is usually present. The total duration of the illness rarely exceeds a week, but convalescence is often delayed by general muscular weakness or by attacks of circulatory impairment. All degrees of severity are met with, from fulminating cases, which may die within twenty-four hours, down to those of slight diarrhoea or malaise insufficient to keep the patient from work.

Mortality. The average mortality is from one to two per cent., but varies considerably in different outbreaks. Outbreaks due to Gaertner's bacillus show a higher mortality than those caused by *B. suipestifer*.

Diagnosis. The symptoms do not differ from those caused by some irritant poisons, and in sporadic cases the relation of the illness to the consumption of unsound meat may be difficult to establish; this difficulty rarely arises in large outbreaks.

The complete diagnosis rests upon the isolation of *B. suipestifer* or *B. enteritidis* (Gaertner) from the meat to which the illness was attributed and from the blood or stools of the patients. A positive reaction of the patient's serum for these bacilli affords confirmatory evidence. There is usually no difficulty in isolating the bacilli directly from the stools during the first three or four days of the illness.

Treatment. The treatment is that of any acute gastro-enteritis.

Other forms of food poisoning, such as botulism and ergotism, are practically unknown in this country, and do not call for consideration here.

F. A. B.

ALCOHOL AND INSANITY

It has been generally stated and widely accepted that "Intemperance in drink is responsible for more than twenty per cent. of all cases of insanity, being nearly as high as twenty-four per cent. in men." I consider that the above statement regarding the influence of alcohol and insanity should be restated in this way: "Alcohol is responsible for a large number of admissions to asylums." How far it acts *per se* as the efficient cause of insanity, and how far it is only a coefficient or coincident in a person potentially insane, it is at present difficult to gauge.

Cases of true alcoholic psychosis directly due to chronic alcoholic intoxication are relatively infrequent in asylums, and still more infrequent are the cases of permanent alcoholic dementia in which these cases may end. It is a very rare thing to find cirrhosis of the liver obvious to the naked eye on the post-mortem table of the asylums, whereas it is of fairly common occurrence in the general hospitals. Moreover, Drs. Sullivan, Bevan Lewis and MacDonald have shown a regional dissociation between alcohol and insanity.

Coincidence and cause may be confused, for a lapse from moderation to intemperance may be the first *recognizable* sign of mental breakdown.

There can be no doubt that neurasthenics, epileptics, imbeciles and potential lunatics—all those, indeed, with an inherent narrow margin of highest control—possess a marked intolerance to the effects of alcohol, and the failure to discriminate between what is the *result* of alcoholism and what is *innate* and *due to inheritance* has been the cause of much confusion.

The chronic alcoholic may develop an acute or chronic form of insanity; but there is no hard-and-fast line between the two, viz. delirium tremens and Korsakow's polyneuritic psychosis. The question arises, is alcohol the sole direct cause of insanity in a potentially sane person free from any hereditary taint? It may be argued that for years individuals can take large quantities of alcohol every day without suffering from delirium tremens; then a severe injury or an infective disease occurs, or gastro-intestinal troubles arise, and although the man takes no more alcohol than previously, nevertheless he no longer feels, thinks or acts like a sane person. Three factors may have been at work: the alcohol, a microbial or other poison the result of deranged metabolism, and a diminished specific energy of the nerve cells caused by alcoholic intoxication in the past, accompanied in some cases by the effect of shock produced by injury.

Delirium Tremens is usually only a temporary insanity, so that not many cases are admitted to asylums, but numbers of these cases are admitted to infirmaries and are discharged cured within a week; by no means a few chronic alcoholics are admitted repeatedly to infirmaries and hospitals for this same cause. The signs of oncoming delirium tremens in a chronic alcoholic are these: he often becomes suspicious and jealous, and frequently doubts his wife's fidelity; he has morning vomiting, he loses his appetite; restless at night and troubled with terrifying dreams, he is constantly getting out of bed and wandering round the room or house; the temperature may be raised to 100° F. or more. The face is usually flushed; there may be a little thickness in utterance and slurring of words, and a slight tremor of the lips and nostrils when speaking. A marked tremor in the hands when the fingers are separated is usually observed, and is one of the most constant signs. This tremor may now become general, and the dreams begin to terrify him by day; he suffers from auditory and visual hallucinations, especially the latter. He sees and feels crawling creeping objects; the perverted kinæsthetic sense gives rise to visual associations of creeping, crawling, black and grey terrifying objects, *e.g.* spiders, beetles, snakes, rats, black devils, which he mentally projects on to the wall, the ceiling, the bed-clothes or on his body. Again he has illusions of all kinds; he mistakes the identity of persons. A noisy, busy delirium occurs, *e.g.* the publican serves his customers, talks to them and hears them reply, the actor shouts his part, or the carman drives his horses in his delirious imagination. If such a chronic alcoholic be put in a padded room and left to himself, some fluid nourishment being given him and all alcoholic drinks withheld, in the course of a few days, in the majority of instances, he will fall into a deep sleep from which he will awake with his mind clear; but cases do occur in which after the delirium has subsided the mind remains affected from one to several weeks; thus there is confusion, disorientation in time and place and amnesia, with a recurrence frequently of the delirium at night, though the patient is quiet during the day.

Such cases seem to indicate a transitional stage between delirium tremens and the more intense form of the alcoholic poisoning upon the nervous system, viz. Korsakow's psychosis. It is probable they are cases in which there is, besides the effect of the alcohol, the effect of an auto-intoxication. I agree with Bonhöffer and Kraepelin in thinking that delirium tremens and Korsakow's psychosis are but different forms of the same disease.

It is a remarkable thing that delirium tremens

is so much more frequent in men than in women; and polyneuritic psychosis in women than in men. Sex seems in some way to determine the neuritic condition and the deeper and more persistent effects of the poison on the mind.

Women who suffer from Korsakow's disease are usually between thirty and forty-five; they have been drinking steadily and often secretly for years; they are, according to my experience, always married women or women who have cohabited with men; they are frequently the subjects of uterine or pelvic disorders, so that there is a source of constant microbial toxæmia in some form or another.

The symptoms of the disease are quite characteristic even if a history of chronic alcoholism cannot be obtained. In the less severe hospital cases, on the one hand, the neuritic symptoms are most obtrusive, and the mental symptoms, seldom, if ever, completely absent, are apt to be overlooked; in asylum cases, on the other hand, the mental symptoms are most obtrusive, and the neuritic symptoms apt to be overlooked.

Korsakow's Psychosis.—The symptoms and signs are very characteristic. There may be, from weakness in the lower limbs, all gradations of loss of power up to complete paraplegia; occasionally there may be an ataxic paraplegia. The upper limbs may also be affected, and in severe cases, practically speaking, none of the motor nerves may be exempt; thus I have seen facial and ocular paralysis, and have determined the existence of degenerated fibres in the vagus nerves in a fatal case with tachycardia.

In severe cases there is marked wasting of the muscles of the lower limbs, and foot-drop owing to the greater liability of the dorsal flexors to be affected; again, there may be wrist-drop, owing to the greater affection of the extensors of the wrist; these muscles may show not only quantitative changes in the electrical reactions, but qualitative changes also. The knee-jerks are usually absent; they may be present or even increased if the sciatic nerves supplying the hamstring muscles are deeply affected, leaving the anterior crurals supplying the quadriceps extensors comparatively free.

Although there may be a complete paraplegia, unless there be dementia there is no loss of control over the sphincters. A very characteristic sign is the pain evinced upon deep pressure of the leg muscles; this is seldom, if ever, absent.

The patient frequently complains of burning pains in the soles of the feet and legs, and of paræsthesia, and there may be varying degrees of anæsthesia to tactile, painful and thermal stimuli, the distribution of the sensory disturbance being characteristic of a neuritis, in its

onset and spread resembling the pulling on of a stocking or a gauntlet, and in recovery in taking off of the same.

Mental Symptoms. In severe cases the mental symptoms are striking; there is a great deal of *mental confusion* and *disorientation in time and space*; thus a woman who had been in the asylum four months thought she had come the night before; although told repeatedly it was Hanwell, whenever she was asked where she now was, she replied, "Fulham Infirmary"; there was complete *loss of memory of recent events*, of what was said to her and of what she herself had said, although she was able to recount correctly episodes in her early life. The abnormal mental state is obvious at a glance; they appear to be apathetic and to take but little notice of their surroundings, and the attention is obtained with difficulty. They are given to confabulation and fabrication of past experiences, forgetting what they have said and denying the same—they are regarded as consummate liars.

Personal illusions and mistakes in identity of persons are frequent in spite of continuous correction. Delusions are frequent. At night such patients are delirious, they are extremely restless, fumble in the bed-clothes for imaginary objects and converse with imaginary persons; they are undoubtedly the subjects of visual hallucinations, and very often refer to *babies being in the bed* or of hearing the baby cry. The delusions may take the form of persecution, of seeing burglars in the room at night, of being followed by policemen and detectives. Occasionally the delusions are of a grandiose character. In very severe cases the patient lies in a stuporose state, motionless and oblivious of her surroundings and the calls of nature, with the limbs sometimes rigidly flexed or hyper-extended.

Dipsomania.—A form of periodic alcoholic insanity which has been known occasionally to affect several members of a stock. It is almost as if there were two natures or temperaments in an individual; a bad, latent one which occasionally asserts itself, causing a good husband and a good father, suddenly to take to drinking. Leaving his wife and family and living a vagabond life, he becomes careless of his person and reputation, his only desire being the gratification of the unnatural craving for drink. A period of exhaustion comes sooner or later, when the craving dies away and he returns home to renew for a time his normal and often blameless life. Kraepelin regards this periodic craving for drink as an anomalous form of epilepsy.

Acute Alcoholic Hallucinosi.—Most of the cases that are admitted to asylums and diagnosed as acute alcoholic hallucinosis are cases of

intemperance in individuals the subjects of potential insanity, epilepsy, congenital imbecility or cases in which the lapse from moderation to intemperance is the result of the onset of the insanity; some of the cases are, as previously related, cases of delirium tremens in which hallucinations and delusions persist after a week's enforced abstinence.

As a rule it may be said that if the mind clears up while the hallucinations (especially of hearing) persist, and the delusions instead of being fragmentary are systematized, we are dealing with a case of insanity in which alcohol has only been a coincident or coefficient and not the essential cause.

The most difficult cases of all to decide are those of alcoholism associated with the prodromal stage of general paralysis with depression and delusions of persecution. I will cite a case. A book-maker's tout, a heavy drinker for many years, was brought into Charing Cross Hospital for injuries received by jumping off an omnibus in the Strand. He was found to be suffering from delirium tremens; he had the delusion that he was being followed by detectives and policemen, and this had made him jump off the bus. He was sent to the infirmary, and three weeks later I found him in Hanwell Asylum. He gave me a perfectly clear account of his life up to the final acts related. He told me that he always believed his wife was dead and that he had seen her put in her coffin, but she was in this building and she had frequently come and spoken to him and he had seen her.

This case might have been called acute alcoholic hallucinosis, but in a short time well-marked signs and symptoms of general paralysis developed.

Treatment. The treatment of chronic inebriety with mental symptoms is of a twofold nature: the removal of the cause and relief of the symptoms arising from the alcohol and contributory factors.

If the patient can be sent to an infirmary, an asylum or other institution the practitioner has a most troublesome case off his hands. In an institution the patient can be placed in a padded room and no further alcohol is obtainable; the necessity of administering drugs (chemical restraint) to quiet the patient does not arise; mechanical restraint is avoided, and danger to himself and others is reduced to a minimum. Moreover, a patient who is certifiable and is admitted to an asylum can be kept there until all the symptoms have passed off. Once the habit of chronic inebriety has installed itself only a prolonged sojourn in a home or asylum can be considered of any avail in overcoming the habit.

One of the great difficulties in the treatment

of chronic alcoholism in private houses is the withholding of the alcohol; the nurses, the servants, even the wife and near relatives are bribed, cajoled or threatened into supplying it secretly; therefore it is absolutely essential that the practitioner should obtain nurses or male attendants in whom he can place implicit reliance to carry out his instructions. Some male cases can be nursed by female nurses with a male attendant at hand if required; others require several male attendants to prevent them doing injury to themselves or others. If possible both chemical and mechanical restraint should be avoided. Straight waistcoats, tight sheets, etc., are to be deprecated. Hypnotics in maniacal and delirious conditions may however be necessary, especially when the case is treated in a private house. The following may be administered, the selection being determined by such circumstances as previous experience of the action of the drug in the case, condition of the heart and circulation, the kidneys, etc., indicate: chloral and bromide, 15 gr. of the former and 30 gr. of the latter, or chloralamide 15 to 45 gr. in weak spirituous or acidulated solution. If there is heart weakness, paraldehyde in capsules or emulsion in doses of 30 to 120 minims may be tried alone or in combination with trional or sulphonal 10 to 30 gr. When the mania is acute and other remedies have failed, hyoscine or hyoseyamine hydrobromide $\frac{2}{100}$ to $\frac{1}{100}$ gr. may be injected hypodermically. It is necessary to keep the patient's strength up by proper fluid nutriment, to keep the bowels freely open by purgatives, and see that the bladder is emptied, if necessary by catheter. Later, after the acute symptoms are over, tonics in the form of quinine and strychnia may be administered. The question nearly always arises, in what cases should alcohol be administered? Personally, I am of opinion there are very few; still, if there be pneumonia and the pulse improves by giving alcohol, it may be desirable to administer it or ether and ammonia. Oxygen inhalation may be useful also.

The Treatment of the Neuritic Symptoms. In the chronic alcoholism of women, known as Korsakow's psychosis or polyneuritic psychosis, if any cause of septic infection be discoverable it should be treated if possible. I always advise that the patient's lower limbs—which are the most affected, causing varying degrees of paraplegia, should be wrapped up in knitted woollen stockings and cotton-wool, and covered with a cradle so that the weight of the bed-clothes should not increase the tendency to foot-drop; it may even be necessary to put on some form of splint to obviate this. As soon as possible, even though it causes the patient considerable pain, passive movement

of the joints and gentle massage of the limbs should be carried out daily. The patient should later be made to feel the soles of her feet on the ground, supporting the weight of the body and eventually with aid, personal or mechanical, encouraged to walk, thus avoiding permanent contracture. In the carrying out of passive movements by the nurse, the patient should be made to look at the movement and will its performance, so as, if possible, to re-establish the connection between the mind and the groups of muscles necessary for the performance of voluntary movements. Care must always be taken to avoid bed-sores and sores from contact of hot bottles against the insensitive limbs. By careful and patient treatment I have seen remarkable cures effected in apparently hopeless cases of alcoholic neuritis; on the other hand I have seen cases sent to the asylums from the infirmaries hopelessly bedridden from contractures.

F. W. M.

AUTO-INTOXICATION

"There is an element of fashion, personal or collective, in the manner in which the obscure conditions of disease are interpreted. The progress of the auto-intoxication propaganda, like every other uncontrolled movement in practical medicine, is like the development of gossip in common life—the first person suggests that it might be so, the second states that it is so. The serious aspect of the situation . . . lies in the fact that positive diagnosis, however fictitious, inhibits investigation." (A. E. Taylor.)

This reflection, made by an authority, serves to summarize much of the subject at present. There is a loose tendency to attribute to "auto-intoxication" many cases of obscure etiology, and especially cases associated with gastro-intestinal defects. But when it comes to closer scrutiny, and efforts are made to establish a definite chemical process as the cause of the symptoms, the diagnosis is found to be based upon the purest hypothesis. Some years ago Bouchard's doctrine—that the human body exists on the brink of a precipice of poisoning from the products of its own katabolism—found much favour. But the doctrine has not stood the test of time. It has transpired that experiment and observation both show the body to possess a much wider margin of safety than this.

When we come to specify, and to comment upon, the actually proved instances of auto-intoxication they are really very few. The following brief account probably exhausts the conditions that can with reason be brought into this category.

Intoxications associated with Gastro-Intestinal Defects.—Perhaps the most definite symptom-complex coming under this heading is the *tetany* which occasionally complicates dilatation of the stomach. The actual toxic substance causing the nervous symptoms in this condition still lacks isolation and description.

It is possible that *Henoch's purpura* is of the nature of a gastro-intestinal intoxication, and some cases of *erythema*, such as *E. nodosum*. It is commonly believed that many instances of *urticaria*, and especially *urticaria* of the "giant" form, owns a similar origin. The great difficulty is, of course, to exclude the operation of ingested toxic material on the one hand and of the toxic products of bacterial action on the other. And to neither of these last-named toxic processes should the term "auto-intoxication" be properly applied.

Constipation is often spoken of as a source of auto-intoxication; but here, again, bacterial activity may be the real origin of observed symptoms. Andrew Clarke thought *copræmia* the main factor in the etiology of *chlorosis*; and disordered intestinal contents are usually regarded as being responsible for the hæmolytic substances causing *pernicious anæmia*. In both instances, however, the hypotheses lack substantial evidence. Various *neuroses* are frequently attributed to gastro-intestinal poisoning—particularly *megrim* and some forms of *neurasthenia*.

Intoxications associated with Defective Metabolism.—A form of *carbohydrate fever* is spoken of as occurring in some children. But the disease-process most often attributed to metabolic defects is *gout*. Some authorities are still satisfied with the simple explanation of this complex disease which attributes all its manifestations to the production of uric acid, regarding this chemical substance as highly toxic in its effects. In *diabetes* the accumulation of certain by-products of the acetone and diacetic acid series does, no doubt, lead to a toxic state which has been termed *acidosis*. It is probable that we are here dealing with the best-authenticated instance of true "auto-intoxication"—certainly we are on surer ground as regards chemical investigation than in connection with most other so-called instances of the condition. There is really no good evidence at all that in *obesity* toxic products play a part in the pathological process. In *myxœdema* and in *Graves' disease*, and to a less certain degree in *Addison's disease*, we seem to be concerned with disordered metabolism as the result of deficiency or excess of normal internal secretions rather than with actual "auto-intoxication."

Intoxications associated with the Retention of Secretions and Excretions.—Constipation overlaps also with the conditions to be considered in this

group. But more definitely may be mentioned *jaundice*, a state in which the biliary constituents re-enter the blood stream, and *anuria*, in which the urinary substances are not passed out of the body, but are retained in it. And yet the very fact that there is no sort of parallelism between jaundice and hepatic coma on the one hand, and between anuria and uræmia on the other, warn us that mere retention of normal secretions does not necessarily lead to toxic manifestations at all. Indeed, patients may be deeply jaundiced

without appearing much, if at all, poisoned, and the same may be said of patients who secrete no urine for several days; whereas a fatal coma may appear in a case of failing liver function without jaundice, and serious uræmic symptoms may develop in a patient who is passing plenty of urine. The "poisons" concerned are obviously not constituents of the normal secretions, but intermediate products of metabolism, or abnormal products, of as yet unascertained nature. T. J. H.

DISEASES DUE TO VEGETABLE PARASITES OTHER THAN BACTERIA

ACTINOMYCOSIS

Actinomycosis is a chronic disease caused by the *Streptothrix actinomyces*, or *Ray Fungus*, which is supposed to live on and be conveyed into the body in the husks of certain cereals, especially barley.

The fungus may gain entrance to the human body through a carious tooth and give rise to suppuration about the jaw or neck; it may enter by the alimentary canal and set up suppuration about the cæcum and appendix, or more rarely it may be inhaled through the air passages and give rise to an empyæma.

The disease, wherever it occurs, is characterized by a chronic form of suppuration which is very resistant to treatment. A swelling slowly forms, infection spreading by extension, so that a whole region may become infiltrated and swollen, and if near the skin the abscess eventually bursts and sinuses result. Owing to the chronicity of the inflammation much fibrous tissue is formed, and on this account actinomycosis may be mistaken for sarcoma, tuberculous or syphilitic disease, the last-named most particularly, for in both improvement follows the administration of iodides.

The condition is recognized by finding in the pus minute granules about the size of a pin's head, generally of a yellow colour (sometimes black, the gunpowder variety). If one of these granules is picked out on the point of a needle and flattened between two cover-slips and stained by Gram's method, it will be seen to consist of an irregular mycelium or network of filaments. The terminal clubs from which the organism receives its name of ray fungus are rarely seen in the human variety, but are found in the ox and the horse, in which the disease manifests itself by the formation of large hard tumours in the jaw and tongue (woody tongue).

Prognosis. Spontaneous cure is rare, and when the disease implicates internal organs it is almost always fatal.

Treatment. If the diseased part is accessible the abscess should be opened, scraped and drained like any other abscess. In addition potassium iodide in large doses should be given (100 to 200 grains per diem). The use of vaccines prepared from cultures of the organism has proved of some value. X-rays may be employed in the case of superficial abscesses.

G. E. G.

INFECTIOUS DISEASES CAUSED BY BACTERIA

ENTERIC OR TYPHOID FEVER

Etiology. The disease is due to infection by the bacillus typhosus whose discovery is associated with the names of Eberth and Gaffky. This micro-organism is a short, thick rod with rounded extremities and is actively motile, being provided with numerous flagella. Its differentiation from the micro-organisms of the paratyphoid and colon groups is a somewhat difficult task, which is only possible by expert bacteriologists.

The bacillus is to be found in many of the internal organs of persons who have died from the fever. It probably occurs in greatest numbers in the spleen, but is often easiest to isolate from the gall bladder. In life it may be recovered from the stools, blood and urine of patients.

As regards *predisposing conditions*, the disease can flourish in almost any climate and occurs in all parts of the world. In this country the early autumn is its most usual season, but cases occur at all times of the year. It is a fever of

early life, the majority of patients being between ten and twenty-five years of age. Infants rarely suffer from it, and it is unusual to find it in persons of over sixty. Males are affected in a somewhat higher proportion than females. It is probable that such conditions as fatigue, over-work and ill-health predispose to infection, and a change to new conditions of life and climate certainly renders a person more susceptible. Active military service, whether in standing camps or on the march, affords most favourable opportunities for epidemics, and the fever has been described as the "destroyer of armies."

Infection is always derived directly or indirectly from the excreta of a previous case. The bacillus, however, may reach the human subject in a variety of ways, which may be briefly considered. (1) *Water* has long been recognized as a cause of outbreaks. It may be contaminated by sewage leaking through defective drainpipes and fouling the soil in the neighbourhood of a water supply; shallow wells in particular are liable to contamination from excreta carelessly disposed of, and even reservoirs may occasionally become infected. The detection of the bacillus in water is difficult, and its absence must not be held to prove that a suspected water is safe. (2) Various *articles of food* may give rise to typhoid outbreaks. Of these *milk* is the most important, as it is readily contaminated by infected water. *Shellfish* are also responsible for typhoid infection, both oysters and mussels having been proved to have caused the disease. Other incriminated articles are ice-cream, celery and watercress, which doubtless are infected by the milk, water or soil with which they have been associated. Quite recently suspicions have been aroused regarding fried fish, which appears to have been responsible for some London outbreaks, although it is very difficult to see how the bacilli could survive the cooking process. (3) *Dust* can undoubtedly disseminate the bacillus. Contamination of soil and dry weather is all that is required for the dissemination of the disease in this manner. (4) *Flies* and possibly other insects are also capable of carrying the bacillus and contaminating food. It has been recently shown that in Manchester the period of enteric prevalence corresponds closely with the prevalence of the common house-fly. (5) *Fomites*, such as bed-linen, blankets and clothes soiled by patients can also spread infection. (6) *Carriers*, that is healthy persons who have had the fever and have retained the bacillus in their intestines, bladder or elsewhere for long periods, appear to be occasionally responsible for small outbreaks. Most of the reported cases have been of persons whose employment was the preparation of food for other people, and it is

probable that want of care in cleansing the hands after defæcation is responsible for the contamination. Bacilli have been isolated from such individuals thirty years after an attack of typhoid. (7) *Personal infection* by direct contact also plays some part in the dissemination of the fever, and was especially well illustrated in the American standing camps during the Spanish war. In hospitals, also, nurses often contract the disease. In all cases, however, the infection is derived from the excreta of a patient or carrier.

Pathology and Morbid Anatomy. The bacillus is probably always swallowed and obtains its first nidus in the alimentary canal. The lymphoid tissue of the intestine is first attacked, and from it the micro-organisms find their way into the blood. The Peyer's patches and solitary glands in the ileum become infiltrated with leucocytes and somewhat raised above the surrounding mucous membrane. After about ten days or a fortnight a process of necrosis sets in and the glands slough wholly or in part, leaving the typical typhoid ulcer, which corresponds in shape to the Peyer's patch, has its long axis parallel to that of the bowel, and is situated opposite the peritoneal attachment of the gut. Occasionally the result of the ulceration is perforation. Usually, however, the ulcer heals by granulation. The mesenteric glands are enlarged, and the spleen is always large and dark in colour. Ulcerations may be found in the larynx, and the lungs often show hypostatic congestion. It is well to remember that the bowel lesions may be quite trivial even in very severe and fatal cases and that the disease is really a septicæmia, the bacillus having been found all over the body.

Course of the Fever. The stage of *incubation* is very variable, the limits being from one to twenty-one days. The onset of the fever is usually insidious, though in some cases the disease commences abruptly. Usually, however, the temperature rises very gradually and the symptoms are often correspondingly indefinite. The patient suffers from discomfort and malaise and there is usually more or less headache. The sleep is broken and disturbed and some delirium may be noticed at night. Abdominal pain or discomfort is almost invariably complained of and the bowels are seldom normal. Constipation is almost as common as diarrhoea, but the latter is, of course, a more significant symptom. Epistaxis occurs in from twenty-five to thirty per cent. of the cases. In some patients the bronchial catarrh which is usually present is severe enough to cause a troublesome cough. The invasion stage lasts about a week, by the end of which time the temperature has usually reached the acme.

The course of the *temperature* is very characteristic. Rising in the first week by step-like gradations, in the second it assumes a continued type with fairly well-marked morning remissions. The level is usually between 101° and 103° F., but may be higher or lower. The continued stage may last into the third or even the fourth week. In many patients, however, a well-marked lysis sets in in the third week, or a little later, and the temperature regains the normal as gradually as it rose.

By the end of the first week the patient has usually taken to his bed and may be said to have entered the *stage of advance*. While in some cases there is little more to note than the continued pyrexia and enlarged spleen, in most the characteristic symptoms of the fever will be found present. The face is usually pale and often shows a slight hectic flush. The pupils are larger than normal and the expression weary and apathetic. The tongue is furred and tends to be dry in the centre. There is often a clean red triangle at the tip. The abdomen is nearly always tumid and may be much distended. Tenderness, especially in the right iliac fossa, is sometimes well marked. The spleen is often readily palpable, particularly in children. The abdominal reflex is in most cases absent.

The *eruption* is often visible from the eighth day. It consists of rose-coloured lenticular spots, which disappear readily on pressure. They are most frequently seen on the abdomen, back and flanks. They appear in successive crops, the life of an individual spot not exceeding four days. The eruption is usually scanty, sometimes only two or three spots being visible, in other cases twenty or more being present. It is probable that this rash occurs in the great majority of patients, but it has often disappeared before it is looked for. Children are less likely to show it than adults. The *stools* are not always loose, but, when they are so, they usually assume the ochre yellow colour which has caused them to be compared to pea-soup. They have a peculiarly foetid odour, and often contain undigested curds of milk. The *pulse* is of low tension, and, in the early stages of the fever, markedly dicrotic. At this time also it tends to be slower than would be expected from the height of the pyrexia, seldom exceeding one hundred in the male adult. Later in the illness, however, it becomes relatively faster. The first sound of the heart is often very feeble in the third week and later, the cardiac weakness being probably due to the effect of the toxins on the myocardium. The *respirations* are accelerated in proportion to the temperature level. In the later stages of the fever, if the case is a severe one, they may become faster as the result of congestion of the lungs. More or less bronchial catarrh is always present.

The *nervous symptoms* are often well marked. Headache is not complained of after the first week, but insomnia is often troublesome and there is frequently low muttering delirium, especially at night. Deafness is very commonly noticed. Subtultus of the tendons, picking at the bed-clothes, and retention or incontinence of urine are all liable to occur in sharp cases. The prostration of the patient is shown by his helplessness and inability to turn in bed. In children meningeal symptoms are common and are most frequently due to the toxæmia.

The *urine* is usually scanty until the stage of defervescence. It may contain traces of albumin, but seldom large amounts. The diazo reaction is usually present from the sixth to the fourteenth day. The bacillus typhosus can be recovered from the urine in about forty per cent. of patients. The *blood* is remarkable for its low leucocyte count. From four thousand to six thousand leucocytes is a common figure, and still lower counts, such as two thousand, are not very unusual. Bacilli may be cultivated from the blood throughout the fever.

Results of Ulceration. After the end of the second week the necrotic process in the lymphoid tissue may be responsible for various accidents. *Hæmorrhage* occurs in from six to eight per cent. of cases and is more common and more severe in men than in women, seldom appearing in children of under ten years. The amount of blood lost varies, but it may be sufficient to kill the patient in a few minutes. Usually, however, chocolate-coloured or dark-red stools are passed with or without such symptoms of collapse as pallor, a falling temperature and a rising pulse. The frequent loss of small amounts of blood over several days is seldom followed by good results, but single hæmorrhages, even if copious, are often followed by a good recovery. About three per cent. of all cases of typhoid suffer from *perforation*. This is usually situated in the last eighteen inches of the ileum. The accident may be preceded by pain for some days, but as a rule there is no warning. The first and most common symptom is sudden and violent pain. This may not be well marked in stupid and delirious patients. The temperature often falls and the pulse is increased in frequency. Shivering, if present, is a highly suggestive sign. In many patients the face expresses anxiety from the first. On examination the abdominal muscles are rigid, and there may be localised tenderness. The abdomen itself is very tumid and hardly moves on respiration. The liver dullness may be much diminished or obliterated. After a few hours peritonitis sets in. Vomiting is usual and is often persistent to the end. The abdomen becomes more distended and is exquisitely tender. The knees are drawn up, and the face becomes pinched and

livid. The pulse is irregular, thready, and very fast. Death probably occurs within three days, consciousness remaining acute until the last. The early recognition of perforation is extremely important, as operation affords the only chance of recovery. Rigidity of the abdominal muscles, taken together with an immobile abdomen and tenderness, following on sudden pain with or without collapse, would in most instances justify surgical interference.

Severe and persistent diarrhoea is often associated with extensive ulceration. Meteorism is another condition which must always be regarded as dangerous. Like diarrhoea, it is most liable to occur in injudiciously dieted patients.

After a more or less prolonged stage of advance the *stage of defervescence* terminates the fever by a somewhat prolonged lysis. The patient now becomes ravenously hungry. The abdomen loses its tumidity and the spleen diminishes in size. Convalescence may be said to be reached when the temperature becomes steadily normal. Fluctuations of temperature are, however, very common. The patient is left wasted and feeble, but in most instances regains his strength and weight in a few weeks. A *relapse* may interrupt convalescence, appearing any time within a fortnight of the termination of the first attack. It is a repetition of the original fever, usually in a shorter form, and is to be distinguished from simple post typhoid pyrexia due to such causes as constipation or indiscretions in diet.

Types. There is a hæmorrhagic or *toxic* form associated with bleeding from the gums, nose and bowels, and with purpuric spots on the skin. It is very rare and always fatal. More common is the *ambulatory* type, in which a patient merely suffers from slight malaise and continues to do his work for two or three weeks, when perhaps he is prostrated by a hæmorrhage or perforation. The *abortive* type is an abridged form of the fever lasting from a week to a fortnight. In the *apyrexial* type, which is very uncommon, the patient goes through his fever with classical symptoms but no elevation of temperature.

Complications and Sequelæ. Almost any condition may be found in association with an attack of typhoid fever. It will be sufficient to mention the most important complications only. The disease may commence with all the symptoms of pneumonia, and it is possible that in some cases there is a primary infection of the lungs by the bacillus typhosus. Ordinary pneumococcal pneumonia may complicate the fever at any stage. Renal complications are rare, but some patients commence their illness with nephritic symptoms, and pyelitis is sometimes the result. More characteristic of typhoid fever is the *venous thrombosis*, so liable to occur

during the lysis or in convalescence. The left lower limb is most often affected and the femoral, long saphenous and popliteal veins those most frequently thrombosed. The symptoms are pain and œdema of the affected part, with or without irregular pyrexia. Arterial thrombosis may also follow the fever and is due either to embolism or to obliterative arteritis.

Periostitis, due either to the typhoid bacillus or to pyogenic germs, is a well-known but not very common sequela. The tibia is the bone most usually attacked. The first symptom is pain, and a small swelling may be palpable. Suppuration is the usual result. Another late complication is *typhoid spine*, characterized by pain and rigidity of the back and often associated with pyrexia, tenderness, incontinence of urine and exaggerated knee-jerks. It is probably due to a peri-spondylitis and in some cases may be merely a neurosis. It is a tedious condition, but the prognosis is on the whole good.

Parotitis, unilateral and always ending in suppuration, is met with in severe cases, and superficial skin *abscesses* are common in children.

Among other conditions liable to complicate typhoid fever may be mentioned laryngitis, otitis media, cancrum oris, cholecystitis, meningitis and various cerebral lesions. Pregnancy, if present, is usually interrupted.

Diagnosis. The only absolute proof of enteric fever is the isolation of the bacillus typhosus from the blood of the suspected patient. Short of this, diagnosis must depend on the appearance in varying combinations of certain signs and symptoms, none of which are constant, and many of which are often absent. The serum reaction, if not infallible, is undoubtedly of the greatest assistance.

It must be remembered that it is not unusual for the typhoid patient to seek advice while he is still able to walk about. Many cases appear to be missed because the idea of the fever being present has never crossed the mind of the practitioner. There are, however, certain symptoms which, if complained of, should suggest the possibility of the disease. Thus, if in addition to a complaint of the ordinary febrile symptoms of headache, chilliness, loss of appetite and insomnia, it is found that the patient suffers from abdominal pain, diarrhoea or epistaxis, it is wise to make certain that typhoid fever is not present before going further. Continued fever taken together with any or all of these signs is highly suggestive. On the other hand it must be recollected that diarrhoea is not invariable by any means, many patients suffering from constipation throughout. Should the fever be suspected, confirmatory evidence will often be gathered by examination. Spots may or may not be present, but the abdomen is usually tumid, seldom gives an abdominal

reflex, and is often tender. If the spleen is normal in size it is unlikely that we are dealing with a case of the fever. Pea-soup stools have some value, but they may be imitated by the dejecta of other conditions, *e.g.* those of a patient with acute pneumonia who has been given too much milk. The slow pulse relation to the temperature, seen chiefly in male adults, and only to be expected in the first fortnight of the fever, is a valuable sign, and the dicrotism of the pulse may prove of assistance in coming to a conclusion.

We are often, however, compelled to diagnose the fever by a process of exclusion. And here it is well to realize that the disease most frequently incorrectly labelled typhoid fever is acute lobar pneumonia. Should the respirations of a suspected patient exceed thirty per minute, the lungs should be most carefully examined to exclude this condition. Broncho-pneumonia in children is another cause of error. Various tubercular conditions must also be remembered. Tubercular peritonitis, tubercular pleurisy with effusion, tubercular meningitis, general tuberculosis and even phthisis are not infrequently notified as typhoid fever. Once the possibility of the confusion of these conditions with the fever is thoroughly grasped, mistakes are not very liable to occur, but occasionally the practitioner will have to depend upon bacteriological assistance to make the distinction. Abdominal and pelvic inflammations may often give trouble, and, while cases of appendicitis are sometimes labelled "typhoid," it is not unheard of for a case of the latter disease to be actually operated on for an imaginary appendicitis.

Meningeal inflammations are also a source of difficulty. The tubercular variety often closely resembles typhoid fever in young children whose head symptoms are liable to be exaggerated, and who may even suffer from inequality of the pupils or strabismus. Kernig's sign points to actual meningitis, but is sometimes observed in the "meningism" due to typhoid toxæmia, and a retracted abdomen is never seen in the fever. Other conditions worth remembering are cholecystitis, ulcerative endocarditis, septicæmia, acute rheumatism and malaria. Typhus is now so rare it need not be seriously considered. Influenza, however, if prolonged, may cause some difficulty.

A word must be added on the subject of **Paratyphoid Fever**. The paratyphoid bacillus is capable of causing a disease clinically indistinguishable from enteric fever and presenting all its characteristic features, such as rose spots, ochre stools and enlarged spleen. Ulceration is apparently uncommon and the course of the fever is not so severe or prolonged as that of the ordinary infection. It may be

said that, if an apparently obvious case of typhoid fever gives a persistently negative serum reaction, the rarer condition should be suspected. In any case the question is one of interest only to bacteriologists, and from the public health point of view these cases should be notified and treated as typhoid fever.

Laboratory Diagnosis. The simple urine test known as Ehrlich's *dialo reaction* is not much employed in general practice. It is, however, of great assistance in early diagnosis. Two solutions are required: first, a saturated solution of sulphanilic acid in dilute (1-20) hydrochloric acid; second, a one-half per cent. solution of sodium nitrite. The reaction works best and most consistently if done as follows:—Fill a third of an ordinary test tube with urine and add an equal bulk of the first solution: mix by inverting the tube and then add one or at most two drops of the nitrite, and shake up the mixture until a good froth is obtained. Now render alkaline by allowing a solution of strong ammonia to trickle into the tube. The froth in a negative urine remains pale or may be coloured bright yellow. In a urine which gives the reaction, however, it becomes a beautiful rose pink, the body of the urine turning to a deep crimson colour. It must be noted that the reagents, especially the nitrite, should be freshly prepared and not more than a fortnight old.

A positive reaction is present in many fevers, and is almost invariable in advanced tuberculosis. But if a negative result is obtained from a patient who has suffered from continued pyrexia for not less than six or more than fourteen days, it may be said to exclude typhoid fever.

A low *blood count*, six thousand leucocytes or under, with a high percentage of mononuclears is suggestive of typhoid fever. For the isolation of the bacillus from the blood, stools or urine some bacteriological experience is required, and this test is not available in private practice.

The *serum reaction* test associated with the name of Widal is convenient for the general practitioner who can easily obtain a drop or two of blood in a capillary tube and send it to a laboratory. The serum diluted to about one in fifty parts of beef bouillon is mixed with a young culture or emulsion of typhoid bacilli, and examined microscopically to see if agglutination of the organisms takes place. If the test is accurately performed and is checked by suitable controls the results given are very reliable. The reaction, however, may be delayed, and a negative result in the first fortnight of illness means little or nothing. Should, however, negative reactions be still obtained in the fourth week the disease is not likely to be typhoid. A positive reaction means that the patient actually has typhoid fever or has

suffered from it at some previous and probably recent date. It must, nevertheless, be remembered that persons vaccinated against the fever also give a positive reaction.

Prognosis. A mortality rate of from seven to seventeen per cent. of those attacked may be regarded as a fair estimate. The death-rate of children under fifteen years is comparatively small, ulcerative accidents not being common in the young. After fifteen years the mortality may be said to increase as age advances. Women appear to have a somewhat better chance of recovery than men. Stout, heavy persons usually take the fever badly, and such pre-existing conditions as alcoholism and old-standing disease of the kidneys, heart or lungs prejudice the chances of recovery.

The pulse is more important than the temperature in prognosis. If in adult males it exceeds 110 we are probably dealing with a severe case; should it be more than 120 there is good reason for alarm. A rapid pulse in a woman or child, however, need not cause much anxiety. The mere presence of high fever is not a bad sign, especially if the morning remissions are satisfactory, but if it is long maintained with little or no remission there is always reason to dread the resulting prostration. A sudden fall of temperature, if the pulse does not correspondingly improve, may imply the onset of an ulcerative accident, such as hæmorrhage or perforation, and therefore is not of favourable import.

Should the "typhoid state" supervene there is always reason for anxiety, but children often make good recoveries even when the nervous symptoms have been so severe as to suggest meningitis. Hæmorrhage is seldom directly fatal, but many patients who suffer from it have their resistance weakened and succumb to other causes. Perforation, unless successfully operated on, is invariably fatal. Complications add much to the danger of a case, and pneumonia, laryngitis, or renal disease may be mentioned as especially dangerous.

Treatment. Once the patient has been placed in suitable surroundings the first requisite is a competent nurse. The recumbent position must be strictly maintained and the bed-pan always employed. The skin should be kept in good condition by the frequent use of the tepid sponge. The parts exposed to pressure should be rubbed with methylated spirit twice daily, after the spongings, and to any parts which show redness a dusting powder of boracic and starch, with perhaps a little bismuth or zinc oxide added, may be freely applied. The toilet of the mouth is of great importance. The teeth and the buccal cavity must be carefully cleaned at frequent intervals with cotton-wool swabs. Some mildly antiseptic ointment, such as equal

parts of boroglyceride and glycerine, should be applied after each swabbing. The more water supplied to the patient for drinking purposes the more comfortable and moist will his mouth be, and to force sufficient fluids on delirious and resisting patients is one of the most important and arduous of the nurse's duties. The patient should not be allowed to lie long on his back if he can support himself on his side. Frequent change of position will lessen the risk of bed-sores and render hypostatic congestion of the lungs less probable. The temperature should be charted every four hours and the nurse must be instructed to report at once any sudden complaint of pain, change in the pulse or temperature, or appearance of blood in the stools. Every opportunity must be given to delirious patients to pass their urine at short intervals. The medical attendant should examine the abdomen at least once daily, satisfy himself the bladder is being properly emptied, and note any difference in distension or movement which might indicate the occurrence of perforation. He should also inspect the stools and note if they contain the curds of undigested milk.

The typhoid patient seems to be able to do well on either a liberal or a restricted diet, but the latter is much to be preferred in the acute stage. Allowance must, however, be made for individual idiosyncrasy, and wide deviations from the generally accepted methods of feeding may be made in appropriate cases without undue risk. For the great majority of patients milk forms the best staple diet, but great care in its administration is necessary, and the amount given should be strictly limited. For an adult about three ounces every two hours is amply sufficient, and this is best given diluted with one quarter of its bulk of warm water. Each feed should be regarded as a meal, and milk must not be allowed to stand at the bedside. The appearance of curds in the stools suggests that too much milk is being given or that it is being given improperly. In such cases the deduction of half an ounce from each two-hourly feed often makes all the difference. Water should always stand at the bedside and the patient be encouraged to drink all he possibly can. Six pints a day is a good ideal to aim at, and there is no doubt that headache, delirium and severe nervous symptoms are all modified favourably by the forced ingestion of large quantities of water. On the other hand, aerated drinks are best avoided as they increase the risk of meteorism. If there is no diarrhoea, beef tea is a useful adjuvant to the diet. Given hot it often induces sleep, and it is moreover an excellent stimulant. Many patients enjoy a cup of tea in the afternoon, and there is no reason why this should be withheld. Cocoa and coffee are sometimes useful in assisting patients to take milk.

If diarrhoea is present the milk should be boiled, reduced in quantity, or diluted with lime water. When there is much prostration various meat-juice preparations may be employed, and jellies are usually safe. Constipation may be dealt with by adding fluid magnesia to the milk. In cases of severe meteorism or vomiting it is well to remember that the typhoid patient tolerates complete starvation excellently, and it is sometimes advisable to cut off everything except water.

When the temperature touches the normal line in the morning it is usually safe to increase the dietary. Suitable first additions are Benger's food or Plasmon, egg-flip and well-boiled oat-flour porridge or bread and milk. Provided the morning temperature does not rise in consequence, after about two or three days steamed white fish, either haddock or whiting, may be given with thin bread and butter. Thereafter the amount of food may be increased, and by the sixth or seventh day of completely normal temperature chicken may be allowed.

Numerous special diets have been suggested. A very rational one is that which aims at "plenty of food but no fæces." With this in view Ewart gives whey in large quantities, allowing a reasonable amount of maltine or honey. If, however, milk is given rationally, and constipation avoided, the bowel can be kept fairly "clean." At the Edinburgh City Hospital the plan adopted is to empty the small intestine every second day with a two to three grain dose of calomel followed up by washing out the large intestine with an irrigation of about four pints of hot water.

After regulating the diet the best rule is to *treat complications as they arise*. The temperature should not be interfered with and the use, in particular, of the coal-tar antipyretics is most undesirable. Anything that is required can be most safely effected by the use of the tepid or cold sponge. Headache seldom gives much trouble. Insomnia should be actively treated from the first, and bromide of sodium and chloral hydrate in equal parts is a satisfactory combination of drugs for this purpose. When sleeplessness depends upon worry and anxiety, or upon the disturbance caused by a tendency to diarrhoea, there is nothing so useful as a five-grain Dover's powder. Dietetic modifications are usually all that is required to check diarrhoea. Drachm doses of castor oil or simple enemata are adequate means of combating constipation. Enemata are also to be recommended for meteorism, and twenty-drop doses of turpentine often give good results.

If the pulse tends to fail, especially if it becomes unduly rapid, the administration of *stimulants* must be considered. On the whole, alcohol is undesirable in typhoid fever, and if

we are driven to use it the dose should be small and its effects carefully watched.

Should *hæmorrhage* occur our chief object should be to allow its natural arrest by immobilizing the bowel. This can be effected by starvation and by the administration of opium. The use of the latter is often objected to as being liable to mask the symptoms of perforation, should that accident occur, but it is on the whole advisable to give it. Turpentine or calcium chloride may be given by the mouth, and some advise the injection of a few cubic centimetres of horse serum. The bowels should not be allowed to move for four days, after which they may be opened by an olive oil enema. After very profuse hæmorrhages it may be necessary to stimulate cautiously, great care being taken not to improve the circulation too much. Once *perforation* is diagnosed the abdomen should be opened and an attempt made to close the hole. The chances against success are certainly not less than six to one.

It will be unnecessary to say much on the subject of the systematic treatment of the fever by the *cold bath method*. It has never been much used in this country, and is difficult to carry out effectively in private practice. Its success depends on the fact that it increases the elimination of toxins and generally tones the nervous system. By the judicious administration by the mouth of large quantities of water, and by the frequent use of cool sponges, equally satisfactory results may be obtained with less trouble.

Serum and Vaccine Treatment. There is at present no available serum which can be relied upon. It is possible, however, that as the results of recent work on this subject by Hewlett and others, a satisfactory antitoxin may before long be obtainable. In the meantime more may be hoped from the employment of vaccines. An autogenous vaccine, that is to say, a culture of bacilli obtained from the blood of the patient himself, and killed by heat or by the addition of 0.5 per cent. carbolic acid, is likely to give the best results, but stock vaccines are also used and have been spoken of favourably. There is a great difference of opinion as to the amount to be given as a dose, and as to the intervals between the doses. Some recommend doses of 300 or 400 million bacilli, whereas others consider quite small doses of one or two million likely to be more efficient and safer. An interval of from four to five days between the injections as long as the fever lasts appears to give the most satisfactory results.

Management of Convalescence. The recumbent position should be maintained for some days after the temperature is steadily normal. There is always some risk of cardiac failure at this period. Should the pulse be satisfactory and not unduly fast the patient may be raised

gradually on pillows after four or five days, and can be safely allowed up on the tenth day of completely normal temperature. Relapses may occur any time up to three weeks, and the patient is best confined to hospital or his room for a month at least.

Prophylaxis. As regards the prevention of infection from an existing case, great care must be taken to see that the excreta are properly disposed of. They should be mixed with their own bulk or more of one to twenty carbolic acid and allowed to stand for an hour or longer before being emptied down the drains. The bed-pan must be carefully covered and care taken to prevent flies settling on either urine or fæces. Soiled sheets should be rapidly rolled up and placed in a bucket at the bedside and damped in carbolic solution at once. They should then be wrung out of the antiseptic and, faecal stains having been brushed out, left to soak in one to forty carbolic acid from six to twelve hours before going to the laundry. Nurses must be warned to take care in cleansing their hands after touching the patient or linen. In some hospitals they are encouraged to wear rubber gloves.

Typhoid Vaccination. Reliable vaccines can now be obtained for prophylactic purposes. About 1000 millions of dead bacilli are usually injected, and double that quantity as a second dose ten days later. There is usually a slight local reaction and a certain proportion of patients suffer from fever, malaise, and even slight diarrhoea. Prophylactic injections should be advised for those who are starting for India or countries where the disease is endemic, and for troops entering upon a campaign. It is, however, considered inadvisable to vaccinate in the presence of an epidemic, as during the negative phase following the first injection the patient may be unduly susceptible. After vaccination the blood gives a positive Widal reaction. The protection conferred is very considerable for at least two years. C. B. K.

TYPHUS FEVER (TYPHUS EXANTHEMATICUS, JAIL FEVER)

Etiology. The causative micro-organism is still unknown and is quite possibly protozoal in nature. The disease, however, has been attributed to various forms of cocci and also to a short bacillus. Recently Nicolle has proved that the *infection* is disseminated through the medium of the body louse, and he has been by this means able to infect apes and monkeys. Predisposing conditions are dirt, destitution and overcrowding. The fever is found in all climates, but is now but rarely met with in the British Isles.

After a variable *incubation*, usually from ten to fourteen days, the fever commences with an

abrupt onset, headache, chilliness and vomiting being the most frequent *invasion* symptoms. The patient is prostrated early and is mentally stupid from the first. The temperature mounts gradually, reaching its acme by the fourth or fifth day. By this time the *eruption* is appearing as pale pink spots, at first disappearing on pressure but soon becoming darker and stained into the skin. This rash invades the whole body except the face, and, if profuse, presents a somewhat measly appearance. As it develops, true hæmorrhagic spots or petechiæ may also appear and some degree of "subcuticular mottling," as of spots seen faintly below the cuticle, is generally present. These elements taken together form the "mulberry rash" of typhus. A characteristic odour resembling more or less that of mice is often noticeable. The *temperature* having reached the acme, 102° to 104° F., is continued with but little or no morning remission until the thirteenth or fourteenth day, when it falls by a slow crisis. The pulse throughout the fever is rapid and the respirations unduly accelerated. The tongue is furred and dry and often becomes crusted and fissured. Albuminuria is almost invariable and the diazo reaction is present in the urine. The leucocyte count is increased and there is an unusually high percentage of large mononuclears. The spleen is much enlarged.

The nervous prostration is well marked and is evidenced by the delirium of the patient, occasionally of the excited but usually of the low muttering type, by the subsultus of the tendons, the picking at the bedclothes and the loss of control of the bladder and bowel reflexes. Death occurs in fatal cases between the eleventh and fifteenth days and is usually preceded by a rising temperature and a failing pulse. Not infrequently coma is present for some hours before the end.

If the crisis occurs improvement is usually rapid. The complications and sequelæ of the fever are but few. The hypostatic pneumonia so often seen is rather a symptom than a complication. Venous thrombosis may follow typhus as it does enteric fever. Parotitis, unilateral and tending to suppurate, is not uncommon. Relapses are almost unknown and second attacks very rare.

Morbid Anatomy. There is general congestion of the internal organs but nothing very definite.

Diagnosis must depend on the appearance of the patient, who has a "drunken" expression, injected conjunctivæ and contracted pupils, on the course of the temperature, and most of all on the presence of the rash. This, if scanty, may be often best appreciated in the axilla and on the flanks. The main conditions which must be excluded are lobar pneumonia, meningitis, influenza, measles and enteric fever.

Differentiation from the latter will give the most trouble, and in making it we cannot, unfortunately, place implicit reliance upon the Widal reaction which has been proved to be sometimes positive in typhus. The absence of rash, however, the wider pupils and clear eyes, and the more decided morning remission of the temperature in enteric are points of importance.

Prognosis is usually good in the young, but is serious in the elderly, the alcoholic, and the fat. A temperature tending to decline from the commencement of the second week is a good sign. A tendency to rise just before the fourteenth day is ominous, as are also excited delirium and coma.

Treatment. The patient should be isolated for five weeks from his first symptom. During his fever his diet should be on the lines of that suggested for enteric fever. Water should be liberally supplied, and great care must be taken to encourage the patient to empty his bladder at reasonable intervals. The mouth must be kept clean and the back attended to. Most patients require alcoholic stimulation. It is important that sleep should be secured in the first days of the illness as otherwise insomnia may become intractable. For the safety of the attendants, as well as for the benefit of the patient, it is well that the nursing be under conditions approximating to open-air treatment. The skin should be frequently sponged with some mild antiseptic.

A quarantine of one fortnight may be imposed upon "contacts," who should be taken to a receiving house, bathed, and freed from vermin by the disinfection of their clothes by steam.

C. B. K.

RELAPSING FEVER (FAMINE FEVER)

Since 1873 outbreaks of this fever have been almost unknown in Great Britain. It is, however, frequently met with abroad and is common in Russia, Egypt and India, being obviously but little influenced by climate. The causative micro-organism is the *Spirochæte Obermeieri*, a spirillum which is found in large numbers in the blood of the patient during the febrile paroxysms and can be detected by direct microscopic examination. All recent evidence goes to prove that the infection is transmitted through the medium of body vermin and, in particular, of the pediculus corporis, though the bug has also been proved to be concerned in the transmission of the virus, and the disease has by its means been successfully communicated to the monkey. Epidemics are doubtless favoured by such conditions as low vitality due to insufficient food, overcrowding and bad sanitary surround-

ings, but it must be remembered that vermin are particularly likely to be numerous among the dirty and the destitute.

After a variable *incubation* stage, lasting in most cases from five to ten days, the illness commences abruptly with headache, giddiness, chills and, in many instances, vomiting. The temperature rises rapidly to high levels, 104° to 106° F., and is maintained with but little morning remission throughout the fever. The pulse is proportionately accelerated. This *first paroxysm* of the disease lasts from five to seven days, during which marked prostration, intense thirst and delirium are often prominent features. The liver and spleen are enlarged and tender. The skin occasionally presents a faint roseolar rash which is evanescent in character. Some degree of jaundice is usually present, and many patients suffer from distressing vomiting and retching. Diarrhœa is also liable to be severe. This stage of the illness terminates by crisis, the temperature falling to a very low level, 96° to 97° F., within twenty-four hours. Copious perspiration accompanies the fall. The patient now enters upon the *first period of apyrexia* and rapidly improves, but about fourteen days from his first symptom, and from seven to nine after his crisis, he is again seized with fever. During the apyretic interval the spirilla are not found in the blood.

This relapse, sometimes described as the *second paroxysm*, is a repetition of the first attack and its symptoms may be quite as severe. It is usually, however, a day or two shorter in duration, the crisis, which is in every way comparable to the first, occurring after from three to five days' fever. A *second period of apyrexia* follows, and this in most cases synchronizes with the stage of convalescence. But in some patients a second or even third relapse may occur.

The *complications* of the fever are not very important. Jaundice may become excessive, and in some instances the continued vomiting is a source of danger. Epistaxis not uncommonly occurs about the time of the crisis, and parotitis is a not unusual sequela. As regards the *morbid anatomy* of the disease there is not much that is characteristic. The spleen is always much enlarged and considerably softened and the size of the liver is enormously increased.

Diagnosis must chiefly depend upon the presence of the outbreak and the detection of the spirillum in the blood. The conditions with which relapsing fever is likely to be confused are influenza, typhus fever and malaria. The *prognosis* is always good, except in old persons and in complicated cases.

Treatment. The patient should be isolated and plenty of air space allowed. Drug treatment is not of much avail and the fever is

uninfluenced by quinine. Hata, however, has demonstrated the favourable effects of Ehrlich's remedy, "606," upon infected mice, and it seems reasonable to suppose that this preparation might be employed with advantage. Gabritchewsky has obtained encouraging results with a serum prepared from horses immunized with blood containing spirilla. C. B. K.

SMALLPOX

Synonym: Variola.

Etiology. The causative micro-organism has not been definitely identified. There is some reason to believe, however, that it may be protozoal in nature and that the sporozoon described by Guarnieri under the name of the *cytocytes variolæ* is the responsible germ. The disease is spread chiefly by direct infection from person to person, and it is probable that the virus is inhaled. Clothing and other fomites may remain infective for long periods. Many competent authorities believe that the infection can be carried long distances by air, and that, therefore, the neighbourhood of smallpox hospitals is actually dangerous. Smallpox can also be communicated by direct inoculation, and in these circumstances the disease usually assumes a distinctly modified form.

The disease may occur in any climate and has been met with all over the world. In this country its season is winter and spring. Sex appears to exert no special influences, and in unvaccinated communities all ages are equally liable to attack. Where infantile vaccination is practised, however, the great majority of the patients are adults.

Pathology and Morbid Anatomy. Smallpox presents two distinct phases, the first of which, the initial fever, appears to depend upon toxæmia, while the second, the eruptive phase, may be regarded as the result of septicæmia, the eruption being due to the deposition in the capillaries of the skin of the causative organisms carried by the blood stream. Much of the subsequent inflammation doubtless depends upon the action of pyogenic bacteria, which therefore play a considerable part in the causation of the secondary fever. The *post-mortem changes* resemble those of the other acute fevers. The lesions caused by the eruption on the mucous membranes may be seen in the oesophagus, larynx and trachea, and the lungs often show hypostatic congestion or broncho-pneumonia. Small yellowish foci of degeneration may be found in the liver and other organs, and notably in the testis, which is often the seat of inflammation during the course of the disease. As regards the *blood* the outstanding feature is the relative increase in the mononuclear leucocytes.

Stage of Invasion and Initial Fever. After an incubation period, the extreme limits of which are five to sixteen days and which in most cases is about twelve, the illness begins abruptly with high fever, headache, chills, vomiting and often pain in the back. This last symptom, although very characteristic, is not infrequently wanting. The patient is prostrated from the first and may suffer from all the symptoms of toxæmia, such as insomnia and delirium. The pyrexia is always considerable and is maintained at a high level until the first appearance of the true eruption, when it commences to abate.

An interesting feature of the initial fever is the comparatively frequent occurrence of *prodromal rashes*. These are often erythematous and may be scarlatiniform, morbilliform or multiform. Their distribution tends to be irregular and is often limited to the trunk. They are evanescent in character, seldom persisting after the true eruption appears. More important are the *petechial rashes*, which are sufficiently characteristic to be diagnostic of smallpox. They are usually limited to the axillæ and groins, especially the latter, and consist of small punctate petechial spots, usually purple in colour. This form of rash has been named by English writers the "triangular rash," the base of the triangle being a line across the abdomen a little below the umbilicus. The French speak of it as the "bathing-drawers" rash, as it affects the parts usually covered by that garment.

The Stage of Eruption. The true eruption of smallpox appears, as a rule, on the third day. Provided the case is not a hæmorrhagic one, its severity depends upon the amount and development of the eruption. Dull red macules or spots appear and are usually noticed first on the brow and wrists. They soon become elevated above the skin, the *stage of the papule*. They are hard to the touch, more round, and better defined than those of measles, and do not disappear when the skin is stretched. They do not show the same tendency to coalesce into groups as do those of measles and, when palpated, they are usually distinctly "shotty." After they have been visible for twenty-four hours they begin to show the commencement of vesiculation at their summits. During the papular stage, which lasts about two days, the temperature falls, often attaining the normal with the completion of vesiculation.

The *distribution* of the eruption is of interest and importance for diagnosis. The eruption is general, but shows a marked preference for certain situations. These appear to be determined to some extent by skin irritation caused by exposure, the friction of garments and so forth, the best protected parts of the body, the

axillæ for instance, being spared partially or completely. The face, forearms and wrists show the greatest density of eruption, these parts being most exposed or most affected by free movement. The protected flexor surfaces suffer less than the extensor, and the flank, the most protected region of the body, least of all. The prominences of the face show a more profuse eruption than the hollows. Parts irritated by pressure, such as the waist or the region covered by the garter in women, show a plentiful crop of lesions, and areas of skin recently contused, abraded or inflamed tend to present a greater density of eruption than the surrounding parts. It may be broadly stated that the eruption is centrifugal, increasing in density the greater the distance from the centre of the body. The lower extremities usually suffer less than the upper, but the eruption is nevertheless much more profuse than on the trunk. The palms and soles are both involved. The eruption always attacks the mucous membrane of the mouth, and, developing quickly in that situation, vesicles can often be recognized on the soft palate while the skin still presents only papules. The larynx is often affected, and laryngitis is in consequence a common symptom.

The stage of the vesicle must now be considered. The lesion is at first conical and its contents fairly clear and translucent. Its margin is rounded and encircled with a distinct areola of redness. It is firmly set in the skin and quite hard to the touch. It is multilocular, and, unlike the vesicle of chicken-pox, does not collapse if pricked. The vesicular stage lasts for three or four days, during which the vesicles become larger, more rounded and more opaque. A central depression or *umbilication* is usually noticed. By the end of this stage the patient, who has been feeling much better and whose temperature has been nearly normal, begins to feel considerable discomfort, especially if the eruption is profuse. The pocks in the tough skin of the hands and soles commence to cause pain, and formation of pus in the lesions causes the temperature to rise at night. *The stage of the pustule* now commences. The pocks become yellowish in colour and continue to increase in size. The surrounding areola becomes more red and inflamed. There is much œdema of the skin, especially in copious eruptions, and the face in particular becomes bloated and puffy. The maturation of the pustules is accompanied by considerable pyrexia, the so-called *secondary fever* of smallpox.

The life of a pustule lasts for four or five days, after which rupture occurs and thick honey-like material of a disgusting odour exudes. A *crust* is formed of a brownish and sometimes black colour and separates in many instances in a

few days. If, however, as is often the case, the true skin has been involved in the necrotic process, the crust is deeply set in the skin and may not become detached for weeks. Permanent *pitting* or scarring of the skin is left behind. Owing to many of the pustules set deeply in the tough skin of the palms and soles failing to rupture, the contents of these pocks dry up into oval brown disks which lie under the horny layers of the epidermis and only reach the surface slowly unless picked out on the point of a penknife.

Eruptions are classified as *discrete* if the pocks are separated from each other by areas of healthy skin. If the lesions are so closely set together as to practically touch each other they are termed *coherent* or *semiconfluent*. An eruption in which the pocks have in certain instances amalgamated and mingled their contents is called *confluent*.

The Secondary Fever. The temperature rises with the formation of the pustules and remains elevated until all necrotic changes in the lesions have ceased. The pulse in a sharp case will range from 120 to 140, and the respirations are usually accelerated as the result of pulmonary congestion. Insomnia is common, the condition of the skin causing great irritation and, in the crusting stage, intense itching. Delirium is often present, occasionally excited, but usually of the low muttering type, and the patient may present all the characteristics of the "typhoid state." Albuminuria is not unusual. If the eruption is severe the patient presents a very characteristic appearance, with œdematous face, half-open mouth and apathetic expression. In confluent cases the face appears to be covered with a dirty yellow mask. The duration of the secondary fever is very variable. In discrete cases it may only last a few days, in confluent it may exceed a fortnight. Should death, from toxæmia and exhaustion, supervene, it most commonly occurs on the twelfth, thirteenth or fourteenth day of the illness, and is sometimes preceded by hyperpyrexia.

Stage of Convalescence and Desquamation. Once the temperature has fallen the patient, unless the attack has been very severe, regains strength rapidly. The separation of the crusts, however, is often a tedious process. The hair often falls out in considerable quantities. Convalescence is not, as a rule, much troubled by complications, but glandular swellings and otorrhœa are not uncommon, and boils and small abscesses not infrequently occur.

Complications. Laryngitis may be serious, as œdema of the glottis sometimes occurs. Bronchitis and broncho-pneumonia are often observed in bad cases. The eyes may suffer severely, conjunctivitis being relatively common. Occasionally the cornea is ulcerated and

the whole eye is in some instances destroyed. Otitis, adenitis and superficial abscesses are common. Bed-sores are very difficult to avoid, the condition of the skin favouring their development. Orchitis is liable to occur during the secondary fever. Nephritis is rare, as are also the nervous sequelæ which have been described as following smallpox. In pregnant women abortion is almost inevitable in the most severe types of the disease.

Types of Smallpox. As apart from the difference of type which depends upon the amount of the eruption, these may be classified as mild and severe. While very slight and almost unrecognizable attacks may occasionally occur even in the unvaccinated, it is usual to find modified types chiefly in those who owe some degree of protection to vaccination. The extreme mildness of an attack may be evidenced by the fact that the eruption consists of perhaps only two or three lesions, or indeed is wanting altogether, although the initial fever may have been of at least average severity. Or a most profuse and characteristic eruption may wholly or partly abort, leaving the lesions in different stages on the patient at the same moment, papules remaining as papules and lying beside badly developed vesicles or vesicles again drying up and failing to become pustular. Such cases are called *varioid* and, it must be remembered, are in reality true smallpox and capable of transmitting the illness in its most fatal forms. The severe type of smallpox is spoken of as *toxic* or *hæmorrhagic*. The initial symptoms are severe and the fever is high. The face tends to be pale and the expression is anxious. On the second or third day numerous hæmorrhages appear on the skin. They vary in colour from purple to black and may be scattered over the whole body. Epistaxis and subconjunctival hæmorrhage are common, and blood is passed in the stools and urine. Thirst is usually a prominent symptom. The true eruption attempts to come out, but the vesicles develop badly, being flat and empty. It will be noticed that the hæmorrhages tend to lie between the elements of the eruption rather than within them. The toxic variety of smallpox is always fatal, the patient succumbing any time from the third to the seventh day.

Second Attacks. These are rare but not unknown. When they do occur they are usually mild.

Diagnosis. In the presence of an epidemic any patient who is suddenly attacked by headache, chills and high fever should be suspected, and, should pain in the back be also present, it is wise to isolate the case provisionally. Prodromal rashes should be looked for as, if a petechial rash is detected, the nature of the case is at once apparent. The soft palate may

be examined for early lesions. It may be necessary to distinguish the initial fever from influenza, and, if a morbilliform rash is present, the possibility of measles must be thought of. But the absence of catarrh and of Koplik's spots, together with the fact that the prodromal eruption is macular rather than papular, should render the distinction from measles fairly easy.

Once the true eruption has appeared the papular stage may again cause measles to be considered. In smallpox, however, the temperature falls as the eruption develops, whereas in measles the contrary is the case. The papules of measles are seldom hard, except occasionally on the brow, and always tend to coalesce into blotches. *When vesicles have developed we have to distinguish the disease from chickenpox.* It may here be suggested that although few medical men have much opportunity of making themselves familiar with smallpox, all should make a careful study of chicken-pox, and so avoid one of the chief pitfalls of smallpox diagnosis. It must first be remembered that adults can, and not uncommonly do, suffer from chicken-pox and that some amount of prodromal fever is not unknown in that disease. Differentiation, therefore, depends upon the character and distribution of the eruption. Typical oval vesicles, such as only occur in chicken-pox, should be carefully looked for. *It should be noted whether the lesions are all in the same stage, as is to be expected in smallpox, or in different stages, as is the usual rule in the milder infection.* The edges of the chicken-pox lesion, moreover, are very apt to show crenation and the covering pellicle is much thinner than that of smallpox. *The main distinction, however, is the distribution of the eruption* (see above, p. 50). In chicken-pox the trunk, and especially the back, suffers most, and in a large proportion of cases the extremities, and particularly the forearms, show relatively few lesions. The axilla is often invaded. The spots, moreover, are usually first noted on the trunk, whereas in smallpox they are seen earliest on the face and wrists. These distinctions apply equally even in mild cases of varioid, the character of whose eruption is often atypical.

The distribution of the lesions and the history of the patient will in most cases serve to distinguish smallpox from iodide and bromide rashes, from pustular syphilides and from acne.

Vaccination may be used as a final test in diagnosis. If successful when performed as late as on the third day of a suspected eruption, it may be held as proved that the illness is not smallpox.

Prognosis. This is always much affected by the condition of the patient as regards vaccination. Trivial attacks of smallpox, however,

can and do occur in unvaccinated subjects. Among the unvaccinated, infants and children in the first five years of life show the highest mortality. In persons over forty years the death-rate is again extremely high. A trivial initial fever means that the attack will also be a mild one. The converse, however, does not hold, as a severe initial fever is occasionally followed by a slight attack of varioloid. Very intense pain in the back is often associated with the toxic type of the disease. The appearance of purpuric hæmorrhages on the skin may be regarded as a fatal sign.

An imperfect remission of the pyrexia between the initial and secondary fevers usually denotes a more than averagely severe case. The symptoms of the secondary fever are severe or mild according to the profuseness of the eruption. Discrete cases generally terminate favourably, whereas the death-rate of the confluent type may exceed sixty per cent.

During the secondary fever such symptoms as high temperature, a pulse-rate exceeding 120, and marked delirium should cause anxiety. Rapid respiration, suggesting hypostatic congestion or a complicating broncho-pneumonia, is also a bad sign. Edema of the glottis is most dangerous.

Treatment. The indications are to maintain the strength of the patient by suitable diet and medication, and to attend to the local skin condition with the view of modifying, so far as possible, its development and preventing subsequent disfigurement.

General Management and Treatment. Plenty of air space, not less than 2000 cubic feet per patient in hospital, is required. In the initial stage the diet is best limited to milk; it may be increased considerably in the vesicular stage if the temperature is moderate; and it should be restricted to fluids and soft solids during the secondary fever. Ice to the head is often of service for the initial headache. Insomnia should always be treated, and such drugs as a combination of chloral and bromide, sulphonal or veronal will be found useful. If the fever is high cold sponges should be frequently used.

When the eruption has developed, laryngitis is best treated by steam inhalations. Stimulation may be necessary in bad cases, and strychnine will be useful, especially if the breathing becomes laboured. Excited delirium is best controlled by hypodermic injections of morphia or hyoscine. For patients with profuse and painful eruptions a water-bed will be of service, and the bedclothes should be supported on a cradle. The toilet of the mouth and eyes is of great importance. The mouth should be carefully cleaned at frequent intervals and gargling should be encouraged. The eyes should be bathed with boracic or weak corrosive solution

and the lids smeared with vaseline. In toxic cases no treatment is of any avail and hæmostatic drugs are quite useless.

Local Treatment. The application to the face of a light mask of lint, frequently soaked in iced water and kept thoroughly moist, often gives great relief. Some patients will not tolerate a mask, and in that case carbolized vaseline may be smeared over the face. When the crusts have separated zinc ointment may be used for the raw surfaces. Warm baths give the greatest comfort to patients who suffer much from itching in the stage of desiccation. To accelerate the separation of the crusts poultices of starch, or of linseed sprinkled with iodoform, may be employed with advantage.

Various measures are recommended with a view to abort the eruption. Salol has been used for this purpose without very striking success. The red light treatment, introduced by Finsen, depends on the absolute exclusion of actinic rays and practically means treating the patient in a photographic dark room. Red glass for the windows and shades for the lamps are required, and it is doubtful if the results obtained repay the trouble caused by the difficulties and inconveniences of the method. The treatment must commence before the fourth day of illness, not later than the early papular stage, and even then competent authorities state that it is not always efficacious in preventing pustulation.

Isolation. The patient must be detained until the last crust has separated.

Prophylaxis. See article on *Vaccination and the Control of Smallpox.* C. B. K.

VACCINATION AND THE CONTROL OF SMALLPOX

I.—VACCINATION

Jenner and Vaccination.—Dr. Edward Jenner, in the course of his various writings, from 1798 onwards, based his advocacy of vaccination on facts, correlated by hypothesis. The facts fall into different groups.

Throughout the dairy districts of Gloucestershire and other counties, there was, in the eighteenth century, widespread experience that cowpox prevented smallpox. Cowpox, with consequent accidental inoculation of milkers, was very common. Fortunately for the discovery of the protective power of the bovine disease against smallpox, variolous inoculation was also very common. It was much easier to observe that persons who had suffered from cowpox were not susceptible to smallpox by inoculation, than that they could not be infected in the ordinary way, though even that could not have been very difficult in presence of the abundant smallpox of the time. In

his "Inquiry into the Causes and Effects of the *Variolæ Vaccinæ*" Jenner gave an account of about twenty cases (including one group of eight) furnishing evidence of immunity from smallpox conferred by cowpox. In all of them there had been resistance to smallpox by means of inoculation, and in all but five there had likewise been exposure to infection, in some instances very close exposure, as by the nursing of smallpox patients, without infection taking place. The intervals between cowpox inoculation and subsequent resistance to smallpox varied from less than a year to periods of about 10, 20, 25, 30, 37 and 53 years. Concerning these longer intervals it is to be borne in mind that accidental inoculation of milkers was not an event of infancy, but of adolescence or adult life, so that the duration of protection was equivalent rather to that due to revaccination than to infantile vaccination.

In the course of the discussions which followed the publication of Jenner's "Inquiry," Dr. Fewster of Thornbury (in Gloucestershire), a well-known contemporary practitioner, wrote, "I have not been able to produce the smallpox, in a single instance, among persons who have had true cowpox." Various other medical men gave similar accounts of their experiences.

Further, as regards the very essence of his thesis, Jenner recorded a short series of arm-to-arm vaccinations, starting from a sore on the hand of a dairymaid, which showed that cowpox was capable of transmission in this way, just as smallpox was well known to be. One of these cases was inoculated with smallpox matter on both arms forty-seven days after vaccination, but no disease followed, and later attempts had a similar negative result. The inoculation test thus inaugurated was taken up and practised all over the world, until confirmation of the anti-variolous power of vaccination became no longer necessary.

Such was the nature of the evidence, and it was soon supported and confirmed by medical observation and experiment throughout the country and abroad. The theory by which Jenner accounted for the facts was that cowpox and human smallpox were essentially the same disease, though differing in their manifestations, and that cowpox could prevent smallpox simply because it was smallpox. He also concluded that the cow was subject to more than one teat eruption, and that only one of these was capable of preventing smallpox. This he called the true cowpox, and he believed he had traced it back to horsepox, wrongly supposing that it could have no other origin. As regards duration of immunity, he assumed that cowpox, being smallpox, was bound to give exactly the same protection as smallpox itself, which protection in his time was commonly looked on

as lifelong. This was his one serious mistake in dealing with the subject. Otherwise he had a wonderfully clear and true perception of essential principles, which served him well in controversy with some contemporaries who adopted the practice but fell for a time into fundamental error.

The Modern Doctrine of Vaccinal Protection.—In the present day smallpox inoculation is illegal, so that experimentation as conducted by Jenner and others is impossible, but a whole century of world-wide experience has afforded overwhelming proof of the power of vaccination over smallpox. The facts which gradually accumulated to show that Jenner was wrong in assuming that cowpox gave lifelong protection against smallpox, showed at the same time that where smallpox is not prevented, it is greatly modified or mitigated by previous vaccination. Experience has also shown that diminution of the protective influence of vaccination is a gradual process, and that its power of mitigation, which continues after total immunity has been lost, diminishes also through lapse of time. A further proved fact is that the value of vaccination depends to some degree on the amount of the protective material introduced into the system when the operation is performed, as indicated by the number and extent of the insertions of vaccine lymph. Finally, it has been found that successful revaccination fully restores the lost or diminished immunity, and there is reason to believe that the duration of this protection is greater than that of infantile vaccination, revaccination being done when the main period of bodily growth and development has passed.

With regard to the doctrine of vaccination it is perhaps right to call attention to one point as to which a mistaken view appears to be not infrequently taken. On the one hand, it is not safe to assume that failure of an attempt at revaccination is proof that the individual is still immune from smallpox attack. Sometimes complete failure may be followed by success on a second or third attempt. On the other hand, local success of the operation of revaccination is not to be held as proving that the individual was open to attack by natural smallpox. There is evidence that in the eighteenth century smallpox for inoculation purposes was occasionally itself cultivated locally on the arm of a person immune to attack. In the same way, after a sufficiently long interval since primary vaccination, it may be possible to produce some degree of vaccinia on the arm of a person who has remained able to resist infection by smallpox. His condition as a potential vaccine carrier (though he is not used as such) is perhaps to some extent analogous to that of a typhoid or diphtheria

carrier. The microbe may find a local habitation on the body while the system is immune. But the course of such a vaccination is commonly modified in respect that the phenomena display themselves in a shortened cycle, and for a considerable time afterwards no reaction whatever is likely to be obtained to the insertion of vaccine lymph.

Vaccination Risks. After the fullest hearing of antivaccination evidence, and of investigation into every allegation of evil effects brought before them, the Royal Commission, whose sittings extended over a period of seven years, reported in 1896 that—

“A careful examination of the facts which have been brought under our notice has enabled us to arrive at the conclusion that, although some of the dangers said to attend vaccination are undoubtedly real and not inconsiderable in gross amount, yet when considered in relation to the extent of vaccination work done they are insignificant. There is reason further to believe that they are diminishing under the better precautions of the present day, and with the addition of the further precautions which experience suggests, will do so still more in the future.”

With regard to syphilitic infection, which most of all has been used to discredit vaccination, rare though it was in this country when humanized lymph was universal, the use of calf lymph has made it an impossibility.

Statistical Evidence.—Coming now to statistical evidence of the value of vaccination in the prevention and control of smallpox, the material is so abundant that selection is difficult. Since I last wrote on the subject (in 1906¹) the country has been passing through an inter-epidemic or post-epidemic period, so that no fresh statistics on a large scale are available, and it will suffice to mention a few well-known examples from evidence already published.

Smallpox in Pre-Vaccination Times.—In the first place, it is necessary to have some conception of the prevalence of smallpox in pre-vaccination times, when exact statistics were wanting, or at least very rare. Sir John Simon collected much interesting historical matter in his classical “*Papers on Vaccination*,” and to these the reader is referred. He records how, in 1518—within twenty-six years after the discovery of St. Domingo by Columbus—smallpox destroyed what fire, sword, famine and bloodhounds had left of its inhabitants. In Brazil, in 1563, it extirpated whole races of men; about the same year, in the province of Quito, according to De la Condamine, it destroyed upwards of 100,000 Indians. “As

late as 1734,” says Simon, referring to a Danish Government report, “Greenland suffered its first epidemic of smallpox, where nearly two-thirds of the inhabitants were swept away.”

Catlin, writing in 1841, regarding the North American Indians in more recent times, says:—“Thirty millions of white men are now scuffling for the goods and luxuries of life over the bones and ashes of twelve millions of red men, six millions of whom have fallen victims to the smallpox and the remainder to sword, bayonet or whisky.” In Iceland, the Danish Government records show many epidemics from the thirteenth century onwards. In the years 1430–2 the deaths from it are said to have numbered 8000, and in 1707, in a population of about 50,000, the deaths are set down as 18,000. In London, 1660–79, of every 80,000 deaths 4170 were due to smallpox, and Dr. Edwardes points out that in successive decades of the eighteenth century the proportion of smallpox deaths to all deaths in London was one-eighteenth in 1701–10, and from one-tenth to one-fourteenth in the other nine decades.

Records relating to Glasgow, Liverpool, Manchester, Warrington, Kilmarnock, Chester, Ware and other places in Britain show an extraordinary prevalence of smallpox. In Kilmarnock, from 1728 to 1764, 161 out of every 1000 children born died from that disease.

As regards the influence of smallpox inoculation on the prevalence of the disease in the eighteenth century, it is impossible to say whether it did more good in preventing death amongst the inoculated than harm in spreading the disease amongst those who did not accept inoculation. But the figures of smallpox prevalence in Geneva, long before the era of inoculation, indicate the great extent of the disease even then, whilst in Sweden, where smallpox inoculation never obtained a hold, there was very heavy mortality in the eighteenth century.

Coincidentally with the introduction and spread of vaccination in the first part of the nineteenth century there was a remarkable diminution of smallpox prevalence and mortality, whilst the relationship in place and time and all other circumstances left no doubt as to cause and effect. Early in the century it was not necessary that vaccination should be universal in order to show its influence on the total smallpox mortality, a large part of the population being already protected by smallpox, either from ordinary infection or by inoculation.

Revaccination.—Towards the end of the first quarter of the century smallpox again began to raise its head, and for a considerable time there was failure in this country to appreciate the position. The generation which had been protected by smallpox was dying out, and the

¹ Allbutt and Rolleston's *System of Medicine*, Vol. II, Part I. Also Stevenson and Murphy's *Treatise on Hygiene*, 1893.

vaccinations of the early years were beginning to lose their effect, while at the same time the need for revaccination was not recognized. But in several of the armies of Germany the practice of revaccination of recruits was instituted between 1833 and 1843, with the usual result in diminution of smallpox, and in 1874 the general population there began to be dealt with similarly. Britain has lagged far behind, yet the value of revaccination has been frequently illustrated, as in the navy, the army, the postal service, the nursing staffs of smallpox hospitals, and in epidemics in particular communities.

The Navy. In illustration of its effects the following details may be given regarding the navy, in which the practice of vaccination of recruits dates from 1864, and was extended to the whole service in 1871, excepting that until 1873 the rule did not apply to natives becoming members of the service abroad, nor to "foreigners," such as Kroomen. The statistics are partly from the Royal Commission's Report, and, for recent years, from information courteously given to me by the director-general of the medical department.

Year.	Attacks of Smallpox to every 10,000 of the Force.	Deaths from Smallpox to every 10,000 of the Force.	Year.	Attacks of Smallpox to every 10,000 of the Force.	Deaths from Smallpox to every 10,000 of the Force.
1860	51	3.9	1886	2	.6
1861	50	3.8	1887	.2	0
1862	17	3.1	1888	4	.2
1863	22	2.8	1889	1	.2
1864	87	6.2	1890	1	.4
1865	32	2.9	1891	3	0
1866	48	1.6	1892	2	.3
1867	49	2.7	1893	1	0
1868	16	.4	1894	3	0
1869	17	1.0	1895	1.7	0
1870	9	.2	1896	1.5	.2
1871	31	2.5	1897	6.3	.2
1872	19	2.3	1898	2.8	.2
1873	3	.2	1899	1.6	.2
1874	2	.2	1900	1.3	.1
1875	4	.2	1901	.9	.1
1876	5	1.3	1902	1.4	.2
1877	4	0	1903	.2	0
1878	2	0	1904	1	0
1879	12	3.1	1905	.18	.09
1880	2	.2	1906	.55	0
1881	6	.7	1907	.28	0
1882	2	.5	1908	.36	0
1883	2	0	1909	0	0
1884	1	0	1910	.08	0
1885	1	0			

German statistics are to the same effect. In the fifteen years 1895 to 1909, inclusive, the smallpox deaths in the German Empire (population 1910 census, 64,903,423) were 790. In England and Wales (population 1911 census, 36,075,269) they were 6,478. Such smallpox as remains in Germany is largely on or near the frontiers of less vaccinated countries.

Recent Revaccination. Glasgow suffered from an invasion of smallpox in 1901-2, and the health authority, in addition to all ordinary reasons for controlling the disease, was specially anxious to have it stamped out quickly, owing to the imminence of an international exhibition. All medical men in the community were empowered to vaccinate on behalf of the corporation, and the table, taken from Dr. Chalmers's report, shows the result. With regard to the following table, it is to be particularly noted that it gives the results not of infantile vaccination, but of recent vaccination, done during an epidemic.

Not Recently Revaccinated and Recently Revaccinated Population of Glasgow, over five years of age, in each fortnight, with the cases of Smallpox occurring in each Class. (Dr. A. K. Chalmers.)

		Not recently Revaccinated.		Recently Revaccinated.	
		Population.	Cases Regis- tered. ¹	Population.	Cases Registered.
1901.					
January	12	675,887	23	0	0
"	26	674,816	350	1,071	0
February	9	671,025	202	4,862	0
"	23	634,213	127	41,674	0
March	9	556,561	299	119,326	0
"	23	518,426	161	157,461	0
April	6	474,694	92	201,193	0
"	20	429,056	67	246,831	0
May	4	384,371	28	291,516	0
"	18	366,125	18	309,762	0
June	1	352,633	11	323,254	0
"	15	347,777	2	328,110	0
"	29	345,293	8	330,594	0
July	13	281,867	1	394,020	0
November	16	279,452	1	396,435	0
"	30	279,232	5	396,655	0
December	14	279,020	4	396,867	0
"	28	278,796	0	397,091	0
1902.					
January	11	278,623	28	397,264	0
"	25	278,152	23	397,735	0
February	8	277,653	23	398,234	0
"	22	277,134	147	398,753	0
March	8	276,033	92	399,854	0
"	22	274,611	85	401,276	0
April	5	272,694	36	403,193	0
"	19	271,619	15	404,268	0
May	3	271,032	10	404,855	0

Hospital Nurses. No less striking is the experience of smallpox hospitals with regard to their working staff. In such institutions the nurses are necessarily exposed to infection in a greater degree than any other class in the community. Every epidemic tells the same story of vaccinal protection, whilst usually

¹ The cases under five years have not been excluded from these figures, because their allocation through the various fortnights would have been difficult, and their inclusion is unimportant. In the 1900-1 part of the outbreak these numbered 60, 54 of whom (including 30 cases occurring under one year) were unvaccinated primarily

there have been a few, commonly a very few, members of the staff, who from one cause or another have not been revaccinated, and so yield a control experiment which meets the most rigid claims of statistical science.

The case of Leicester is of special interest. In the years 1892-3, when smallpox prevailed, in a hospital staff of forty, six nurses refused to be revaccinated. Five of these developed smallpox, and one of the five died. The one who escaped was the matron, who naturally was less exposed to infection. Of the other thirty-four, twenty were revaccinated at the time of the outbreak and all escaped smallpox, whilst fourteen had either suffered from smallpox or been revaccinated at some previous time. One of these fourteen had a slight attack. Her revaccination was ten years old. The next serious Leicester outbreak was eleven years later, and the staff by that time numbered seventy-four. Seventy-one of these had the protection of recent vaccination and three had had smallpox. (I do not know whether these were three of the four who had recovered from smallpox in the previous epidemic.) Not one of the seventy-four was attacked by the disease in 1903-4. It happened that the type of smallpox which invaded Leicester at this time was very mild, but that cannot account for the escape of the nurses, because two workmen at the hospital, when the outbreak occurred, had not been revaccinated, and both took the disease, though they had not been in the wards.

In the Metropolitan Asylums Board Hospitals in 1901-2, of 947 individuals on the staff, 494 were nurses, of whom two took smallpox. One of the two was an example of exceptional susceptibility, as she had had smallpox previously and on that account had not been revaccinated. In earlier epidemics revaccination had not been quite so thorough, and a few cases occurred, showing that apart from vaccination or previous smallpox, nurses enjoy no immunity from smallpox. Needless to say, nurses in wards where enteric fever, scarlet fever, typhus fever and the like are treated have no such immunity. Many cases of infection occur, notwithstanding the adoption of every known preventive measure.

Vaccinated Infants in Smallpox Hospitals. Sometimes a mother suckling a vaccinated infant is attacked by smallpox, and any other arrangement being impracticable, the child has to be sent to hospital along with the mother. It has, of course, been duly vaccinated before admission. A few years ago, during a prevalence of smallpox in the county of Stirling, two such children had to be sent to hospital under these circumstances, and both escaped infection. In Dewsbury the same experience occurred on a larger scale. In Leicester the

medical officer, though disapproving of compulsion, thoroughly believes in vaccination as an individual protection. He took his own vaccinated children into the smallpox wards, where they were photographed amidst smallpox patients, the photographs being used for persuasion of contacts.

Smallpox in Invaded Households.—In the Sheffield epidemic of 1887 note was taken by the late Dr. Barry of the incidence rate of smallpox in houses invaded by the disease, the total vaccinated and unvaccinated population of such households being separately grouped. That line of investigation has been adopted in subsequent outbreaks, with very interesting results, and the Royal Commission in their Report devote attention to the facts. The following table gives the particulars relating to outbreaks in four towns, three of which,

	Incidence Rate under ten years of age.		Incidence Rate over ten years of age.	
	Vaccinated.	Unvaccinated.	Vaccinated.	Unvaccinated.
	Per cent.	Per cent.	Per cent.	Per cent.
Warrington ..	4.4	54.5	29.9	57.6
Dewsbury ..	10.2	50.8	27.7	53.4
Leicester ..	2.5	35.3	22.2	47.6
Gloucester ..	8.8	46.3	32.2	50.0

namely, Dewsbury, Leicester and Gloucester, have all been noted as centres of antivaccination. The special value of the figures is emphasized in this—that vaccination being practically optional in three of these towns, non-vaccination is not due to postponement under medical certificate, but to parental option, so it cannot be alleged that the excessive smallpox attack rate of the unvaccinated children is due to their being in poor health, and therefore specially susceptible to infectious disease. On the contrary, according to antivaccination theory all the vaccinated are the victims of blood poisoning, and are therefore less able to resist infection than the unvaccinated. In other respects their circumstances were identical, vaccination being the only differentiating factor.

Smallpox after Vaccination.—Evidence is abundant that when, owing to lapse of time, vaccinal protection against smallpox has diminished so that attack has become possible, the disease is yet greatly mitigated in violence. The facts also show that, other things being equal, severity of attack depends on the interval since vaccination, the disease being more severe the longer the period that has passed since the protective operation. Similarly, the extent and thoroughness of the original operation commonly stand in inverse ratio to the severity of subsequent smallpox. In connection with every such experience it is

necessary to pay attention to the existing type of the disease. In one epidemic the fatality rate, independently of vaccination, may be lower or higher than in another, but whatever be the standard of virulence for the time, the vaccinated are in a much better position than the unvaccinated, whilst the difference is accentuated

Age.	Vaccinated, Good Marks.			Vaccinated, Imperfect Marks.			"Vaccinated," but no evidence of Vaccination.			Not Vaccinated.		
	Cases.	Deaths.	Per cent.	Cases.	Deaths.	Per cent.	Cases.	Deaths.	Per cent.	Cases.	Deaths.	Per cent.
0-2	4	0	0	32	3	9	22	9	41	276	181	66
2-5	57	0	0	150	18	12	96	38	40	401	202	50
5-10	206	2	1	532	27	5	297	40	19	510	180	35
10-15	439	5	1	939	32	3	214	42	20	317	74	23
15-20	606	12	2	1037	66	6	205	39	19	204	86	42
20-25	389	11	3	843	100	13	167	56	34	174	83	48
25-30	189	12	6	529	80	15	116	35	30	105	56	53
30-40	147	14	10	526	78	15	137	49	36	103	42	41
40-50	29	4	14	186	33	18	85	24	28	49	21	43
50	19	2	11	80	18	22½	46	20	43	30	13	43
All ages	2085	62	3	4851	455	9	1295	352	27	2169	938	43

according to the brevity of the interval since vaccination and the thoroughness of its performance. Another point requiring to be borne in mind in making these comparisons is the natural fatality of smallpox at different ages. It is a much more mortal disease under five years than between five and ten, whilst the age period of lowest natural fatality is ten to fifteen years.

The table on this page, by Dr. W. Gayton,¹ being a digest of over 10,000 cases treated by him in the metropolitan hospitals, is a convenient compendium in which all these facts are illustrated. The epidemics which furnished Dr. Gayton's statistics were of a comparatively severe type.

Age Incidence.—Finally, a very notable statistical fact has to be mentioned as to the age at which smallpox finds its victims. In pre-vaccination times it was almost wholly a disease of childhood, like measles and whooping-cough. As infantile vaccination became general, smallpox more and more deserted infancy and was deferred to later periods of life, revaccination not being sufficiently practised. In Kilmarnock, in 1728-64, of 622 smallpox deaths at all ages, 118 were under one year old, 146 between one and two years, 136 between two and three years, and no less than 98·8 per cent. of the 622 cases were under ten years old. Measles and whooping-cough still remain diseases of childhood, but where vaccination of infants is practised, smallpox is no longer an infantile disease.

II.—THE PRESENT-DAY PROBLEM OF SMALLPOX CONTROL

It is no part of my purpose here to discuss the subject of compulsion in relation to vaccination, but as indicating my own attitude, the following passage is quoted from an address to a conference of medical officers at Birmingham in 1898²—

"Speaking to an audience of health officers—speaking especially after some 1,100 of us have testified by signed declaration that vaccination and revaccination prevent and control smallpox, and that smallpox cannot be effectually prevented and controlled without these means—I need not spend time in urging the value of the Jennerian prophylaxis. But, for the present purpose, I shall assume further that the Legislature is equally convinced, (1) that smallpox is a disease which ought to be prevented, (2) that it can be safely prevented by vaccination and revaccination, and (3) that it cannot be prevented by any other known means. Does it then unavoidably follow that vaccination should be compulsorily enforced? Can nothing be conceived capable of justifying parliament in refraining from enacting a power of absolute coercion? Smallpox is an evil—a very terrible evil—but there are other evils besides smallpox, and it is sometimes necessary in mundane affairs to make a choice of evils. Let us suppose that

¹ *The Value of Vaccination.* London, McCorquodale & Co. 1885.

² Vol. XIX, Part III of the *Journal of the Sanitary Institute.*

parliament is, rightly or wrongly, of opinion that in many places in England, the opposition to vaccination is so deep-seated that its attempted enforcement could be carried out only with the aid of an army of soldiers, or would involve the wholesale imprisonment of large communities. Surely in such circumstances parliament is right in endeavouring to weigh and measure the two evils and to choose the less. It may make a wrong choice, and the country may have to pay for the error, but the medical profession has no need to feel injured or aggrieved. The crucial fact is that the decision of such matters is a function of the legislature, and of the legislature only, and where the duty is, there the responsibility must rest."

While it is utterly impossible for any unbiassed man of ordinary mental capacity and unwarpd intellect to give adequate study to the subject without reaching the conclusion that vaccination prevents and modifies smallpox, and that practical abolition of smallpox can be achieved by national vaccination and revaccination, there yet remains the important question whether and to what extent outbreaks of the disease can be controlled by other means. What can be done by sanitary organization, disinfection, isolation of cases, and observation of contacts? The answer in my opinion is that in the entire absence of vaccination these are practically powerless. In hospital, if neither doctor, nor nurses nor servants were protected by vaccination (or by previous smallpox), then the disease would unquestionably spread among them. Other nurses and doctors would have to be brought in from outside, and they similarly would fall victims, so that smallpox would extend in ever-widening circles. In short, smallpox cannot be prevented without vaccination.

The question, therefore, has to be altered. Can smallpox be controlled by limited vaccination, combined with hospital isolation, observation of contacts, disinfection, and general sanitary organization, and can health authorities, in the absence of epidemics, prepare to fight the battle on these lines? That problem is becoming of the utmost consequence in this country.

In Germany there is no such question. In that empire both primary vaccination and revaccination are so systematically carried out that smallpox has very nearly disappeared, and that expenditure of public money on any auxiliary means of prevention is quite unnecessary—indeed, opportunity hardly arises for such expenditure, and smallpox hospitals are practically non-existent. In Berlin, with its population of about two millions, the total smallpox hospital accommodation consists of only twelve beds in a pavilion in a general medical and surgical hospital within the city.

Such is the condition of the German Empire

with regard to smallpox, and if a similar system were followed in this country similar results would be achieved. But it is useless to deny that the German system is at present unattainable in this country. It is not merely that infantile vaccination has much diminished under relaxation of the law. To achieve Germany's protection, systematic revaccination is also required, and no Government is likely under existing conditions to attempt legislation to that end. Sanitary authorities and their officers have everywhere to make the best of the situation as it exists, and, instead of adopting an attitude of despair, have to take note of every advantageous position at present occupied.

As a basis of operations there is the Infectious Disease Compulsory Notification Act, which was not on the statute-book during the pandemic of the early seventies. In addition, chickenpox can be made notifiable, and this is not without value when smallpox prevails, in lessening the mischief done by mistaken diagnosis. Also, the country is on the whole much better armed in respect of staff and general equipment against infectious disease than ever before.

Further, there is in most parts of the country some hospital provision for smallpox, and much of that provision is in isolated localities, so that risk of infection of surrounding populations is much diminished. At some hospitals also there is vacant ground available for emergency wards in presence of epidemics. The hospitals themselves have commonly a steam disinfecter, whilst house disinfection is much more effectively carried out than formerly. In many large towns there is a reception house available for contacts, and in the country observation of contacts can often be maintained without reception houses.

It is necessary to enter into detail with regard to some of these measures.

Hospital Isolation of Smallpox.—The rôle of smallpox hospitals is briefly this:—If vaccination and revaccination were universal, hospitals would be needless; on the other hand, in an altogether unprotected community hospitals would be powerless, because the disease would spread to nurses and attendants, and then to persons having necessary intercourse with the hospital, and finally, to the general population. It is in a partially protected population that properly conditioned smallpox hospitals are of great service. Obviously it is good to have a smallpox patient surrounded by a cordon of vaccinated and revaccinated persons, themselves insusceptible to infection, whilst preventing contact and communication with susceptible persons outside. Under British conditions the value of hospital isolation is

essentially that it enables this to be done. Moreover, by doing it at the earliest possible moment, as is so often possible with modern organization, the patient is removed before his eruption has reached the vesicular and early pustular stages—in other words, before he has developed his maximum degree of infectivity.

Three conditions influencing the value of hospitals for smallpox have to be noted—their size, situation, and management.

Size of Smallpox Hospitals. The adequacy or inadequacy of smallpox hospitals is likely to be related to the vaccinal condition of the population to be served by them. Other things being equal, less provision is necessary where the general population has a satisfactory record as regards vaccination than where the reverse is the case. Broadly speaking, this is so, but there are other and less certain factors which have also to be reckoned with. The varying types of epidemics, the differing facilities for securing prompt intimation and action by health departments, and the unequal extent to which emergency vaccination and re-vaccination are likely to be accepted in different circumstances—these and other considerations make it hardly possible in the case of smallpox to formulate working rules or standards for hospital accommodation such as we adopt for other infectious diseases.

The standard provision required by the Local Government Board for all infectious diseases other than smallpox is one bed per 1000 of population. I do not know whether originally this provision was intended to include smallpox, but apparently no general rule has been laid down with regard to the amount of separate accommodation for that disease.

As we shall shortly see, part of the so-called Leicester system of controlling smallpox consisted in treating the disease at the same hospital with scarlet fever and other infectious maladies, and also in quarantining contacts at the hospital. These two planks of the original Leicester platform have disappeared like the rest. Now there is a hospital of sixty beds reserved for smallpox, and when that disease has become epidemic the whole fever hospital, consisting of about 200 beds, has also been set apart for it, cases of scarlet fever and diphtheria being discharged in bulk. In January 1903 no less than ninety-eight scarlet-fever patients and fifteen diphtheria patients were sent home. The accommodation thus provided was found sufficient for the epidemic of that time.

In badly vaccinated Gloucester, with a population of 40,000, the hospital-ward accommodation consisted of forty-eight beds at the beginning of the epidemic in the latter months of 1895, and this was gradually extended to no less than 318 beds by the middle of May,

1896. The difficulties of administration under such conditions must have been extreme.

Several years ago in Dewsbury, where vaccination default amounted to over forty per cent., the borough, with a population of 27,000, had a hospital of twenty-six beds which it used for smallpox, but that amount of accommodation was found insufficient, and two temporary pavilions of wood and iron were run up. Also, a marquee for nurses and a large institution with accommodation for about forty convalescents was provided.¹ It is not suggested here, however, that Dewsbury, in dealing with smallpox, did justice to any control system, real or imaginary. Looking to such facts, it is manifestly impracticable to state what would be for centres of antivaccination adequate smallpox hospital accommodation.

In arranging accommodation for any community in this country in the present day, the best procedure is to provide an ample administrative building, including bedrooms and sitting-rooms for nurses and servants, kitchen department, laundry, etc. For reception of patients it is, for the reasons already stated, impossible to say how many beds may be required, but in large towns perhaps the London standard might be followed. It has 2000 or 2500 beds for a population of 5,000,000, or, say, one bed for every two thousand inhabitants. The hospital site should be so extensive as to permit of temporary buildings being quickly erected. In the opinion of the author, such buildings may most suitably consist of wood, or wood and iron, as, though these are subject to risk of fire, they can be quickly run up, and can stand empty without gathering so much damp as would buildings of stone or brick.

Situation of Smallpox Hospitals. It is now, I think, pretty generally agreed that smallpox hospitals constitute a risk to surrounding populations, and that therefore such isolation hospitals should themselves be isolated.²

Hospital Management of Smallpox. Inter-course being one possible means of spread of smallpox in and from a hospital, no matter where situated, efforts must be made in every case to minimize that risk.

If, under any circumstances, it becomes necessary to treat smallpox in a hospital to which other infectious diseases are admitted, very special precautions have to be taken. It is assumed that the vaccination of nurses will in all cases be attended to. The vaccinal condition of every patient should be examined,

¹ One of the temporary pavilions, it may be mentioned, was destroyed by fire before ever receiving a patient, and the nurses' tent was blown down by the wind.

² The subject is discussed in the *Epidem. Soc. Trans.*, 1904-5, where various views find expression.

and, wherever necessary, consent for vaccination should be asked. In my own experience consent has been hardly ever refused, but sometimes a patient may be too ill for vaccination. So long as smallpox is under treatment in the hospital, no patient suffering from any other infectious disease should be admitted unless he has already had smallpox, or his vaccination is satisfactory, or will be permitted if unsatisfactory. Difficulty may occur where vaccination is refused on behalf of a patient really requiring it, whose isolation is essential for the protection of the public against infection by the disease from which he is suffering. Such a patient can probably be sent to some other hospital.

The hospital population being rendered insusceptible, it is necessary to take all possible measures towards preventing spread of the disease by intercourse direct or indirect. Visitors should only be admitted if they are in a proper vaccinal condition and if patients are very ill. The usual waterproof overalls and caps should be kept for all persons entering the wards. If the hospital should unfortunately have to deal with other diseases, smallpox patients should of course be treated in a pavilion by themselves. Their airing-ground should be separated by two unclimbable fences, with space enough between to make contact with the outside impossible. The pavilion should be self-contained in respect of cooking, and of sleeping accommodation for the staff. Nothing should be sent to the laundry which has not already been thoroughly steeped in a reliable disinfectant solution. As regards contact with the outside, all risks should be reduced to the minimum degree consistent with efficient hospital management. Fever nurses are often very willing to take the opportunity to gain experience of smallpox, and will sometimes consent to intermit all outside leave for six weeks or three months at a time, after which other nurses can be employed on similar terms. Telephonic communication from the hospital is valuable in reducing intercourse. The condition of patients can be reported by telephone to the health office, whence the information can be transmitted to relatives by letter. Hospital supplies should, as far as practicable, be left at the gate lodge and thence brought in by the hospital porter. In large hospitals there should be separate entrances for goods and patients. All tradesmen sending goods to the hospital should be informed that only revaccinated messengers are to be employed. Ambulance vans should, of course, be disinfected after use. The above precautions apply to all hospitals where smallpox is treated, whether or not they are wholly devoted to that disease, and mention is made of the latter alternative not in the least

as signifying approval, but only as contemplating possible expedients where separate accommodation is insufficient or unobtainable.

Control of Persons who have been Exposed to Infection by Smallpox.—*Vaccination after Exposure.* One fact of great value in dealing with smallpox in an incompletely protected country like Britain is that vaccination has an unquestionable, though not unvarying, power of forestalling smallpox if performed within two or three days after exposure to infection. This depends on the ordinary incubation period of vaccinia being shorter than that of variola. If variola has not too long a start, vaccinia often gets home first. Revaccination will also have effect two days later than vaccination performed for the first time, because revaccinated cases reach the stage of vesiculation two or three days sooner than those vaccinated for the first time. There are exceptions, however, in which variola succeeds in overcoming vaccinia, even if there is only a single day between smallpox infection and vaccine inoculation. Yet the rule is so usually correct that vaccination of contacts should never be omitted if it can be performed within a reasonable time after their exposure to infection. Where persons engaged in hard manual labour are revaccinated, they have sometimes to take a rest for a few days, and payment for loss of time may be made by the sanitary authority.

Observation of "Contacts." This is a routine measure and has been so, in varying degrees in different places, since the great epidemic of 1871-5. Obviously, it can only be thorough in presence of compulsory notification. Reception houses are useful in towns, but contact cases can often be kept under observation at home. After house and clothing have been disinfected, and bedding disinfected or destroyed, it is not essential that "contacts" should be debarred from following any ordinary employment, provided they are medically visited during the full period in which the smallpox may be expected to develop. Much, of course, will depend on the circumstances of a given case. It is, for example, entirely unnecessary to put restrictions for a fortnight on the movements and occupation of a contact who, before exposure to infection, was recently and successfully revaccinated; all that is necessary is to disinfect the clothing which he was wearing at the time of his exposure, and to clean his body. When, on consideration of the time and character of the exposure of a contact and his vaccinal condition, it appears likely that in the course of a certain number of days he may be attacked by the disease, there is still no reason to think him a material danger to others until definite symptoms have declared themselves. It is necessary, however, in such a case to be sure that the man is available

for observation during the critical period, and sometimes this can only be ensured by his being from the first taken charge of and maintained by the sanitary authority.

Few towns have reception houses large enough to receive all the inmates of common lodging-houses when a case occurs there, and the lodging-house itself may practically become a reception house, by arrangement with the keeper. When a case occurs in navvies' huts belonging to waterworks or railways in course of construction, or the like, a hut should be set apart as a reception house. Even then the inmates, or some of them, may disperse, though with the aid of the employers, and by persuasion, warnings, or money payment, they are often influenced to remain. The keepers of lodging-houses and navvies' huts should be required to ascertain as correctly as possible the names and destinations of those who depart. The police may be helpful in tracing vagrants and navvies.

In connection with every case of smallpox the medical officer of health should make as full a list as possible of all contacts, and should at once send a note of the facts to any other medical officers in whose districts any such reside. In doing so, he should specially state the dates between which infection may have been incurred, so as to save needless inquiries and loss of time. Such contacts should, of course, be kept under observation in their respective districts. Where any large dispersion takes place of navvies, or inmates of lodging-houses, general intimation should be made to neighbouring medical officers, especially to those whose districts contain large lodging-houses, or public works likely to attract navvies.

Disinfection.—Instead of disinfection of bedding, especially of mattresses, its destruction is a common practice, and is manifestly the safest procedure. In a common lodging-house or navvies' hut the difficulties are often very great, owing to the large number of articles which may have been exposed to infection. Occasionally a lodger or navy may have occupied two or three beds during the period of infectivity before his removal to hospital. Disinfection of house and furniture and clothing should be very thorough, but the means to be used do not differ in nature from those adopted in the other principal infectious diseases.

Promptitude.—Finally, promptitude is important in every procedure relating to the prevention of smallpox.

RESULTS

Influence of Epidemic Type.—The success of efforts to control smallpox by the measures above indicated has greatly varied in different

outbreaks in different localities. What the author regards as an important factor in some recent epidemics has been the exceptionally mild type of the disease. Much-modified types, or "sports," of smallpox have long been known. In 1789, before Jenner began to practise vaccination, he and a medical society of which he was a leading member were greatly interested in such an outbreak, and he discussed the question whether the modified virus could be introduced for smallpox inoculation, with the view of getting a milder result than could be relied on even from the Suttonian method then in vogue. In 1806 Dr. Adams, of the London Smallpox Hospital, investigated a similar outbreak. Leicester, and in 1901-4 a considerable area in the midlands and north-west of England, experienced an unusually light form of the disease, whilst London, which may readily get its smallpox introduced from the continent of Europe, had a much higher fatality rate.

Mildness of smallpox, whether due to the prevailing type of the disease, or to the influence of previous vaccination of the individual, acts in two opposite directions in influencing the spread of infection. On the one hand, slight cases of variola are apt to be overlooked, and therefore get full opportunity of exercising whatever infective power they possess. On the other hand, the infective power of a case may safely be regarded as dependent in considerable measure on its severity. A confluent case manifestly yields many times more *materies morbi* than a case which presents only one or two papules or vesicles or pustules. A very mild case, therefore, though more likely to be missed, may have very little inherent power to spread the disease, whilst a severe case, though less likely to be missed, may be infinitely more infectious.

With regard to very mild cases, my own experience has been that they are likely to cause infection within their own dwelling-house, but often do no harm outside. For example, a mother, whose eruption consisted of only a few spots with almost no preliminary fever, infected two members of her own household. When these fell ill the disease was recognized, and I found that the mother had been moving freely about in a town with a population of 14,000, shopping, walking through the streets, conversing with neighbours, and so forth. An offer of general revaccination was thought of by the sanitary authority, but was departed from, and I awaited the result with some apprehension, but as it turned out the woman infected no one outside her own house. The records of various experiences by other observers seem to me to give general support to this proposition. Where the apartment occupied by the case is a large one—say a hospital

ward or lodging-house dormitory, there is, of course, opportunity for many inmates to be infected.

Again, whilst cases with an ordinary amount of eruption are usually diagnosed, they are by no means invariably so. The preliminary illness in such cases is not always enough to cause a medical man to be sent for, and in many an outbreak, perhaps at the end of it, one reads of people having been met on the streets or calling at dispensaries with the eruption abundantly present. It is not mildness of type that explains the frequency with which vagrants spread smallpox. A tramp may have a few days' sharp illness without calling in a doctor, and when a considerable eruption appears the fever departs, so that the man resumes his wanderings, chiefly among people who pay little heed to the appearances of smallpox. If the spots are remarked on, they may be set down to drink and dirt and ill-living. A copious eruption therefore by no means invariably results in immediate removal to hospital.

This is a question in respect of which each infectious disease has to be considered by itself, in accordance with its own natural history. Looking to all the facts, it seems to me that as a source of infection, mild is distinctly less to be feared than severe smallpox. In support of the contrary opinion it is easy to cite medical officers' records of infection due to mild and unrecognized smallpox, but it is impossible to say that such infecting cases, if severe, might not have been much more mischievous.

This question of the risks of infection from mild smallpox has lately been discussed with reference to the influence of vaccination, the view having been that vaccination, by greatly modifying the disease, tends to spread infection, owing to non-recognition of trivial cases. Mildness of type of smallpox in after-life, and a very low fatality rate, are, indeed, among the principal benefits of infantile vaccination, and reasons have just been given for the opinion that mild smallpox is less likely to spread infection than severe. But if primary vaccination be criticized on account of its producing a mild disease difficult of diagnosis, what practical conclusion is to be drawn? Surely it is that those who are liable to infection from either recognized or unrecognized smallpox should make themselves immune by vaccination, rather than that others should remain unvaccinated with a view to any smallpox attack from which they may suffer being so severe as to be unmistakable.

Leicester and Gloucester.—The system of dealing with smallpox in this country by vaccination (including revaccination), combined with isolation of cases and observation of con-

tacts, is almost universal, and has been so since compulsory notification began—to some small extent, indeed, long before that time. Certain towns, however, where antivaccination opinions prevail have purported to treat smallpox by means of isolation and control of contacts, without vaccination. Leicester is constantly referred to in this connection, and the facts concerning it are so often misunderstood that some space may be devoted to the subject. During the pandemic of smallpox which swept over Europe in the early seventies, England suffered severely, and Leicester had its share, the deaths in the town being 346. The usual antivaccination history of Leicester presented to the public is that the town had been fully vaccinated previously to the 1872 epidemic, and that, having suffered terribly then, it came to abandon vaccination in favour of other measures, and has ever after rejoiced in its freedom from smallpox. In November 1886 the *Vaccination Inquirer* wrote, "Leicester became completely vaccinated, yet in 1872, while thus fortified with the Jennerian rite . . ." Similarly, in 1890, the *Inquirer* stated with reference to Mr. J. T. Biggs, the acknowledged representative of antivaccination in Leicester, that "Mr. Biggs showed how, at a time when ninety-eight per cent. of the births of Leicester were vaccinated, they had the severest epidemic of smallpox and the greatest death-rate they had experienced from it for fifty-two years, while last year, out of 5,000 births, they only vaccinated 101, and had no smallpox at all." In 1892 (*Vaccination Inquirer*, Nov. 1) Mr. Biggs himself wrote, "After the subsidence of the great smallpox epidemic of 1871-3, when the town was thoroughly well vaccinated," and Dr. Killick Millard writes that, "Prior to this period, however, Leicester ranked as a well-vaccinated town." But it is unnecessary to go outside the pages of the Anti-Vaccination League's own organ and Mr. Biggs's own evidence before the Royal Commission, to learn that long before 1872 Leicester had been notorious for its neglect of vaccination. It appears that in 1842 the Leicester Guardians decided not to carry out the Vaccination Act of 1840, and that in 1846 forty-one infants died of smallpox in six months, and that in 1851 its population was 60,462, and "not half the inhabitants were vaccinated," and that Lord Lyttelton, in introducing the Vaccination Act of 1853, cited Leicester as an example of neglected vaccination. In 1864 it had a smallpox epidemic, with, as usual, consequent extra resort to vaccination during the outbreak, and in 1868, the year when it appointed a vaccination officer, there was opposition to the practice.

The figures supplied by Mr. Biggs himself to

the Royal Commission show how irregularly vaccination was attended to, activity alternating with neglect. Beginning with 1854, when the first so-called compulsory Act came into operation, the registered vaccinations to births ranged in the quinquennium 1854-8 from about seventy-four to about ninety-three per cent., and if deaths before vaccination are allowed for, the vaccination age then being under three months, a small percentage may be added to these figures, so that infantile vaccination at that time was well attended to. Then the vaccinations became much fewer, the maximum being about sixty-nine per cent. in 1860, and the minimum less than thirty-seven per cent. in 1865, but here again an addition of five per cent. may be made on account of deaths before vaccination, and if that be done, 1865 is found to have about forty-one per cent. of its infants vaccinated, and 1867 about seventy-nine per cent., so that the default ranged from over twenty per cent. to nearly sixty per cent. Next, from the beginning of 1868 onwards till after the pandemic, the influence of the Vaccination Act of 1867 comes into play, Leicester having appointed a vaccination officer in 1868. At the time of the epidemic, therefore, and for three or four years before it, infantile vaccination had been well practised, but, looking to the previous high degree of neglect, it is quite unjustifiable to suggest that vaccination in Leicester had been anything like universal before the epidemic came, or that the population exposed to the outbreak did not contain a large percentage of unvaccinated people.

Coming now to the vaccinal condition of Leicester in more recent years, though the default in infantile vaccination has been very great, yet the medical officer of health, in taking (in 1903) a census of the vaccinal condition of a typical population of over a thousand people, found that about sixty-two per cent. had been vaccinated. The population of the town was then about 220,000, so that if the census were a fair index of the rest of the town the vaccinated population would be about 140,000, and the unvaccinated about 80,000. In so far, however, as the vaccinations were done many years before, their value in preventing attack by smallpox had greatly diminished, and this must be borne in mind with regard to such figures. But any suggestion that Leicester was fully vaccinated prior to the 1872 epidemic, and was unvaccinated at the time of its last serious outbreak in 1903-4, is very wide of the truth.

The Leicester Method in Fiction and Fact. Such having been the vaccinal condition of Leicester, reference may next be made to the steps which that town has commonly been supposed to take in preventing smallpox. The

phrase, Leicester System or Leicester Method often appears in print, and Mr. J. T. Biggs has declared quite definitely that the Leicester System is "without recourse to vaccination." He told the Royal Commission that "with the abandonment of vaccination and with the perfecting of the Leicester Method of sanitation, isolation, quarantine, disinfection, etc., during the last six years, smallpox mortality became extinct." This evidence was given in 1891. Further points in the system as expounded by Mr. Biggs in the *Vaccination Inquirer* and elsewhere were that the same hospital was used for smallpox and for all other infectious diseases at the same time; that contacts can be quarantined in hospital; that no compensation is paid to them for loss of wages; and that there is no compulsion. "We find smallpox very easy to deal with, and the same hospital and staff of officials deal with smallpox as with other infectious diseases. There is no compulsion. If people choose they may go into quarantine, or they may stay out. No one's liberty is infringed."

The method had thus been made perfect in 1891, and smallpox had, in consequence, disappeared. But Mr. Biggs was too hasty. Smallpox invaded the town the year after he gave evidence, and in 1892-3 the total attacks were 357. It returned in 1903-4, and the total notified cases were 715. There were therefore more than a thousand cases of smallpox in the town from which the disease was stated to have disappeared, under the influence of the method. Furthermore, in presence of smallpox, every item in Mr. Biggs's method was abandoned. Instead of the hospital being used alike for smallpox and for other infectious diseases, everything excepting smallpox was cleared out. The scarlet fever cases were all sent home, and whether in consequence of that or not, within the next two months after the hospital was closed against scarlet fever the cases of that disease doubled in number in the town, so that according to the then medical officer, Dr. Priestley, if unnotified cases are included it appears that the total amounted up to about 4,000. Of scarlet fever notifications the number was 132 in 1888, 409 in 1889, 516 in 1890, 794 in 1891, 1,331 in 1892, and 2,308 in 1893. Next, as regards persons who had been exposed to smallpox infection, the attempt to deal with them by quarantining at the hospital was given up. Also, compensation was paid, though its non-payment was part of the method. As regards compulsion, and the preservation of the liberty of the subject, whatever the theory may have been, all known cases appear to have been taken to hospital. Next, and most important, Mr. Biggs's statement as to vaccination had been quite strong and definite. The

system was *without recourse to vaccination*, and Mr. Biggs himself italicized the crucial words. But when smallpox came it is simply undeniable that the health committee itself recommended vaccination as coming within the euphemism of "all protective measures known to science" to "all persons who are frequently brought into contact with smallpox patients," and the Jennerian prophylaxis was largely resorted to by such persons. That there were exceptions, some of whom paid for their folly, we have already seen.

In his annual report for 1902 the medical officer wrote that, "it should be clearly recognized that all those medical officers of health who have carried out the 'system' have been firm believers in vaccination, and have not hesitated to make as full use of it as possible, short of compulsion, where the occasion for it has occurred." The story of the epidemic of 1903-4 is similar. In 1903 the list of contacts was 1084, and in a paper on the subject Dr. Killick Millard wrote that of these he "induced nearly 800 persons (living in invaded houses) to submit to vaccination, almost all of whom were disbelievers in, and actually hostile to, vaccination in any form."

By 1902 the hospital which had previously been regarded as sufficient not only for smallpox, but for all other infectious diseases at the same time, had been supplanted by a new hospital of sixty beds, wholly devoted to smallpox, situated well outside the town and away from populous areas, and, in addition, as has been already stated, the whole fever hospital of 200 beds was set apart for smallpox, cases of all other diseases being sent home. Vaccination and observation of contacts, together with isolation of cases and other supplementary measures applied to an exceptionally mild type of the disease, had the effect of limiting the outbreak to 715 notified cases. But the Leicester System described by Mr. Biggs had been given up. It is, of course, open to any one who pleases to describe as the Leicester Method whatever is at any time done in Leicester, and if the term is to be seriously applied to the management of smallpox, say in the last epidemic, then vaccination to the indicated extent is part of the method.

A curious example of how the term Leicester Method can be applied to diametrically opposite proceedings at different times, is to be found in connection with the payment of compensation to contacts. In 1892, in the *Vaccination Inquirer*, under the title "How Leicester deals with Smallpox," Mr. J. T. Biggs indignantly denied that, as had been stated in the *Lancet*, "contacts were offered compensation." He declared that "compensation for loss of time is not offered." But the Royal Commission

subsequently recommended as follows: "Power should, in our opinion, be conferred on Sanitary Authorities to give compensation for the loss of wages, and generally for expenses occasioned either by the isolation of patients, or persons who have come in contact with them, or such supervision of them as is necessary, whether in hospital or elsewhere." Then the Leicester medical officer (who had not been in office in 1892) declared that this recommendation "marks the approval of the Royal Commission of one of the special features of the 'Leicester Method.'"

Gloucester imitated and even surpassed Leicester in its neglect of vaccination, so that in the six years 1889-94, inclusive, among 9047 births there were only 300 vaccinations registered. Like Leicester, it sent representatives to the Royal Commission to declare how it had abandoned vaccination and trusted to "sanitation." The secretary to the local antivaccination society stated to the Commission, "Gloucester is a very clean town," and "I think we have always been well abreast of sanitary improvements." Gloucester's lesson came in 1895-6. Its population was about 40,000. Its hospital, though containing no less than forty-eight beds which were devoted entirely to smallpox, soon became filled, and, as already stated, additional hospital accommodation was gradually provided till the total amounted to 318 beds. Rather than keep cases at home more were sometimes admitted than there were beds for, though it must be allowed that no attempt was made to imitate Leicester's alleged method of treating all other infectious diseases in the hospital at the same time as smallpox.

Notwithstanding all efforts to cope with smallpox in a badly vaccinated town the disease spread rapidly, and overcame all barriers but one. The Commission had been told that nothing would induce the Gloucester people to submit to vaccination. The epidemic, however, had that effect, and before its close Gloucester had become the best vaccinated city in the empire, about 35,000 vaccinations being performed from January 1 to July 11, 1895. The balance of population was, therefore, about 5,000, and the total known cases of smallpox were 1979.

Dewsbury was another well-known centre of antivaccination opinion and practice, its default having amounted to between forty and fifty per cent. of the births. The chairman of its board of guardians, who was also a vice-president of the Anti-Vaccination League, gave evidence before the Royal Commission, testifying to Dewsbury's "love of freedom." In Dewsbury, he said, they did not regard themselves even as requiring hospital accommodation

or other such measures. Yet in the town itself the sanitary authority had provided a hospital with twenty-six beds, or about one to every thousand of the population. Smallpox visited Dewsbury in 1891-4. At that time in the town there were 312 cases. A later invasion was on a larger scale, the total cases in the town in 1903-5 being 700, while in the whole union there were over 1300. As the guardians, led by their chairman, refused even in presence of smallpox to provide sufficient facilities for vaccination, the Local Government Board issued an Order conferring on the town council and certain other sanitary authorities in the union the power of providing vaccination stations and medical assistance in controlling the epidemic. Under this régime the smallpox outbreak soon came to an end. In the town of Dewsbury, with its estimated population of 27,502, the total vaccinations in presence of smallpox amounted to about 8,000, and as the previous neglect had not been eighty-three per cent. as in Gloucester, but only between forty and fifty per cent., it is obvious that a large part of the population accepted the long-despised protection.

Hospital isolation of smallpox is now so constantly insisted on by antivaccination writers as an essential part of the Leicester Method that the impression may readily be created that public health authorities and the medical profession require to be converted to a belief in its value. But in reality hospital isolation was medically advocated at a time when it was being hotly denounced by official opponents of vaccination. In 1892 the *Vaccination Inquirer* took occasion to declare its "diametrical hostility" to compulsory isolation, and in earlier antivaccination tracts hospital isolation was most violently anathematized.

But the very important question remains, Have Leicester and Gloucester really nothing to teach us? In spite of all the misstatements and misrepresentations that have been made by exponents of the mythical Leicester Method, the experiences of that town are well worth study, and, in particular, the contrast between the Leicester and the Gloucester epidemics demands attention.

The striking facts about Leicester, as cogently urged by Dr. Killick Millard, are that 357 cases of smallpox were notified in 1892-3, and 715 in 1903-4, yet the infection did not spread further amongst the very many thousands of unvaccinated persons in the town. But on the other hand, it is important to note that in Gloucester, where vaccination had also been grossly neglected, in a population of about 40,000, the epidemic came to an end only after 35,000 had been vaccinated or revaccinated, the total cases of the disease having in the mean-

time mounted to 1979, so that only a small fraction of the 40,000 were without either vaccination or smallpox. What is the explanation? Relying on impartial reports, I cannot see that the methods of management differed in any essential respect as between Leicester and Gloucester. The Gloucester method was thus reported on to the Royal Commission by Dr. Sidney Coupland: "I was informed by Dr. Campbell that the following was the procedure adopted at the earlier period of the epidemic with regard to all cases of smallpox. On receipt of the notification the medical officer of health visited the house, confirmed the diagnosis, and directed the sanitary inspector to remove the case to hospital. Removal was in all cases promptly done. The bedding, carpets, etc., in the rooms occupied by the patients were destroyed by the sanitary authority, and compensation granted by the sanitary committee of the town council. The remaining inmates of the house were kept at home under 'quarantine' surveillance for a period of fourteen days after the removal of the case. Or, if the case were not removed, the 'quarantine' was prolonged until fourteen days after the patient had been declared free from infection. After the close of the quarantine period the house was disinfected by the sanitary authority. The room which had been occupied by the patient was sprayed with mercuric chloride solution and fumigated with sulphur for a period of six hours. The windows and doors were then thrown open and the floors cleaned with carbolic soap. The ceilings were limewashed and the walls mostly repapered." Why, then, did the one city require to resort to wholesale vaccination or revaccination of its population, whilst in the other vaccination did not extend much beyond those who were in contact with the disease?

In searching for an explanation we have no right to overlook the remarkable difference between the epidemic type of the disease in the two cities. Gloucester, amongst 1979 cases, had 434 deaths, or nearly twenty-two per cent. Leicester in 1892-3 had 357 cases and twenty deaths, or 5.6 per cent., and in 1903-4 it had 715 notifications and twenty-five deaths, or 3.4 per cent. These include vaccinated and unvaccinated, and there were of course the usual differences between the two classes. But the point of immediate interest is that, quite independently of vaccination or non-vaccination, the epidemic type in Gloucester was very severe and in Leicester very mild. One view, carried to its logical conclusion, would appear to be that Gloucester's task in checking the epidemic should have been all the easier because its cases were so severe, and that Leicester's was all the

more difficult because its cases were so mild. My own conclusion is just the reverse—that the total amount of infective material, being infinitely greater in Gloucester than in Leicester, made Gloucester's task all the harder and Leicester's all the easier.

Since 1904 epidemic smallpox has been practically absent from this country, and, coincidentally, systematic infantile vaccination has been more and more neglected. I think I am right in saying that in such trivial outbreaks as have occurred the disease has exhibited, generally, the mild type already referred to, and its invasions have been repelled without any very serious difficulty. The epidemics of Leicester, Gloucester and Dewsbury have not been repeated, neither these nor any other town having had any serious spread of infection from such cases as have occurred. In 1905-6, Dr. Millard, in Leicester, was able to prevent spread of infection from five cases of non-fatal smallpox in persons vaccinated in infancy. In 1906 he had a similar experience with one case whose vaccinal condition is not mentioned. Bristol, London, Dundee, Paisley, Stirlingshire and, no doubt, various other places, have had experiences of this sort. The means relied on have been with local variations those already discussed, namely, vaccination of the hospital and sanitary staff, and of contacts so far as persuasion and fear can exert their influence, combined with hospital isolation, search for and observation of contacts, and disinfection. The disease being stopped in this way, general vaccination and revaccination were not carried out in connection with these occurrences of mild smallpox with its restricted infectivity.

The Future.—In writing on the subject of Smallpox and Vaccination nearly twenty years ago I made some remarks on the question whether there was any likelihood of smallpox dying out or diminishing as plague and leprosy had done, and I said that quite conceivably smallpox, rather than either scarlatina or measles, might be the next in order of maladies to disappear from the civilized world. Since that time plague has reconquered India, and has even invaded some white communities, where its incursions have been countered with considerable difficulty. Such speculations are more interesting than profitable, and would be dangerous if they were to lead to any relaxation of preventive measures. The possibilities, however, remain as before, and it is now forty years since the last great pandemic of smallpox. But for all we know, next month or next year may see a renewed attack capable of overcoming every defence except that of vaccination. What the future has in store for us, indeed no man can tell. Whether and to what extent, as vaccination falls more and more into general disuse,

such measures as have already been discussed will be able to prevail against smallpox, it is impossible to say. Whether we shall continue to have the mild type of disease characteristic of recent years, with its sparse eruption and correspondingly limited infective power, cannot in the least be foreshadowed. But every weapon must be kept polished and available towards repelling assault. Meantime, the health officer and the medical profession have the supreme satisfaction of knowing that practically every person who likes can so protect himself against smallpox as absolutely to defy its attack; that vaccination can be so used as to enable the individual to enter in safety the dirtiest and most infected house in the kingdom; that the youngest and least experienced nurse can accompany unharmed the worst cases of variola in the limited air-space of an ambulance van; and that within the hospital the staff can carry on their unpleasant duties whilst themselves invulnerable to infection. To that extent, therefore, it is easy to surround a notified case with a cordon of immunity. Vaccination of contacts being optional, each one who refuses and develops smallpox will himself become the centre of a similar scheme of control.

If the infection breaks through these preventive measures, and an epidemic has to be faced, no ordinary amount of hospital accommodation will suffice for all its victims. But the speed with which calf lymph can now be produced and treated makes it possible within two or three weeks to provide such a stock of vaccine as will meet the necessities of the most extensive prevalence. Further, those who choose to avail themselves of the protection will have all the advantages of the recency of their vaccination, so that it will not be a mere question of mitigation, but of entire security against the slightest susceptibility to infection. In the beginning of an epidemic, and before the public becomes alive to the danger, there will, indeed, be some toll of attacks and deaths levied by smallpox on those who have neglected to protect themselves, and on those who, after infection by smallpox, have not been vaccinated in time to avert development of the disease. How few or how many such cases there may be will differ in different circumstances. A scattered community where each household has its own cottage, or even a town where each dwelling has its own door opening on a street, should be much better off than a large city with its population packed in high flatted tenements with multiple dwellings on every floor. Differences will also exist as regards schools and occupations and workshops.

But after severe epidemic smallpox has succeeded in establishing itself, the extent of

its ravages will depend on the wisdom or folly of the public attitude towards it. There is no teacher of vaccination so persuasive as smallpox, and an epidemic will be quickly limited if the lesson is quickly learned. It will always be the desire of the health officer to protect even the antivaccinationist from his own folly, but he must act with great discretion to prevent subsequent charges of oppression or illegality. The fact that vaccination is now practically optional should be borne in mind, and consent should be definitely obtained to its performance. At the same time the medical officer must neglect no auxiliary measure—isolation, observation, disinfection—and to that end he will probably have to put aside all his routine work. Doing his own duty thoroughly, he will have no personal or official cause for anxiety as to the outcome. Whatever happens, his withers will be unwrung.

J. C. McV.

CHICKEN-POX (VARICELLA)

Though endemic in this country, chicken-pox is apt at times to become epidemic locally. Unlike most of the other infective fevers, its prevalence bears no definite relation with season. Its infectivity is very great; as great, probably, as that of smallpox, or even measles; but while, perhaps, the latter may be capable of creating greater havoc among susceptible persons as the result of close personal contact, the "striking distance" of chicken-pox is greater. The causative organism has not as yet been identified.

The disease is infectious from the outset; certainly before the eruption is fully developed. At this stage the contagion is probably given off by the breath, but at a later period it is commonly believed that it may also be disseminated by means of infective particles derived from the desiccating pocks. In addition to direct aerial transmission from the sick to the healthy, infection may also be conveyed through the mediate agency of some infected article, such as a spatula, spoon or cup, or by the hands, or possibly the dress, of an attendant.

Predisposition is enhanced by the presence of, or convalescence from, other infective diseases, such as scarlet fever, measles, or diphtheria. Second attacks of chicken-pox are exceedingly rare.

The period of incubation is in most cases from thirteen to sixteen days, the limits being ten to twenty-one, though in one case twenty-four days has been recorded. Chicken-pox often appears to arise sporadically, owing, no doubt, to the primary case having escaped detection.

In mild cases the rash is usually the first

indication of illness. In well-developed attacks, however, the patient may complain or present the appearance of being "out of sorts," and the temperature be slightly raised, for a day or two before the rash comes out, and under these circumstances an erythematous flush is apt to appear on the face, chest and arms, sometimes attended with slight conjunctival injection. Chicken-pox occurring in an *adult* is especially liable to be attended with pre-eruptive illness, marked fever and constitutional disturbance being often seen, and sometimes headache of such severity as to suggest the onset of smallpox.

The rash usually first appears on the trunk, in the form of small circular or ovoid spots of pinkish tint, which rapidly become raised above the surface into rounded, and often somewhat pyramidal-shaped, papules. Though all parts of the surface may be invaded, the rash is, as a rule, more profuse on the trunk than on the face or limbs, the hands and feet being usually spared, unless the rash be very copious. Most of the papules in the course of a few hours develop into tense, translucent, glistening vesicles. In some the papular phase is so short that the pock appears as if vesicular from the outset. Usually, however, some induration of the base remains until the second day, as evidence of their original papular formation, while not a few show no vesicular change at all, but persist throughout as immature papules. The pocks commonly reach their full development by the end of thirty-six to forty-eight hours, after which they lose their tension and their contents become opaque and muddy-looking. More or less flattening of the surface occurs as they become less tense, while the larger pocks tend to become somewhat elongated and their margins often crenated.

Some degree of inflammatory redness round the base of the vesicles may usually be noted at this time, especially if the contents have become purulent as the result of scratching or accidental rupture. In the course of four or five days the vesicles dry up, forming dark brownish scabs, which separate at the end of ten days or a fortnight. Pustulation, however, leads to the formation of a definite crust, which is slow to separate and usually results in a permanent, depressed cicatrix. Under these circumstances the skin may not be clear for two, or even three weeks longer. The vesicles of chicken-pox are rarely umbilicated and always unilocular. Consequently they collapse readily when pricked, and if the finger be passed over them yield but little sense of thickening, by reason of their superficial formation.

It is important to note that the chicken-pox rash comes out in a series of crops; as a rule on several successive days, each crop attended

with a separate rise of temperature. The degree of pyrexia is usually proportionate to the amount of rash, and its duration to the number of days, usually three to five, during which the spots are making their appearance. If, however, the eruption be very sparse, the attack may be quite apyrexial.

In ill-nourished or rachitic children some of the pocks are apt to reach an undue size and become the seat of unhealthy and even gangrenous inflammation, a condition which is apt to be attended with severe constitutional depression.

If we exclude modified smallpox (see p. 52), the only affections with which chicken-pox is likely to be confused are herpes, lichen, impetigo, and a papular rash associated with dentition. Herpes should be recognized by its limited distribution, its relation to the course of a particular nerve, and the limited size of the vesicles. It is in cases, however, in which the eruption is sparse, and remains for the most part papular, that the other affections are likely to be a source of difficulty. The absence of pyrexia and of at least one single typical vesicle, and a due regard for the circumstances under which the eruption has arisen, are the chief points to rely upon.

The treatment of chicken-pox consists for the most part in giving a laxative and in preventing the child from scratching its pocks, the itching of which may prove a source of considerable discomfort. For its relief either weak carbolic lotion or one of borax and soda may prove effective. The patient should be isolated until every scab has separated, with a minimum period of a fortnight. Having regard to the length of incubation in some exceptional cases, a quarantine of three weeks is desirable.

F. F. C.

SCARLET FEVER (SCARLATINA)

Though always present more or less in the large towns of the British Isles, scarlet fever is most prevalent in the autumn and early winter months. It is most fatal in young children, in whom the disease is more prone to assume the septic form. The case mortality is less than one-third of what it was even twenty years ago, owing to the comparative rarity with which toxic, or so-called "malignant" attacks are met with at the present day.

The essential germ has not yet been identified, though pyogenic organisms, especially streptococci, must be held responsible for most of the serious developments which arise in the course of a severe attack. These, whilst always abundant in the fauces, even in the mildest cases, are liable to invade the circulation, and more often than not the fatal result is depen-

dent upon streptococcal septicæmia. The contagium is present in the fauces and nasal passages, and is doubtless given off in the breath by the projection of minute droplets of saliva or secretion derived from the infected mucous surface.

Direct contact is thus, probably, the most important factor in transmission, though mediate infection through the agency of the fingers or some contaminated article, such as a cup, spoon, fork, handkerchief, toy or pencil, or even a partially sucked sweet, is no doubt of frequent occurrence. In this way the hands or clothing of an attendant may convey the disease, or a flake of desquamating cuticle.

There is no evidence that the scarlatinal desquamation is of itself infectious, except as the vehicle of contagion derived from the mouth or nares; nor, if frequent baths have been given, is there any reason to regard the later peeling as infectious—traditional belief notwithstanding.

Infection attaches to the faucio-nasal mucous membrane for a period which is uncertain and varies considerably in different cases. Owing to this uncertainty it is usual—and the practice is a wise one—to isolate a patient for six weeks from the time of the rash, though in the majority of cases four weeks would probably have been sufficient. After this period the question of peeling may be ignored, assuming that baths have been given frequently.

The persistence of rhinorrhœa, however, especially if there be any reddening of the external nares, otorrhœa, or a relaxed condition of the fauces, should lead to further detention; if possible, until the parts have resumed their normal appearance.

Predisposition to scarlet fever is heightened by recent acute illness, especially where, as in the case of diphtheria, measles, or some operation for the removal of adenoids, etc., the resistance of the faucio-nasal tissues is impaired. Opinions differ as to whether parturient women are more susceptible than others. Every precaution, however, should be taken to protect them from scarlet fever, as septicæmia is very prone to supervene.

The incubation stage is usually between two and three days. It is not often less than two, but may extend to five.

The onset is usually more or less sudden. Sore throat with pain on swallowing is commonly the earliest sign, soon followed by headache and general febrility. The pulse during the early stage is often unduly rapid. Vomiting occurs in four-fifths of cases, and is most constant in children. Headache, on the other hand, in them is often absent. Diarrhœa is sometimes met with in the early stage. Most adults complain of aching back and limbs and some degree of

chilliness, though a definite rigor is uncommon. The rash comes out a few hours later, occasionally not until the next day, and the general symptoms become aggravated.

The temperature usually reaches its full development, perhaps 102° to 104° , on the third or fourth evening, by which time the faucial swelling has become more pronounced, and swallowing correspondingly more painful.

Tender enlargement of the glands beneath the angle of the jaw is present in some degree, and in cases with a high temperature the patient is apt to be somewhat delirious at night-time. A progressive abatement of the symptoms then sets in, and the temperature, falling gradually, reaches the normal towards the end of the week, just as the rash is disappearing. Rheumatic pains in the joints and muscles are apt to occur about this period, sometimes attended by definite synovial effusion. The wrists and finger joints are those most often affected.

The rash first appears on the neck and chest, and, spreading down the trunk and limbs, reaches the feet about twenty-four hours later.

In a well-developed attack the rash reaches its height about the third day, after which it gradually fades, and though usually gone by the end of the week, a number of coarse injected papules may often be discerned on the outer side of the legs and upper arms for several days longer.

The typical scarlatinal rash consists of two factors—a number of minute, slightly raised red points and a vivid red erythema. The composite character of the rash is very distinctive. On the face, however, and on the palms and soles there is no punctuation, while the total absence of any redness or congestion of the skin around the mouth, in marked contrast to the vividly injected cheeks, gives an appearance of circumoral pallor in scarlet fever which is rarely seen in measles. The occurrence by the third or fourth day of fine powdery desquamation on the still flushed cheeks gives them a "powder and rouge" appearance which is very characteristic. The rash, if intense, leaves a uniform greenish-yellow staining of the skin on fading. Over the flexor surface of the larger joints lines of hæmorrhagic staining are sometimes apparent.

By the end of the week peeling of a scurfy character can usually be detected on the neck and chest, best marked over the clavicles and in the axillæ. This extends, and signs of peeling are usually more or less apparent over the whole surface by the end of the second week, with the exception of the hands and feet. Peeling as a rule begins early, and is well marked in the groins and inner aspect of the thighs. Here, and where the skin is soft and elastic, the desquamation

shows the "pinhole," or ringlike character, so distinctive of scarlet fever. Commencing as minute perforations of the superficial cuticle, the pinholes rapidly enlarge and become irregular in outline, and as a result of fusion of their peripheries, the ringlike arrangement soon becomes lost and the peeling passes into the "islet" stage, in which small isolated tags of cuticle alone remain attached, prior to complete separation. On the palms and soles, which are the last to peel, pinholes are seen but rarely, and here the cuticle, especially in adults, comes off in flakes of larger size, though sometimes, on the other hand, a chalky appearance of the surface may yield the only evidence of desquamation. Peeling is usually completed by the end of six weeks, though the soles of the feet may not be quite clear until two or three weeks later.

On inspecting the throat the faucial surface generally presents a reddened and congested appearance. The amount of swelling of the tonsils varies greatly in different cases. In some it is considerable, and more or less ulceration, often with patches of necrosis, occurs after a few days in septic attacks. Not infrequently, on the other hand, the tonsillar swelling is very slight, and the only indication seen is a reddened, tumid appearance of the mucous lining of the throat, which is very characteristic of scarlet fever.

The tongue yields valuable evidence in diagnosis. At an early stage it becomes coated with a thick white fur, protruding through which the congested fungiform papillæ show up as red dots upon the surface.

Peeling of the tip and edges is visible as early as the second day, and, extending centripetally, the whole of the organ becomes denuded of fur by the fourth day, so as to closely resemble a ripe, red strawberry. This condition of tongue is very distinctive of scarlet fever, since in no other form of sore throat could the tongue be described as clean, much less as raw-looking. It must be remembered that the completeness with which the tongue peels is proportionate to the intensity of the congestion of the mucous lining of the throat, just as the amount of desquamation of the skin is dependent on the intensity of the pre-existing eruption.

In the *septic* form of the disease ulceration of the tonsils is always present, and is, no doubt, primarily responsible for the gravity of the condition. It not only provides a focus for septic absorption, but by its liability to extend and involve neighbouring structures the mechanism of deglutition and the movements of the epiglottis may be interfered with, leading to bronchopneumonia and ultimate exhaustion. More or less infiltration of the subjacent lymphatic glands and cellular tissue is always present,

often resulting in abscess; and there is profuse muco-purulent rhinorrhœa.

In the worst type of case the nasal discharge consists of a thin, straw-coloured serous fluid, having intensely irritant properties.

The pyrexia persists and becomes more remittent in type, averaging usually from 102° to 103° , and in cases which recover a gradual return to normal takes place any time between the latter half of the second and the fourth week of attack.

On the other hand, should the case prove fatal, the patient, run down by the fever and unable to obtain proper rest or nourishment, loses flesh and becomes exhausted; while pulmonary congestion and albuminuria, accompanied by diarrhœa of an offensive character, usually supervene before death, which, except in very young children, who are less resistant, commonly takes place towards the latter half of the second or in the course of the third week of illness.

In about eighty per cent. of the fatal cases a septic rash, morbilliform in type, comes out on the extensor surface of the larger joints towards the close of the second week.

In the *toxic* or malignant variety—now, happily, rare—there is as a rule neither ulceration of the throat or glandular infiltration. Its malignancy is essentially scarlatinal. The initial vomiting persists throughout, the temperature ranges between 103° and 105° , or more, and the pulse is extremely rapid. The rash is intense, with a tendency to staining, and petechiæ are seen on the trunk and limbs not infrequently. The mind is early affected, stupor being present almost from the outset in many instances. Others show active delirium. Albuminuria, suppression of urine, cyanosis and coma precede death, which usually occurs between the third and fifth days of illness.

Of the complications of scarlet fever *Otitis Media* is the most common. It is practically confined to young children, and is especially liable to arise in septic cases. Either one or both ears may be affected. Earache, with acute tenderness on pressure over the cartilaginous portion of the canal, and a rise of temperature are present in many cases, all of which symptoms abate on the appearance of the discharge.

In others otorrhœa is the first and only symptom. Most cases clear up in a few weeks with simple treatment. In rare instances, especially if neglected, a septic condition of the middle ear may become established. The discharge then becomes chronic. Under these circumstances extension to the mastoid cells may occur, or, ultimately, meningitis, pyæmia or intracranial abscess.

Cervical Adenitis is apt to arise during the course of the second or third week in young

children, the glands lying under the sterno-mastoid being most often affected. There is usually some rise of temperature, which subsides as the swelling goes down, though supuration occurs occasionally.

Albuminuria may come on at any time during the first four weeks. If present during the first fortnight it is usually slight and transient and has no special significance; that occurring later, however, would appear to be due to nephritis, though perhaps of slight intensity.

Definite *Acute Nephritis* with hæmaturia and some degree of suppression is met with in three or four per cent. of cases. Its time of onset is remarkably constant, viz. the nineteenth to twenty-third day. Vomiting and drowsiness or headache are usually present at the onset, attended with a rise of temperature and pulse-rate, and increased arterial tension. Enlargement of the cervical lymphatic glands is present as a rule, while waxy pallor of the face and puffiness of the eyelids are often noticeable, but anasarca of any degree is rarely seen, unless the case has been neglected. The same thing is true of uræmic convulsions, though the liability to this serious condition must never be forgotten.

Most cases of scarlatinal nephritis recover completely under appropriate treatment. The hæmaturia and suppression soon pass off, and the urine becomes free from albumin in from four to eight weeks in the majority of cases. The albuminuria, however, persists and chronic nephritis supervenes in a few exceptional instances.

Rheumatism is a frequent complication, especially affecting adults and older children. Its time of onset is remarkably constant, too, viz. the latter part of the first week, when the temperature is coming down and the rash just disappearing. The joints most often involved are those of the wrists, metacarpus and fingers, though the larger joints and muscles are sometimes affected. Its tendency is to recovery, though a liability to recurrent muscular rheumatism persists in some persons.

Of the rarer complications *Endocarditis* and *Retropharyngeal Abscess* are the most important. Both are usually associated with the septic form of the disease. A soft systolic murmur of endocardial origin is often heard during the febrile stage and shortly after. It is transient as a rule, and hæmic in nature.

Both *Secondary Tonsillitis* and *Diphtheria* are apt to arise during convalescence and impede recovery. A true *relapse* occurs occasionally, with characteristic rash, throat, tongue, pyrexia and peeling.

In the diagnosis of scarlet fever the greatest difficulty is experienced in connection with the very mild or anomalous cases, attacks about

which the question is not so much "Do the symptoms point more to scarlet fever than anything else?" as "Is there sufficient evidence of any definite disease at all?" Further, it must be emphasized that each of the cardinal symptoms of scarlet fever may fail one—rash, throat, tongue and even pyrexia.

The affections most likely to lead to confusion are measles (if ill-developed), rubella, diphtheria, tonsillitis and the various erythematata associated with belladonna, copaiba, turpentine, food poisoning, sepsis, dentition, enemata and initial smallpox. These rashes, however, except that of early smallpox, are usually apyrexial.

The following points will be found of special value in the diagnosis of scarlet fever:—vomiting or nausea during the early stage; the punctate character of the eruption generally, and the absence of any punctation or spotting on the face, palms and soles; a tendency to exaggerated papulation on the outer side of the legs and upper arms and an absence of mottled staining of the skin when the rash has faded; the peeled ("strawberry") or peeling tongue, especially when associated with faucial inflammation; absence of Koplik's spots; the gradual decline of the pyrexia; a complaint of rheumatic pains in the wrists and finger-joints as the temperature is subsiding; and the early appearance of pinhole peeling.

In the diagnosis of the toxic variety of scarlet fever, septicæmia, malignant endocarditis and smallpox are most likely to be a source of difficulty.

In the treatment of scarlet fever, having regard to the important part which streptococci play in the septic form of the disease, anti-streptococcal serum has been widely employed during recent years, but unfortunately without very much success.

Ordinary polyvalent serum seems to be useless, though some benefit has been obtained with a serum prepared from a number of different strains of streptococci derived from scarlet fever cases. Even this, however, is frequently very disappointing.

More recently streptococcal vaccines have been tried, but unless of autogenous origin, their value is at least doubtful. The latter, however, seem worth a trial, as some report well of the method.

With the object of checking the invasion of the tissues of the fauces and naso-pharynx by septic organisms, the throat, except in the mildest cases, should be frequently flushed out with an antiseptic solution. This is best effected by means of a four-ounce rubber ball-syringe, the nozzle of which should be short to avoid risk of damaging the palate. The nozzle is introduced between the bicuspid or

molar teeth, passed over the surface of the tongue, and then directed backwards, so that the stream of fluid impinges on the tonsils and back of the pharynx, the patient's head, meanwhile, being bent over a basin to catch the escaping lotion.

The best solution to employ is one of chlorate of potash containing plenty of nascent chlorine. For its preparation three drachms of strong hydrochloric acid are poured upon six drachms of powdered chlorate of potash and a quart of water gradually added, the vessel being frequently stoppered and shaken up during the process. This solution should be diluted with an equal volume of either hot or iced water, and about a pint of fluid used on each occasion. No amount of gargling, swabbing or spraying can compare with syringing by this method in point of efficiency. The solution is both antiseptic and astringent, and its effect is cleansing and, at the same time, very comforting to the patient. Moreover, it lessens the chance of inflammation extending up the Eustachian tube into the middle ear. A solution of either boracic acid (10 gr.), permanganate of potash (2 gr.) or bicarbonate of soda (3 gr.), though less efficient, may be substituted. Swabbing the fauces at intervals with Izal or carbolic oil (1 in 10), as recommended by Dr. Milne, is preferred by some as an alternative to syringing.

If the glands be tender and swallowing painful, a hot linseed meal poultice applied to the throat, and frequently renewed, will give much relief. Some patients derive comfort from repeatedly sucking pieces of ice, from steam inhalations, or from having the throat painted with a solution of cocaine (five per cent.) a few minutes before food is taken.

In toxic attacks little can be done beyond supporting the strength by means of hypodermic injections of strychnine and moderate doses of brandy. Cold sponging or the pack may be used if the temperature range very high, and chloralamide or hyoscine for restlessness or insomnia, the latter being especially useful in the presence of active delirium.

The scarlet-fever patient should be kept in bed for three weeks, if a child, though adults, after a mild attack, may be allowed up at the end of a fortnight.

The diet should consist of diluted milk and barley water or sugar water *ad libitum*, so long as the temperature is raised and swallowing is painful. The frequent sipping of "imperial drink" is useful during the febrile stage, and is usually liked by the patient. Afterwards bread and butter, eggs and milk puddings should be given, and fish or chicken a few days later. In severe cases beef juice, glidine or malt glidine and good broth or soup may be added

with advantage. During convalescence a warm bath should be given at least every alternate day, if practicable; and the urine from the sixteenth to the twenty-sixth day should be tested daily.

For the relief of earache a small piece of cotton-wool containing a few drops of warm laudanum should be inserted in the canal, and a hot fomentation applied externally. On the appearance of the discharge, irrigation or gentle syringing with warm boracic lotion should be ordered every four hours; but should the otorrhoea persist for several weeks, carbolic lotion, 1 in 80, containing two grains of sulphate of zinc to the ounce, may be substituted with advantage. An alternative method of treatment is to lay the child on its side and fill up the external auditory canal and concha with hydrogen peroxide (ten volumes strength), two or three times daily. The solution should be left in for from five to ten minutes, the ear being afterwards carefully dried and lightly packed with a piece of antiseptic gauze. Incision of the drum is practically never required in young children. The appearance of redness and oedema over the mastoid or behind the ear calls for immediate incision down to the bone and the application of hot fomentations. If suppuration in the mastoid cells be suspected, the antrum should be at once laid open to ensure efficient drainage. This, if not delayed too long, is usually sufficient, the radical mastoid operation being practically never required except in chronic cases.

For the treatment of nephritis remedies which induce free action of the skin and bowels are called for. Flannel should be worn next the skin, the quantity of bed-clothes increased, and the patient made to sleep between two blankets. Plenty of simple fluids, such as water, lemonade and barley water, should be given to drink, unless vomiting occur and prevent it. A saline mixture containing citrate of potash and acetate of ammonia assists diuresis. As a purgative nothing is better than *mist. alba*. Sufficient should be given to secure a free action of the bowels daily; compound jalap powder, too, is useful for the purpose.

So long as there is any hæmaturia and the quantity of urine passed is less than normal, the diet should consist of milk, and milk only.

If there be any anasarca a hot-air or steam bath, or a hot pack, should be given for half an hour daily to induce free perspiration. On the slightest suggestion of uræmia, whether evidenced by drowsiness or muscular twitching, immediate drastic remedies are called for. Two minims of croton oil should be given without delay and venesection to the extent

of four to eight, or even ten ounces performed if the symptoms continue. Convulsions can always be controlled by the inhalation of a few whiffs of chloroform, repeated as often as may be necessary. This should always be kept handy in anticipation.

Hot-poulticing or cupping the loins are of very doubtful value in comparison with venesection. Under this treatment, the case being otherwise uncomplicated, complete recovery may be expected. During convalescence a light farinaceous diet, with plenty of milk, is indicated. To this white fish or chicken may soon be added.

Tincture of perchloride of iron is of definite value, and patients passing much albumin in the urine will put on flesh and lose their albumin more quickly if one or two hard-boiled eggs be added to their dietary.

For the treatment of scarlatinal rheumatism the affected joints should be wrapped up in cotton-wool sprinkled with a few drops of belladonna liniment. If the joints be swollen and the pain severe, especially if the temperature be raised, either aspirin or salicylate of soda, with the addition of a few grains of the bicarbonate, will soon bring about improvement.

The treatment of other complications calls for no special mention. F. F. C.

MEASLES

Etiology. The bacteriology of measles is very uncertain. The infective agent lies in the catarrhal discharges from the nose and eyes and also, probably, in the blood. The geographical distribution of the disease is general. It occurs most frequently in children of under five years of age, but no time of life is immune, and the comparatively small number of cases seen in later years may be readily explained by the fact that few persons fail to contract the infection in childhood. Epidemics most usually occur in winter and early spring.

Measles is acquired by direct contact, and there is reason to believe that infection can also be contracted by mere proximity to a patient, the "striking distance" having been computed at nine feet. The infectivity is very high, is most marked in the catarrhal stage, and probably declines rapidly with the disappearance of the eruption. The virus is very short-lived. It may possibly be carried on the clothes of a third person for a short distance, but fomites generally play little part in its dissemination. Schools are important as assisting in the spread of epidemics.

Invasion or Prodromal Stage. After an incubation period of from eight to fourteen days, usually about ten days, the illness commences with symptoms of catarrh and irregular fever.

The patient sneezes, coughs and runs at the nose and eyes, and may also suffer from laryngitis. The temperature is very variable. Usually there is a fairly decided rise on the first evening, and this elevation may be maintained for a day or two, but there is a well-marked remission, often to normal, before the rash appears. In other cases the fever is slight from the first, sometimes, indeed, entirely absent. The patient is dull and apathetic and loses interest in games and toys. The eyes are often suffused and photophobia is common. Occasionally some looseness of the bowels is observed.

The recognition of the nature of the illness at this stage depends upon the examination of the mucous membrane of the mouth. On the first or second day the spots described by Koplik may often be distinguished. These are minute white specks, often surrounded by a red areola, and situated at first on the buccal mucous membrane at about the level of the first molar teeth. They rapidly increase in numbers until the whole buccal membrane is involved and that of the lips sometimes affected. The spots, being exceedingly small, can only be seen in bright daylight. The general effect of this enanthem is to cause the lining membrane of the mouth to lose its glistening appearance and to become congested and dirty-looking. The gums also are often more or less inflamed. The mouth of a measles patient at this stage, then, is always suggestive, even if the individual spots cannot be accurately distinguished.

The prodromal stage lasts for from three to seven days, the most common days for the eruption to appear being the fourth and fifth. *Prodromal rashes* are sometimes noticed. They are often somewhat measly in appearance but are sometimes scarlatiniform.

The Eruptive Stage. With the first appearance of the true rash the temperature, which has probably been in the neighbourhood of the normal line for some hours, mounts rapidly and often reaches comparatively high levels, 102° to 105° F. The eruption is usually first detected on the brow or behind the ears. It consists of small, soft, elevated papules of a dusky red colour, which rapidly become grouped into irregularly shaped blotches. The lesions are velvety to the touch, and at first disappear readily when the skin is stretched. Before they subside, however, they are apt to become stained, and a brownish-yellow discoloration may persist for some days. The coalesced papules are in most instances separated from each other by comparatively wide intervals of dead white skin. On the back especially, however, there may be large areas of confluence, giving a uniform redness to the part. The rash is universal, the face, trunk and extremities

being all implicated, and the circumoral region is always affected. The duration of the eruptive period varies, but may be averaged at forty-eight hours. The rash disappears, as it came out, from above downwards, and may often be found still bright on the legs when it has faded from the face. During this stage the pyrexia remains considerable, the respirations and pulse are accelerated, and the patient suffers from all the symptoms of fever and is usually very miserable and depressed. The catarrh continues, but the cough and coryza are hardly so well marked as in the prodromal stage. With the disappearance of the rash the temperature falls abruptly by *crisis*, and in uncomplicated cases all acute symptoms subside with it.

Convalescence. After the crisis the pulse is not infrequently weak and irregular, but the patient is usually fit to sit up in bed within three days. The skin may still show the staining left by the rash, and some degree of branny desquamation is often visible. During this stage the complications characteristic of the disease are very apt to occur.

Types of Measles. As in the other acute fevers there is a *toxic* type which is not infrequently seen in infants and young children. The rash, even if copious, tends to be badly developed, not well raised above the skin, and of a bluish tinge. The temperature is high, and the pulse rapid and feeble. Death is often preceded by hyperpyrexia. *Hæmorrhagic* types of the illness have been described, but are probably very rare. Many ordinary cases show some degree of hæmorrhage into the lesions. There are also *mild* types of the disease, which can undoubtedly exist with practically no elevation of temperature, and sometimes with no appreciable rash.

Complications. Those affecting the respiratory system are the most important. *Laryngitis* is often seen in the prodromal period and is occasionally so well marked as to cause dangerous dyspnoea. It seldom, however, lasts long into the eruptive stage. Should it appear after the rash it is probably due to diphtheria, and, pending bacteriological results, should be treated as such. *Bronchitis* is of less importance. It is seldom responsible for more than a few days' moderate pyrexia with slightly accelerated respiration and persistence of cough. *Bronchopneumonia* is comparatively common and is the cause of the high mortality which often characterizes a severe epidemic. It depends upon secondary infection by various cocci and is communicable from patient to patient if liberal air-space is not allowed. It may appear in the prodromal, eruptive or convalescent stages of the illness and, if it appears early, is often accompanied by noisy breathing and acute suffocative symptoms. The bronchitic element is,

however, less marked if it starts in the eruptive period or later, and its presence may then be suspected if the respirations and temperature do not fall with the subsidence of the eruption. The face is pale, with a slight tinge of cyanosis, the breathing extremely fast, and the pulse much accelerated. The condition is usually prolonged, often lasting two or three weeks before recovery or, what is only too frequent, a fatal termination. Lobar pneumonia is only occasionally observed, but tubercular sequelæ are common.

The *eyes* may suffer from almost all degrees of inflammation, from a simple blepharitis to a destructive pan-ophthalmitis. Purulent conjunctivitis is common, and ulcer of the cornea not infrequently met with.

Among other common complications may be mentioned *otitis media*, *adenitis*, usually affecting the cervical glands, and *enteritis*. The last may be troublesome, the patient suffering from almost intractable diarrhœa and often passing blood and false membranes in the stools. *Nervous sequelæ* have also been described, but do not occur frequently enough to be of much importance. Badly nourished children who have suffered from a severe attack may develop ulcerative stomatitis, which is in rare instances followed by *cancrum oris*. Noma has also been observed. Measles is very apt to cause abortion in pregnant women.

The disease is occasionally found associated with other infections. Whooping-cough and diphtheria are not uncommon sequelæ.

Relapses of measles are almost unknown and *second attacks*, in spite of the popular impression to the contrary, are probably rare.

Diagnosis. In the *prodromal period* the disease cannot be recognized unless its presence is for some reason suspected. An exposed patient should be isolated at the first sneeze, the first rise of temperature, or the first appearance of Koplik's spots. The latter should be carefully looked for, and the practitioner will do well to take every opportunity of familiarizing himself with their characteristics, as it is upon their presence that definite diagnosis in this early stage depends. There are two possibilities of error at this time. Well-marked laryngitis may give rise to the suspicion of diphtheria. It is well, when measles is epidemic, to regard simple laryngitis with suspicion, and, if there is no visible faucial lesion, to look carefully for Koplik's spots. Secondly a scarlatiniform prodromal rash may be mistaken for true scarlatina. In the latter fever catarrh and coryza are not common, sore throat is usually well marked, and vomiting much more frequent than in measles. The mouth will here, also, give valuable indications.

As regards the *eruptive stage*, if the face is

markedly involved scarlet fever may be safely excluded. Even when the measles rash is very confluent it is customary to find fairly large white areas of unaffected skin, and the eruption on the extremities is usually typical. Some cases of scarlet fever, however, are apt to be regarded as measles on account of the blotchy rash seen so often on the forearms and legs. The absence of rash on the face or of its traces in the circumoral region, taken together with the history of the patient, are the chief points on which the distinction depends. In all doubtful eruptions it is well to recollect that the rash is likely to be freshest and most typical on the lower extremities, if the case is seen late.

It is very difficult in many instances to distinguish measles from rubella. In the latter disease, however, the prodromal catarrh is less well marked, the mucous membrane of the mouth is normal, and the rash is more likely to be polymorphous in character, presenting different appearances in different parts of the body. The glands are also more generally enlarged than is the case in that mild type of measles with which rubella is likely to be confused. It is interesting to note that the diazo reaction, always to be found in the urine of measles about the time that the rash commences to fade, is practically never observed in rubella. Polynuclear cells predominate in the blood of measles, whereas the lymphocytes are relatively increased in rubella.

The rash of measles may resemble the prodromal rashes or the papular stage of the true eruption of smallpox (see *Smallpox*). It has also been mistaken for that of typhus, but the latter entirely spares the face. In doubtful cases syphilitic roseola, and rashes due to the troubles of dentition, to certain food substances, to septic causes, to serum and to various drugs, notably copaiba, must be remembered. The distribution and arrangement of these rashes, and the absence of characteristic measles symptoms, will help diagnosis.

Prognosis. While in good-class practice the death-rate is inconsiderable, measles is anything but a trivial disease. It, moreover, may leave behind it all sorts of disfigurements, damaged vision or hearing and various lung conditions such as emphysema or tuberculosis. Prognosis is most of all influenced by the age of the patient, the second year of life being the most fatal. After the fifth year the mortality becomes relatively trifling. If the eruption is bright and well developed high temperature levels and rapid respiration need not cause alarm. Severe head symptoms and a small rapid pulse are bad signs, as is also a pale eruption not raised above the skin and gradually becoming pale violet in colour. Laryngitis in the prodromal stage need not cause anxiety. If, however,

dyspnoea persists after the appearance of the eruption it often proves fatal, and is sometimes due to ulceration of the larynx. Such cases do not do well with either tracheotomy or intubation. The mortality from broncho-pneumonia is a high one. Its danger corresponds roughly with the acceleration of the pulse and respirations. The temperature is of no prognostic value, as even in the very worst cases it may remain subacute. A very pale complexion, purple lips, and recession of the lower intercostal spaces are ominous. The association of diphtheria with measles is always very serious. If, however, serum is used promptly and freely, the outlook is reasonably good.

Treatment. Rest in bed from the moment the presence of the disease is suspected is essential. It is during the prodromal stage that complications are apt to be acquired. The diet should be light, and in the febrile stage restricted to milk alone. When the temperature has fallen, milk puddings and, a little later, white fish may be given. Carelessness in dieting in early convalescence may cause enteritis. Bearing in mind the principal complications of the illness, the chest should be protected with cotton-wool and regularly rubbed with stimulating oils. Free ventilation is of advantage, but direct draughts should be carefully avoided. The toilet of the eyes is of great importance. They should be bathed with boracic lotion night and morning. Should conjunctivitis be feared, a solution of silver nitrate, five grains to the ounce, may be occasionally used as a prophylactic.

The patient should be kept in bed for about a week after all fever has subsided. It may be necessary to treat symptoms. The irritating cough is usually relieved by any simple mixture containing compound tincture of camphor. Tepid sponges, frequently used, give much relief to patients whose temperature is high. Ice to the head is useful in cases of bad headache or mental excitement. If the eruption is scanty and badly developed, mustard fomentations may be applied with advantage or a hot bath administered.

Laryngitis usually improves rapidly in a steam tent, which is also useful in the suffocative-bronchitic form of broncho-pneumonia. On the other hand, ordinary cases of broncho-pneumonia are best treated under open-air conditions, which assist them to eat and sleep better and which help to prevent tubercular sequelæ. Free stimulation is often necessary, and such drugs as strychnine and strophanthus may be employed. In very cyanosed patients leeches or wet cupping are often of service. Cold affusions to the chest sometimes serve to stimulate a failing respiration and may help the return of air to collapsed areas of the lung.

Isolation. A fortnight is ample, if not excessive.

Prophylaxis. Compulsory notification is only practised by a few local authorities, the results obtained hardly justifying the expense. A system of school notification might do much, however, to check the spread of the disease. *Closure of schools* has not been very successful. When measles has occurred in a house all children attending infant schools should be kept at home. Older children who have had the disease may safely attend. Those who have not had measles should be excluded for more than a fortnight. Schools in which outbreaks have occurred should be subjected to *disinfection*, but domestic cleaning is probably all that is required in the home. As regards *hospital isolation*, while it can hardly be justified as a method of prevention, it is undoubtedly the means of saving many lives. C. B. K.

RUBELLA

Synonyms: German Measles, Rötheln, Epidemic Roseola.

Etiology. Rubella is doubtless caused by a micro-organism, but as yet the germ has not been identified. The disease is unquestionably a definite entity, occurring in persons who have had both scarlatina and measles, protecting against neither of these infections, and reproducing itself according to a fairly definite type. It occurs in epidemic waves at considerable intervals and its most common season is spring or early summer. The age incidence appears to be higher than that of measles and it does not seem to be common in the first five years of life. Adults contract the infection readily. The disease is highly infectious to those brought into close contact with it, and the virus appears to lie in the catarrhal secretions of the nose and throat.

Course. After an incubation period of from twelve to twenty-one days, usually about eighteen, the illness starts with very indefinite prodromal symptoms, which sometimes seem to be lacking altogether. The rash, indeed, is often the first sign which attracts attention. But in a considerable proportion of cases it will be found that before its efflorescence the patient suffered from slight malaise, slight catarrh and sore throat, and from some stiffness or discomfort of the neck, this last symptom being due to the marked glandular enlargement which is so often a feature of this disease. The duration of this ill-marked stage of invasion may be as long as several days, though it does not very frequently exceed twenty-four hours. The *rash* appears first on the face, but rapidly becomes distributed over the whole body. The individual spots are considerably larger than the

punctate spot of scarlet fever and are much less closely set together. They are circular in outline, of a pale red colour, and not appreciably elevated. They seldom coalesce into blotches as in measles, except on the face, which may present a very close resemblance to that exanthem. The rash spreads from above downwards and has often faded from the face while it is still quite fresh on the trunk and extremities. On the trunk it tends to become diffuse, and often blends into a very scarlatiniform eruption, usually remaining distinctly spotted or blotchy on the limbs. This multiform appearance is of some diagnostic importance. After the rash has faded from the face the superficial resemblance to scarlet fever may be very striking, as there is no staining left to suggest the earlier distribution of the eruption, and circumoral pallor may be fairly well marked. The rash is sometimes very evanescent. It usually lasts from twenty-four to thirty-six hours, but may persist for four days.

The other *symptoms* are trivial. The catarrh is extremely slight, though most patients sneeze once or twice, and there may be slight cough. The conjunctivæ are often pink, but there is no photophobia. The fauces are usually slightly congested. The buccal mucous membrane remains normal and the tongue presents no special characteristics. The *temperature* is in most cases only slightly elevated, 99° to 100° F., but in some rare instances may rise to 102° or 103° F. It is quite disproportionate to the amount and brilliance of the rash. The *glands* are always more or less enlarged, the posterior cervical, axillary and inguinal groups all being affected. The suboccipital and mastoid glands also may show remarkable enlargement. Some tenderness often accompanies the swelling. Suppuration never occurs and the glands subside rapidly with the disappearance of the rash. The urine presents no special features. The blood seldom shows a leucocytosis. The lymphocytes average about fifty-five per cent., and large mononuclears are relatively numerous.

Slight desquamation of a dusty character follows the eruption, but does not affect the palms or soles. Complications are practically unknown. Relapses undoubtedly occur but second attacks seem to be very rare.

Prognosis is invariably favourable.

Diagnosis. On the first day of the rash the tendency is to confuse rubella with measles, the eruption on the face and the slight catarrhal symptoms pointing in this direction. In making the distinction it should be remembered that Koplik's spots are not found in rubella and the mucous membrane of the mouth is normal in appearance. A very definite history of coryza and coughing would point to measles. On the second day of the rash the difficulty is

usually to distinguish the disease from scarlet fever. The most important point here is to discover if a rash has been noted previously on the face. A history of this would exclude scarlet fever. It is well to examine the dorsum of the foot, where the rash will probably be found to be most discrete. If in this situation the circular scattered macules of rubella are visible they will go far to discount the scarlatinal appearance of the trunk. The multiform character of the rubella rash also assists diagnosis. The glandular swellings are useful in differentiating rubella from both the exanthemata named, but it must be recollected that both the cervical and inguinal glands are often enlarged as the result of vermin or uncleanness. The axillary group are probably the most reliable, the more so as they are seldom found definitely affected by either measles or scarlet fever. A definite complaint of stiff neck by a patient with no throat symptoms of importance is much in favour of a diagnosis of rubella. The disease must also be distinguished from drug, enema and septic rashes.

Treatment. It is sufficient to keep the patient in bed while pyrexia persists, or for a day or two after the rash disappears. The glands require no treatment and the patient is usually quite cheerful and able to enjoy ordinary food. *Isolation* may be maintained for ten days, a period which is amply sufficient, if not excessive. Quarantine should last for fully three weeks.

C. B. K.

FOURTH DISEASE; ERYTHEMA INFECTIONOSUM

It has been suggested that, in addition to the three well-known infectious diseases, scarlet fever, measles and rubella, a "fourth disease" exists. In this country the question was originally raised by Dr. Clement Dukes of Rugby, who described three outbreaks of an infectious exanthem to which he has provisionally given this name. The symptoms ascribed to this illness were a bright scarlatinal rash which did not invade the face, a swollen throat, some glandular enlargement, moderate pyrexia and pink eyes. The incubation period was from nine to twenty-one days. Desquamation usually occurred, and occasionally was as profuse as in scarlet fever itself.

It may be said here that the best authorities have not accepted the views of Dr. Dukes and deny that a "fourth disease" exists. It is possible that, in some of the outbreaks which have been described, mild scarlet fever was in reality the disease. In others, undoubtedly, ordinary rubella appears to have been unrecognized. It is always well to remember also the mild relapses which sometimes follow undoubted cases of scarlet fever. But with the evidence at our

disposal it would be going too far to state definitely that another exanthem does not exist. For instance, the condition described as *Erythema Infectiosum*, or "epidemic megal-erythema," must be considered. This appears to present a rash—first noticed on the face, later on the extremities—consisting of large bluish-red patches of the type of *erythema marginatum*. It does not seem to have ever been epidemic in this country, and from its description it is hardly likely to be confused with either scarlet fever or rubella. It is reasonable to assume that many cases of alleged "fourth disease" can be explained by the fact that the rash in rubella in many instances is extremely evanescent on the face. By the time the patient is seen by the medical attendant all that is obvious is a scarlatinal-looking rash on the body, while other symptoms pointing to scarlet fever are entirely wanting. (See article on *Rubella*.)

C. B. K.

DIPHTHERIA

When we say that a person is the subject of diphtheria, we mean that he is suffering from the effects of a morbid process set up by a certain organism, the Klebs-Loeffler or diphtheria bacillus. The first step in the process is a local inflammation, usually of a mucous membrane, less often of the skin. In the course of the inflammation an exudate is formed, which in most instances is membranous. The bacillus multiplies in the exudate and produces therein a toxic substance. So long as this toxin is not absorbed into the system the symptoms are either those of inflammation of the part affected, such as sore throat, or those due to some mechanical effect of the membrane, such as occlusion of the larynx. But when the toxin has been absorbed other symptoms are added which are due to the destructive action of the toxin upon certain organs and tissues.

The mucous membranes most commonly attacked are those of the fauces, nose, larynx and trachea; less frequently those of the vulva, prepuce and eye. Diphtheria of any other mucous membrane is rare. Diphtheria of the skin shows itself under three forms, to be mentioned later.

Faucial Diphtheria.—The initial symptoms are seldom pronounced. The patient appears to be out of sorts, but makes little or no complaint of sore throat. The temperature is raised and the pulse-rate accelerated. Inspection of the fauces reveals a patch of thin exudate on one tonsil, or the uvula or palate. If unchecked the patch may increase in thickness and extend till not only the whole tonsil or uvula, but the entire surface of the palate, with its pillars and the pharynx, are covered with a tough, whitish

membrane. But extension of the membranous formation may be checked at any stage, so that there are all varieties of lesion, so far as extent is concerned, from a small patch limited to a portion of one tonsil to a membranous barrier almost entirely blocking up the faucial arch. The membrane is more or less intimately adherent to the mucous membrane on which it rests, so that its forcible removal leaves a raw, bleeding surface. If left to itself it decomposes, turns of a darker hue, and finally separates. When the specific antitoxin treatment is not employed it may persist, or, if it disappear, re-form time after time for several days or even four or five weeks. But under the specific treatment it seldom remains for longer than ten days. When there is much membrane an offensive and characteristic odour is given off.

It is very seldom that the formation of the false membrane is accompanied by oedema, except to a slight degree; nor when the membrane disappears is ulceration left. The mucous membrane is rarely more than denuded of its epithelium.

The cervical glands are moderately enlarged, except when the membrane is limited. In the most severe cases the skin of the neck becomes puffy, but is rarely brawny, red and painful, as in scarlet fever.

The faucial exudation is not always definitely membranous; not infrequently it consists of pulaceous material; in such cases it seldom extends beyond the tonsils. The toxic symptoms are in proportion to the extent and persistence of the local exudation. The most prominent are the following:—albuminuria, variably persistent, seldom present before the fourth day; diminution of the daily quantity of urine, amounting in serious cases to total suppression; vomiting; low arterial tension; irregular, slow action of the heart; subnormal temperature; pallor. In some severe and nearly always fatal cases there are hæmorrhages into and beneath the skin and from various mucous membranes (hæmorrhagic diphtheria).

Nasal Diphtheria.—A discharge, at first watery, later muco-purulent and sometimes bloodstained, trickles from the nose. Not infrequently definite membranous casts of the nasal fossæ are expelled. The constitutional symptoms are usually slight.

Laryngeal, Tracheal and Bronchial Diphtheria.—The most prominent symptoms are those due to the obstruction of the larynx: aphonia; a frequent harsh cough; respiratory stridor; recession of the thoracic walls; in a single word, "croup." When the obstruction is becoming complete cyanosis supervenes, and if no relief is afforded the patient dies asphyxiated. White, membranous, hollow casts of the larynx, trachea and bronchi may be coughed up or be

removed by operation. In some cases there are paroxysmal attacks of dyspnoea, with intervals of comparative ease; in others the dyspnoea progresses slowly without paroxysms.

Conjunctival Diphtheria.—A thin membrane forms on the inner surface of an eyelid, which may be moderately swollen. Ocular conjunctivitis is usually present; the inflammation may be severe, and corneitis and even panophthalmitis result. There is little, if any, constitutional disturbance.

Vulval Diphtheria.—A greyish membrane covers the opposing surfaces of the labia majora, and sometimes also the labia minora. The external genital organs are swollen, red and moderately painful. The nearest glands are enlarged. The toxic symptoms are prone to be severe.

Cutaneous Diphtheria.—The only characteristic variety is that in which a false membrane forms upon a wound or raw surface, such as a weeping eczema. In another variety the lesion consists of gangrene; while in a third there is a more or less widely distributed vesicular or impetiginous eruption. In the gangrenous form the toxic symptoms, described above, are usually pronounced.

Other forms of diphtheria are extremely rare. It should be remembered that any form of diphtheria may exist separately or be combined with others. The most frequent combinations are those of the faucial, laryngeal and nasal varieties.

The *complications* are few. The most important is a characteristic paralysis. This is a late effect of the toxæmia, and usually comes on during the third or fourth week. It is due to peripheral nerve degeneration and may be limited to one group of muscles, most commonly those of the palate, or be so widely spread as to involve the majority of the muscles, including those of respiration.

Cardiac dilatation and syncopal attacks may also occur during both the acute stage and the first two or three weeks of convalescence.

Otitis media, cervical adenitis, occasionally suppurative, and broncho-pneumonia are fairly frequent complications.

Diagnosis. If a distinctly membranous exudation be present, diphtheria may be diagnosed with confidence, whatever be the seat of the lesion. But if, in faucial diphtheria, the exudation be not definitely membranous, a bacteriological examination should be made, and the final diagnosis must depend upon its result. Diphtheria can be excluded if there is much œdema or if there is ulceration (unless very superficial) of the fauces. The faucial diseases most often mistaken for diphtheria are scarlet fever and septic inflammation and ulceration. The presence of a punctate erythema is decisive of scarlet fever, but it may

be absent or fleeting. The fauces are usually much more red, the inflammation is more uniformly diffused, the pain is more pronounced, and the temperature remains elevated for a longer period than in diphtheria. Restlessness and delirium are common in scarlet fever but rare in diphtheria. The same symptoms (except the punctate rash) as occur in scarlet fever are present in septic inflammation and ulceration of the fauces. In fact the difficulty lies not in distinguishing these affections from diphtheria, but from scarlet fever. Laryngeal diphtheria presents difficulties only when it presents itself apart from the faucial form, to which it is usually secondary. If there is any exudation on the fauces and croup is present, then in the vast majority of cases the disease is diphtheria. But if the fauces are free from exudate, then croup may be due to diphtheria, or measles, or whooping-cough, or an external swelling, or laryngitis due to organisms other than the diphtheria bacillus (catarrhal laryngitis), or laryngismus stridulus. In measles Koplik's spots will be found on the buccal mucous membrane, more especially if the rash has not yet come out. The presence of a foreign body or of any swelling external to the larynx can be ascertained by inspection and digital examination; the swelling which gives rise to symptoms most commonly mistaken for laryngeal diphtheria is a post-pharyngeal abscess. Apart from these diseases the diagnosis must finally depend upon the results of bacteriological examinations. If diphtheria bacilli are absent the disease is most probably simple catarrhal laryngitis. In the early stages of whooping-cough laryngitis may be present; the occurrence of repeated fits of coughing, even without the characteristic whoop, should arouse suspicion. Laryngismus stridulus occurs usually in rickety infants, and the attacks are paroxysmal and commonly nocturnal; there are no febrile symptoms, and dyspnoea is absent between the paroxysms.

Unless definite membrane be present cutaneous diphtheria cannot be diagnosed without the aid of bacteriology. Vulval diphtheria may be mistaken for erysipelas or noma vulvæ; but in neither of these diseases is false membrane present, and in the latter there is extensive necrosis.

Treatment. The most efficacious remedy is the *antitoxic serum* of horses that have been immunized against diphtheria toxin. It is given advantageously and with convenience by hypodermic injection on one side of the lower half of the abdomen. The syringe should be of the capacity of about 20 c.c., and capable of sterilization by boiling. The needle should be connected to the barrel of the syringe by means of three or four inches of sterilized rubber tube, so that if the patient move suddenly during

the process of injection there is no fear of the needle breaking. The serum must be injected under strict aseptic precautions. The dosage is by the thousand units; and the unit is an arbitrary measure devised by Ehrlich and adopted in most laboratories. The amount to be injected is determined by the severity of the case, which is to a considerable extent dependent upon the length of time the patient has been ill. It has been abundantly proved that the success of the treatment varies directly with the promptness with which it is begun. A mild, and therefore usually an early, case will require from 2000 to 4000 units. The dose must be increased with the severity up to 10,000 to 16,000 units. Half this amount should be repeated next day if no improvement has resulted, and repeated again the day after if much exudation remains. It is best to be on the safe side and to give too much rather than too little serum, for there need be no apprehension of an overdose.

The questions frequently arise—should antitoxin be given in every case of diphtheria, and should it be given in doubtful cases?

With one or two reservations to be mentioned presently I should say that antitoxin should be given in every case of undoubted diphtheria. But I do not recommend its use in doubtful cases except the laryngeal and in children under five. These are so often fatal that it is unwise to wait for the result of a bacteriological examination or for some definite clinical sign. I hesitate to advise the use of antitoxin in every doubtful case, because it is now well known that certain unpleasant effects occasionally follow its administration, and in a few instances these effects are dangerous. They have been noticed to occur especially in those who are sufferers from asthma and allied affections, or who have some three weeks or more previously been injected with serum. I should, therefore, pause before giving antitoxin to a patient I knew to be the subject of asthma or to have been on a former occasion (except within a few days) treated with serum.

Next to serum *rest* is the most important factor in the treatment. The toxin of diphtheria sets up degenerative changes in the cardiac muscle, and consequently dilatation of the heart and attacks of syncope are prone to occur. Hence all cases of diphtheria should be confined to bed for at least a fortnight after the disappearance of the local exudation, and toxic cases for a longer period. When the patient is first allowed to sit up it should be for a short time only, an hour or so, and the effect on the circulation should be observed. At the least sign of paralysis the patient, if already allowed up, should be ordered back to bed and kept there till after every paralytic sign has passed off.

There is often some difficulty in swallowing during paralysis, and in that case the patient should be fed by means of an œsophageal tube, and in severe cases the foot of the bed should be raised to prevent saliva from trickling into the larynx and trachea. When convalescence from paralysis has begun massage of the affected muscles is most beneficial.

In the case of young children *local treatment* of the fauces should not be insisted upon, for in most instances the child resists vigorously and is much exhausted by his struggles. In such cases we must rely entirely upon antitoxin. But in older and quiet patients the fauces and nose should be flushed out every two to four hours with warm boracic solution or with the following mixture: borax, $\bar{3}$ i, bicarbonate of soda $\bar{3}$ i, chlorate of potash $\bar{3}$ ss, common salt $\bar{3}$ ss, compound tincture of lavender $\bar{5}$ i, water to one pint.

If the exudation is strictly limited the lesion should be swabbed three times a day with a 1 in 2000 perchloride of mercury solution, or medicinal izar, either pure or diluted with water. Irritating applications should be avoided.

When the larynx is involved the patient should be placed in an atmosphere moist with steam from a bronchitis kettle, and should he, in spite of this treatment, become restless and get no sleep, or should the recession of the thoracic walls become marked, intubation or tracheotomy should be performed. The former measure, however, is suited only to hospital practice, as it is essential that a medical man should be within a few minutes' call of the patient.

The diet calls for no special mention. During the acute stage it should be liquid; but as soon as the patient can swallow with comfort he may be allowed solid food. Stimulants are, in my opinion, useless in the cardiac failure of the early stage, but may with advantage be administered for the syncopal attacks which sometimes occur later.

No patient should be allowed out of isolation for at least three weeks from the disappearance of the exudation or until two successive bacteriological examinations have proved the absence of diphtheria bacilli.

For the reasons given above when discussing the question of administering antitoxin in doubtful cases I am averse from its indiscriminate use as a prophylactic; it should be so employed only in exceptional instances, such as outbreaks in institutions for children, after every other method of staying the outbreak has been tried and failed.

E. W. G.

WHOOPIING-COUGH

Synonym: Pertussis.

Etiology. The most probable organism is a short bacillus described by Bordet and Gengou.

It is most likely to be found during the catarrhal stage of the illness and is recovered from the sputum. It shows polar staining with a five per cent. solution of toluidin blue. The disease is usually transmitted by direct contact from person to person and is highly infectious, although the bacillus seems to be short-lived outside the human body. The infectivity is highest in the catarrhal stage and once the whoop has developed rapidly declines. Careful disposal and disinfection of the sputum will in any case lessen the probabilities of infection. Whooping-cough is essentially a disease of young children and often attacks infants of under six months. After the fourth year comparatively few persons suffer, but no age is exempt. Females at all ages are somewhat more frequently attacked than males.

Pathology. The bacillus first obtains a nidus in the respiratory tract, and the symptoms of the catarrhal stage are probably due to hyperæmia in that region. The toxins ultimately affect the nervous system, and perhaps the vagus nerve in particular, and the paroxysms are doubtless due to their action. Nothing is likely to be found at an autopsy unless the patient has suffered from complications.

After a variable *incubation stage*, which probably never exceeds a fortnight, the first symptoms appear. The disease presents two definite stages, the invasion or *catarrhal stage*, and the paroxysmal. The former lasts from a few days to about a fortnight in most instances, but may be prolonged for several weeks. Its main symptoms are a short dry cough, malaise, and occasionally slight irregular pyrexia. The sleep is apt to be disturbed, and many children are apathetic and lose interest in their toys. Other more unusual symptoms are coryza and laryngitis. Towards the end of this invasion period the cough tends to become paroxysmal and is apt to be much worse at night.

The *paroxysmal stage*, or period of the "whoop" is characterized by the occurrence at varying intervals of paroxysms of coughing of a peculiar type. These accesses may occur as often as every half-hour, but usually do not exceed from six to twelve in the twenty-four hours. The paroxysm consists of a number of short explosive coughs, as if the patient were trying to expel something lodged in his larynx. The rapidly repeated coughs give no time for inspiration, but ultimately there is a violent inspiratory effort, and the air inspired through tense vocal cords causes the prolonged crowing sound which constitutes the "whoop." Usually the process is repeated several times, the child becoming more and more distressed, with congested face, starting eyes and protruded swollen tongue. Mucus and sticky expectoration trickle from the mouth, and the paroxysm is frequently

terminated by vomiting. The child sits up to cough and sinks back exhausted when the access of coughing is over. Occasionally in severe cases the inspiration is very difficult and the patient may seem on the verge of suffocation. It is, however, exceptional for a fatal result to occur, although syncope sometimes follows a severe paroxysm and convulsions are occasionally observed. Many children have a premonition of the impending spasm and their efforts to stave off the cough are pitiable to witness. Crying or the taking of food will precipitate a paroxysm, whereas fear and other mental emotions may inhibit the cough.

The paroxysms are usually most frequent and most violent at night. The general health suffers, and children are apt to be dull and apathetic. In severe cases the face becomes puffy and the lips are slightly cyanosed. If there is much vomiting there may be marked emaciation and weakly children may die of marasmus. There is no fever in this stage if complications do not supervene. The paroxysms continue for about six weeks. Some patients, however, may escape with a few days' whooping, while, on the other hand, in others the whoops may recur for months, especially if any slight cold is contracted.

Complications. Hæmorrhages are frequent. Epistaxis is common and subconjunctival hæmorrhage may follow a severe paroxysm. Bleeding may also occur into the eyelids and a black eye result. Ulcer of the frænum linguæ is often observed in young children who have cut their two lower incisors and is caused by the protrusion of the tongue in the act of coughing. A greyish oval patch of ulceration is formed which may be useful in diagnosis. Digestive troubles are common. Prolapse of the rectum and hernia are seen in bad cases. Respiratory complications are very fatal. Some degree of bronchitis is often present, but broncho-pneumonia is responsible for the high death-rate so often observed in whooping-cough. It is characterized by irregular fever, frequent respirations and a rapid pulse-rate. The face is pale, with a slight cyanotic tinge, and the alæ nasi move on respiration. A severe paroxysm sometimes causes collapse of large areas of lung in young children, and this accident may be followed by convulsions, syncope or sudden death. In the presence of a complication the paroxysms become less frequent, and a sudden reduction of their number is therefore not necessarily a favourable sign. Throughout the disease the patient is often nervous and irritable and convulsions occur not uncommonly. They may be independent of the paroxysms and in some instances appear to take their place. They are either tonic or clonic in character and too often terminate fatally. Severe forms of nervous

disease, such as hemiplegia and neuritis, have been described as following whooping-cough. Other sequelæ of importance are cardiac dilatation, chronic bronchitis, emphysema and tuberculosis.

Second attacks of whooping-cough are very rare.

Diagnosis is always difficult in the catarrhal stage unless there is a definite history of exposure. When a cough becomes distinctly paroxysmal and is worst at night there is cause for suspicion. Vomiting after an access of coughing is another suspicious feature, and the fact that the cough itself continues to grow worse and resists appropriate treatment is also suggestive of whooping-cough. Blood examination may be of value, as the leucocyte count is liable to be high, a very marked increase in the number of lymphocytes usually taking place. Once the whoop has developed there should be little difficulty in recognizing the disease.

In the early days of the catarrhal stage the condition may suggest measles. Coryza, however, is uncommon and the absence of Koplik's spots will give assistance. Tubercular disease of the bronchial glands is said to cause spasms of coughing not unlike those of whooping-cough.

The *prognosis* should always be guarded in patients of under three years of age. Females are said to have a worse chance of recovery than males. The outlook depends largely upon the condition of the patient at the time of the attack. Rickety and tubercular children have a high mortality. As long as the patient is well and bright in the intervals between the spasms and does not show much wasting we may take a favourable view. The chief causes of death are the complications, and the mortality of broncho-pneumonia is not likely to be less than forty per cent. of those attacked.

As regards *treatment* it is well to keep children in bed during the catarrhal stage. Once the whoop is developed the patient can be allowed up, always provided there is no pyrexia. Although many recommend warm rooms and even temperatures there is much to be said in favour of free ventilation, and patients can be allowed out of doors safely in dry weather. The chest may be rubbed night and morning with some stimulating oil and protected with a light jacket of Gamgee tissue. In severe cases a firm flannel binder applied round the abdomen and lower ribs is a great comfort and support during the paroxysms. While coughing the child should be supported by a nurse, and a suitable receptacle should be in readiness for the coughed-up or vomited matter. The bowels should receive attention and constipation be carefully avoided.

The diet should be light and in severe cases restricted to fluids. The average patient will,

however, tolerate an ordinary diet, care being taken to avoid substances likely to cause much acidity, such as starchy puddings, jam and fruit. Much food is often lost by vomiting, but unless the patient shows wasting there is no reason for alarm. In bad cases, however, it is wise to feed immediately after a paroxysm and allow time for digestion before the next is due. Some children refuse food altogether and it may be necessary to employ rectal feeding for a few days.

As regards *drugs* it may be said that they are very disappointing. A few drops of ipecacuanha wine given at regular intervals appear to make the cough more easy. Antispasmodic drugs may be reserved for severe cases. Belladonna, pushed until the pupils are dilated, is the most satisfactory. It may be combined with small doses of sodium bromide. Butyl chloral hydrate, in doses of one grain every two, four or six hours according to age, is sometimes successful in modifying the severity of the spasms. When one drug fails it is wise to try another. In very prolonged cases small doses of quinine are often of value. A vaccine prepared from the bacillus of whooping-cough is obtainable. In a trial at the Edinburgh City Hospital its results were disappointing.

Broncho-pneumonia is best treated under open-air conditions. Free stimulation is often requisite and the dieting must be careful. If there is much cyanosis leeches are often of considerable benefit. Convulsions may be treated with hot mustard baths, and chloral and bromide should be given by the rectum.

The patient is usually isolated for six weeks from the commencement of the paroxysms. It is doubtful if this is really necessary, the infectivity being very slight after the first week.

C. B. K.

MUMPS

Etiology. A diplococcus, obtained by Laveran and Catrin from the blood, saliva, parotid glands and testes of patients, is possibly the cause of the disease. The majority of persons attacked are between the ages of five and fifteen years. Infants very rarely suffer, and after the age of forty cases are very rare. Mumps does not appear to be influenced either by season or climate. The *infection* is derived from buccal and nasal secretions of persons affected, and is usually communicated by direct contact.

After an *incubation* period lasting from twelve to twenty-six days, often about eighteen, the actual swelling of the parotid is in some instances preceded by such prodromal symptoms as chilliness, headache, earache, malaise, and fever. Epistaxis is also occasionally noted. The

parotid swelling is at first unilateral and is visible in the hollow below the ear. It spreads forwards and downwards and often assumes considerable dimensions. Two or three days later the gland on the opposite side becomes affected. The submaxillary and sublingual glands are often, but not always, implicated, and in some patients the cervical glands are also enlarged. The lateral swellings may meet under the chin, and as there is often some oedema of the face a characteristic and somewhat ridiculous appearance is presented by the patient. The skin is tense but not reddened. There is much tenderness to touch but little pain except on moving the jaws. There is often difficulty in opening the mouth. The fauces are probably always congested, and there is said to be special injection of the mucous membrane in the neighbourhood of Stenson's duct. In some patients the mouth is dry, in others there is excessive secretion of saliva.

Fever is only occasionally present and has no characteristic curve. It is probably better marked and more usual in adults than in children. The resolution of the parotitis takes place in most instances very rapidly, the gland regaining the normal in a week or ten days from the onset. Relapses, however, sometimes occur. Suppuration is extremely rare and must be regarded as due to secondary infection by pyogenic micro-organisms.

Although the parotid is usually the gland primarily affected, *other localisations* of the disease must be remembered. The submaxillary gland may be alone attacked or its enlargement may precede that of the parotid. Mumps is also liable to involve the sexual glands. *Orchitis* is relatively common, occurring in about one-fourth of males above the age of puberty. It usually appears about one week after the onset, at the time of the subsidence of the parotid swelling. It may, however, be the only manifestation of mumps, a point which should be remembered when the disease is epidemic. When the testis is attacked the constitutional symptoms are sometimes severe. The pyrexia is considerable, and shivering, vomiting and delirium are often observed. The patient may even suffer from collapse. The testis rapidly increases in size and is very tender to the touch. It is not always, however, very painful, and some patients may become very ill without giving a hint that they are suffering from any local condition. The epididymis is unaffected, but a slight urethral discharge is sometimes present. The inflammation seldom lasts more than three or four days and the swelling subsides as rapidly as it appeared. The other testis may become involved, and as the parenchyma of the gland may be affected, a serious feature of the condition is the possibility of subsequent atrophy.

In some outbreaks *Pancreatitis* appears to be relatively common, and its onset is attended by alarming symptoms of collapse. There may be vomiting and acute epigastric pain, and in some cases a tender transverse swelling can be palpated. The time of onset usually coincides with the subsidence of the parotitis.

It is not necessary to refer at length to *complications*. These are for the most part rare. Arthritis and erythema have been known to occur. More important are the acute meningeal symptoms which sometimes precede the parotitis. These usually are only transient, but a true meningitis has been described as occurring in convalescence. Mental disturbance has occasionally followed an attack. *Deafness* is the most common complication of mumps. It may be due either to otitis media or, what is more important, to damage done to the labyrinth by the actual virus of the disease.

During an epidemic *diagnosis* is easy. We have, however, to distinguish the disease from the septic parotitis which occurs in such acute infectious diseases as enteric fever. The latter is usually unilateral and almost always suppurates, whereas in mumps we expect the swelling to be bilateral and suppuration is extremely rare. The enlarged glands which accompany scarlet fever and diphtheria have been mistaken for mumps. It is well to remember that in diphtheria the mouth can usually be opened easily, whereas a very moderate amount of parotitis prevents the jaws being separated without pain. Other conditions to be remembered are the parotid swellings due to iodism and lead poisoning. The *prognosis* of mumps is uniformly good, but the possibility of subsequent deafness or of the atrophy of one or both testicles should not be forgotten. Children, as a general rule, suffer less and recover more quickly than adults.

Treatment in mumps is chiefly expectant. While there is any fever the patient must be kept in bed, and it is wise, in the case of males, to continue this restriction until the risk of orchitis is past, say for ten days. Patients who have much difficulty in mastication will require a fluid or soft-solid diet. It is wise to keep the mouth clean by the regular use of antiseptics. For the local condition hot fomentations, frequently renewed, may be employed, but in mild cases it is sufficient to cover the swelling with cotton-wool. Much relief is sometimes obtained by the application of lint smeared with belladonna ointment. Should orchitis occur, the parts should be supported by a bandage, and fomentations sprinkled with laudanum applied. It is well in such cases to keep the bowels freely open.

The patient should be kept in *isolation* for three weeks from the first symptoms, and in

prolonged cases for a week after the complete subsidence of the swellings. A long *quarantine*, twenty-six days, is necessary. C. B. K.

INFLUENZA

Influenza is a disease which has, from time to time, appeared in Europe in severe epidemics, lasting for a few months, and then has gradually died down. The most recent epidemic occurred during the winter of 1889-90, the one before in 1847-48. There was an earlier epidemic in 1836, and at varying intervals epidemics are reported as far back in medical history as 1173.

In the 1889 epidemic the cases were first recognized in St. Petersburg on October 15. By the end of November it had spread to Berlin, Vienna and Paris, during December to London and New York, and by January nearly all parts of the civilized world were affected. It spread first along the main routes of travel, reaching the capitals before the country towns. It attacked all classes indiscriminately, and some idea of its extent can be gained by the fact that in St. Petersburg it was estimated that by the end of December there had been 650,000 cases, nearly three-quarters of the whole population. In Paris the death rate for the last week of the year was 61·7 per 1000, as against the average for past years of 25·1.

The primary epidemic only lasted two to three months, but there were minor ones for some years afterwards, mainly between late autumn and spring. In recent years the epidemics have been much less virulent in type, but that the milder nature of the attacks is due to acquired immunity on the part of the population, and not to attenuation of the bacillus, is rendered probable by an incident following the 1847 epidemic. In 1853 a ship arrived at the Pitcairn Islands on May 15, having among the crew two or three cases of what was supposed to be only a mild bronchitis, but on May 19 typical influenza broke out on the Islands, and by May 25 "only ten out of the 172 inhabitants were able to attend to their own wants."

The Organism. The bacillus of influenza was discovered by R. Pfeiffer of Berlin in 1892. It is a very minute organism about 1·2 μ long by 0·4 μ broad. It is non-motile in a hanging drop. It stains faintly as compared with other organisms, and is not coloured by Gram's method. It is best shown by floating a dry coverslip preparation on a dilute solution of carbol-fuchsin for ten minutes. The bacilli have rounded ends and no capsules, they are usually less deeply stained in the centre than at the poles. They often lie side by side in pairs, or may be in long trains like schools of fish. Some may be seen within pus cells. They will

only grow on nutrient media when hæmoglobin is present. On agar smeared with blood the colonies are colourless, and have a raised translucent appearance like dewdrops. In blood bouillon white flocculi form and fall to the bottom.

The bacilli are found in the sputum, where they may be almost in pure culture; in some cases they persist for weeks or even months. They are often present in the nasal discharge. They are found in the small bronchi and in the lung tissue, also in the pus of empyemata. They have been demonstrated in the membranes of the brain in cases of meningitis, but they are very rarely found in the blood.

Infectivity. The disease is highly infectious. It may be acquired from being in the same room, theatre, or church, as a patient or convalescent. Patients with chronic bronchitis or cough subsequent to an attack may remain infectious for many weeks. Instances are quoted of the infection being conveyed in parcels of clothing and even in letters.

The incubation period is short, between two and five days.

Onset. In the original epidemic the onset of the disease was remarkably sudden. People starting out feeling perfectly well were taken ill in the street and unable to walk home. There was usually a shivering attack, followed by a feeling of giddiness and intense weakness, sometimes actual fainting. This was followed by marked frontal headache and pains in the back of a severe character, also pains in the thighs and calves of the legs. The temperature quickly rose to 102° or 103°, but not commonly much higher. The pulse became rapid; the patient was restless, unable to sleep, and sometimes delirious. The skin was hot and dry at first, but if perspiration set in the pains in the back and legs were relieved. The tongue in a short time was swollen, marked by the teeth, and covered all over with a whitish fur.

Now-a-days the onset is not so acute. There is heaviness in the head and a feeling of weariness, the back and limbs ache, but are not really painful; shivering is rare.

Evanescant, rose-coloured spots on the body and limbs, or a general erythema, most marked on the chest.

After the onset the disease spends its energy on one of the three systems, the respiratory, the nervous, or the gastro-intestinal, although in all cases the nervous system is so far affected that there is an unusual degree of weakness and prostration.

The Respiratory System.—When the respiratory system is attacked there may be smarting of the eyes and coryza, rarely much sneezing, epistaxis very occasionally. The throat is

reddened, but can hardly be called sore; there is a dry irritating cough with no expectoration at first, not necessarily preceded by any nasal or conjunctival symptoms. On auscultation there are perhaps no abnormal physical signs, or only a few crepitations at the bases. If no complications occur the temperature falls to normal after three or four days, but the cough continues. The pulse is weak and quicker than normal, and there is a feeling of lassitude and feebleness, as if after a long illness. The cough may last for weeks or even months in spite of treatment, and is sometimes paroxysmal, almost like whooping cough. If the patient is not kept in bed for some few days after the temperature falls there is liability to relapse, with a return of fever and headache, and possibly pneumonia as a complication. The form of pneumonia is peculiar to the disease. It occurs almost exclusively in people who have attempted to keep about during the attack of influenza, or in those who have got up too early after it.

Pneumonia.—It begins in an insidious way with crepitations at the base of one lung or in the region of the angle of the scapula, and increase of cough. The temperature does not generally rise much above 103° ; rigor is uncommon. The pulse is quickened, if it becomes intermittent the outlook is bad. There is more or less delirium. The sputum is sometimes rusty or blood-stained, sometimes not coloured, usually very viscid. There is a gradual extension upwards of the area of crepitations, which are medium and moist, not fine and dry as in croupous pneumonia. Resonance becomes diminished, and tubular breathing is heard with the crepitations; pleural friction is also often present. In other cases the first signs of pneumonia are dullness and tubular breathing without any crepitations. The inflammation may extend day by day nearly up to the apex, and then attack the base of the other lung and spread in that, while there are signs of commencing resolution in the part first involved. The temperature remains raised while the pneumonic process lasts, often as long as ten days, and then it falls by lysis, very rarely by crisis. Though not so acute as croupous pneumonia, it is almost more fatal owing to the length of the illness and the amount of the lung that may be involved.

Empyema is not uncommon after the pneumonia, when this has been accompanied by pleurisy. Gangrene of the lung and bronchiectasis are rare sequelæ. Occasionally in influenzal pneumonia or in a severe attack of influenza there is a sudden onset of acute oedema of the lungs. Numerous crepitations are heard everywhere, though there may be very little cough and no sputum. The patient becomes

blue and livid, and is delirious or unconscious. The pulse rate rises to 140 or 160, and respirations to 50 or 60. This is a condition of overwhelming poisoning of the medullary nerve centres, and recovery is very rare.

Influenza frequently causes *inflammation in the sinuses connected with the naso-pharynx*. The middle ear is most commonly affected, especially in children, leading to earache and suppuration, which may spread to the mastoid cells. The frontal and maxillary sinuses may be attacked, causing great pain above and around the eyes, from catarrh, and suppuration may take place. The ethmoid cells also may be implicated. Meningitis has been caused by spread of inflammation from each of these sources.

The Nervous System.—Influenza may attack the nervous system with such intensity that, after a sudden onset of severe headache and pain in the back, the patient becomes comatose in a few hours, and may even be dead in less than a day. This has generally occurred where there have been large numbers of cases of influenza in a confined space, as, for instance, in a training-ship at Portsmouth, where there were six deaths from coma. In other cases with rising temperature the patient becomes drowsy and apathetic, and lapses into coma after two or three days. There may be squint and various pareses and rigidities and other evidence of meningitis. Post-mortem there is a condition of meningo-encephalitis hæmorrhagica, which has been described as characteristic of influenza.

Influenza, again, has led to thrombosis of cerebral veins and sinuses.

In other cases there is profound prostration with muttering delirium, and in others an active maniacal condition. The onset of *insanity* has been precipitated in those who have been previously insane, or who have had a strong hereditary predisposition to it. Already-existing nervous diseases, such as locomotor ataxy and disseminated sclerosis, may be made much worse.

Neuralgia and Neuritis are not uncommon sequelæ of influenza. The neuritis may be local, fairly often attacking the olfactory nerves, and causing prolonged or permanent loss of smell, or rarely the optic nerve, producing a retro-bulbar neuritis, with loss of vision. Multiple neuritis comes on late in the attack, it chiefly affects the legs, but the whole body and even the respiratory muscles may be involved. In a large number of cases the *cardiac nerves* are injured. During the acute illness there may be intermittence, or tachycardia, and afterwards a feebly-acting rapid heart, which may cause death, especially if care is not taken to prolong the time in bed and to prevent any sudden exertion. Angina pectoris may be a sequela. The influenzal poison may lead to degeneration

of the bundle of His, and set up permanent bradycardia.

The muscle of the heart is also often affected, leading to loss of tone, deficient response to exertion, and to dilatation.

Gastro-Intestinal System.—In the abdominal form of influenza, after the initial pain in the head and back, there are attacks of cramp in the stomach and griping, with frequent vomiting and diarrhoea of an acute character lasting some days, from which the patient may become very collapsed. In other cases there is vomiting only at first, followed in a day or two by jaundice.

Diagnosis. In the original epidemic the suddenness of the attack, the marked pain in back and limbs and great prostration left little room for doubt concerning the diagnosis. It resembled dengue in its onset, but dengue is a disease of tropical countries, does not attack the respiratory system, is always accompanied by a rash, and the pains are in the joints as well as in the muscles and last much longer. Nowadays the headache and pains are so much less that they may have to be inquired for in cases where a troublesome cough or unaccountable physical depression point to influenza. The bacillus may have to be sought for in the sputum.

The diagnosis from enteric fever is by no means easy; it is a not uncommon error for the early stage of the latter to be mistaken for influenza. The headache, fever and feeling of illness are common to both. The tongue is smaller and more furred in the centre in enteric, and there is often a localised flush on the cheeks. Moist sounds in the lungs are more commonly sibilant in enteric and crepitations in influenza. Before the end of a week the clinical picture of enteric is generally definite. Gastro-intestinal influenza more resembles ptomaine poisoning. In jaundice due to influenza the temperature is higher than in ordinary catarrhal jaundice. Often there are several cases in the same epidemic, and it is only the presence of other forms of influenza which distinguishes them from Weil's disease. Influenzal pneumonia is recognized by its not conforming to the typical physical signs of croupous or catarrhal pneumonia, and by its attacking a fresh portion of lung each day, even while the part first affected may be clearing.

When there are said to be frequently recurring attacks of influenza it is well to look for some other cause. In some such cases there is unsuspected pus in the urine, and the attacks cease or become less frequent under treatment directed to the urinary tract.

Treatment. Absolute rest in bed should be insisted on from the outset of the attack until the temperature has fallen below normal, and longer if the heart shows signs of weakness. The diet should be fluid during the course of the

fever, and afterwards easily digestible and nourishing.

For the pains of the acute onset salicin, salicylates, Dover's powder, and sometimes morphia, used to be given. Now there is nothing to equal aspirin, which, after one or two ten-grain doses, usually relieves the pains and headache, as well as partly reducing the temperature. A dose of calomel followed by a saline draught also does good at the outset. Ammoniated tincture of quinine, carbonate of ammonia, and liquor ammonii acetatis are useful when the respiratory system is attacked. In severe cases of pneumonia, and in the condition of acute oedema of the lungs with a running pulse, rectal injections of four to six drachms of Warburg's tincture may save life. For the persistent cough often left after influenza a linctus containing heroin is the most effective treatment.

When the disease affects mainly the nervous system aspirin or salicylates act better in combination with strychnine or nux vomica. In cases of coma hypodermic quinine has sometimes restored the patient to consciousness. For meningitic symptoms it would seem to be worth while to try urotropin, judging from its good effects in epidemic meningitis. For the gastro-intestinal form hydrocyanic acid, bismuth, and sometimes opium are needed; aspirin does good if it is not vomited. In severe cases hypodermic strychnine or transfusion may be necessary.

Most cases of influenza require prolonged after-treatment owing to the bodily and mental depression. For this tonics containing strychnine should be given, in some cases hypophosphites, in others iron, in others nitrohydrochloric acid in addition do most good. W. B.

CEREBRO-SPINAL MENINGITIS

Etiology. The causative micro-organism is the *diplococcus intracellularis* of Weichselbaum, which is found in the cerebro-spinal fluid and meninges of persons suffering from the disease. The coccus occurs in pairs, is not provided with a capsule, and is often found within the cells of the spinal exudate. It is negative when examined by Gram's method and grows best on a medium of ascitic fluid and agar. Adults exposed to infection appear to harbour the micro-organism very frequently in their faucal or nasal secretions, and, without taking the disease themselves, are liable to disseminate it by coughing or spitting. It is, indeed, through the medium of "healthy carriers" that infection appears to take place. Such fomites as spoons, cups, handkerchiefs and so forth may also aid the dissemination of infection. Direct infection does not seem to be very common.

Pathology. It is generally held that the diplococcus first obtains lodgment in the nasopharynx and finds its way to the base of the brain by the lymphatic vessels through the cribriform plate. The typical lesions consist of an acute inflammation of the pia-arachnoid, with effusion, sometimes merely turbid, often quite purulent, into the subarachnoid space. In most cases the under surface of the cerebellum and pons suffer most and may be covered with a gelatinous exudate. The cord usually shows well-marked inflammation and may be thickly plastered with sticky pus.

Cerebro-spinal meningitis may occur in widespread epidemics or in very small sporadic outbreaks. The *post-basic meningitis* seen not infrequently in children's hospitals appears to be the same disease as the epidemic form, but presents certain bacteriological distinctions which need not be very seriously considered.

After an *incubation period* of probably under ten days the fever commences suddenly with acute symptoms. The patient may become unconscious at once. More usually intense headache, vomiting and stiffness and pain in the neck are the outstanding features of the invasion. Some degree of pyrexia is always present, but the temperature varies much in different cases.

As regards the *course of the illness* it may be divided into two stages, the acute and the chronic. Should death not occur in the first fortnight the patient may either recover or enter upon a prolonged chronic stage which not infrequently terminates fatally. The duration of the *acute stage* varies from a few hours to about three weeks. In very severe cases death occurs in the first few days. The patient is flushed and often slightly cyanosed. The mind is confused and delirium is common. Adults complain much of headache and of pain in the back of the neck. The head is held rigidly retracted. Strabismus and inequality of the pupils are sometimes observed. The temperature is very variable, often falling to nearly the normal line. Some suggestion of general improvement often accompanies such remissions of the fever, but acute symptoms are always liable to recur. In the most severe type of case petechial spots and purpuric hæmorrhages of moderate size may appear upon the skin within twenty-four hours of the onset; but this feature of the disease is not to be expected in more than twenty per cent. of patients. Herpes, especially of the lips, is much more common and is a valuable aid to diagnosis.

Kernig's sign is present from the first and persists through the whole illness, being the last sign of the disease to disappear. With the thigh semiflexed on the abdomen it is impossible to extend the leg of the patient. The knee-jerks are often normal but may be abolished.

Hyperæsthesia is very common and the patient appears peculiarly sensitive to cold. Total deafness or blindness may be present from the first.

A very large proportion of the total deaths occur in the first week of illness. The respiration becomes laboured, the face cyanosed, and hyperpyrexia often supervenes. Occasionally the disease terminates by a fatal syncope. On the other hand, especially in serum-treated cases, improvement may be manifest at about the end of the first ten days and the symptoms gradually disappear.

If, however, no improvement occurs the patient ultimately enters the *chronic stage*. While the chief symptoms of the disease continue, the temperature becomes subacute and marked wasting sets in. The emaciation is quite independent of the amount of food taken by the patients, many of whom eat voraciously. In young children opisthotonus is common, and head retraction and neck rigidity usually persist in all cases. Vomiting, apparently causeless, occurs at frequent intervals. Convulsions not infrequently occur and may terminate the case. Such symptoms as ptosis, nystagmus, strabismus and conjugate deviation are all liable to appear, and chronic hydrocephalus is a common sequel in the later stages. Death is often long delayed, sometimes for three or four months. But the patient sometimes survives even the chronic stage and makes a slow recovery, Kernig's sign being the last symptom to disappear.

The *complications* of the fever are unimportant, except for those which affect the ear or eye. Cerebro-spinal meningitis is a frequent cause of deaf-mutism. The deafness is usually due to damage to nerves, but may follow otitis media. The eye may be destroyed or permanently damaged by panophthalmitis following conjunctivitis or corneal ulcer, or blindness may be the result of central lesions.

Relapses, after an interval of complete apyrexia and freedom from acute symptoms, are somewhat common in those who survive the acute stage.

Diagnosis depends upon the detection of the meningococcus in the spinal fluid. Sudden onset of illness with headache, vomiting, neck rigidity and Kernig's sign are sufficient to justify *lumbar puncture*. The patient should lie on the side with the knees well drawn up and the head and shoulders as far forward as possible. A long needle with a large bore from a serum syringe is all that is required. The spines of the vertebræ having been made prominent, the needle should be thrust into the space between the fourth and fifth lumbar vertebræ—which is on the level of a line between the summits of the iliac crests. In children the middle line

will be found most satisfactory, the needle being inserted between the spines either absolutely straight or with a slight upward slant. In adults a point about three-eighths of an inch to the right or left of the middle line should be chosen and the puncture made between the laminae. Fluid is struck at a depth varying from one and a half inches in young children to nearly three and a half in some adults. It usually exudes in drops, but may spout in a continuous stream if there is much pressure. In delirious patients a general anaesthetic is advisable.

The fluid is turbid or even purulent in the acute stage. In the chronic stage it is sometimes quite clear, but the contained cells will be polymorphs, differing, therefore, from the lymphocytes found in the clear fluid of tubercular cases. A smear preparation, stained with methylene blue, shows in addition to the cells a varying number of diplococci, some of which are almost certain to be intracellular. It must be remembered that turbidity of the fluid may be due to other conditions, such as pneumococcal or septic meningitis. From these conditions, as well as from tubercular meningitis, acute lobar pneumonia, enteric fever and other acute infections, the disease must be distinguished.

As regards *prognosis* the mortality of patients untreated by serum varies from fifty to eighty per cent. in different outbreaks. Infants of under one year seldom recover. As in diphtheria the chances of the patient become less with each day that passes before a suitable serum is given.

Treatment, unless serum can be procured, is merely palliative. Hot baths, frequently repeated, do much to relieve the pain, and such drugs as phenacetin, sulphonal and veronal have been used freely to control the headache or to procure sleep. Morphia is more effective, but it is better avoided. An attempt should be made to obtain either Flexner's serum or Dopter's. Both of these have proved their efficacy. But if they are not available some antimeningococcic serum must be procured and injected into the spinal canal. After abstracting a certain amount of fluid the serum is introduced in its place, the general rule being not to inject more serum than the amount of fluid withdrawn. Average doses are 30 c.c., repeated daily for four days, or longer if by that time improvement is not manifest. The safest guide is the condition of the fluid. As long as diplococci are present it is wise to continue the injections. After each injection the foot of the bed should be raised for a few hours to encourage the distribution of the serum to the base of the brain. Serum is but little use after the first week.

In chronic cases vaccines obtained from the

patient's own meningococci may be used with advantage.

Isolation. It is well to isolate the patient. The length of his detention depends more upon his strength than anything else, but three or four weeks are apparently sufficient. *Quarantine*, if employed, should last ten days. If preferred, contacts should be bacteriologically examined and "carriers" isolated.

C. B. K.

ERYSIPELAS

Erysipelas is due to infection by the *streptococcus pyogenes* which, in an ordinary case, is found in the lymphatic vessels and spaces of the corium, and is most abundant in the area just beyond the spreading edge of the dermatitis. The micro-organism gains entrance by a wound or microscopic abrasion of the skin. The disease is most prevalent in the winter months, and is more common in females than in males, though it is much more fatal to the latter. While it is not uncommon in the newly born, the vast majority of patients are over twenty years of age. The *infection* may be disseminated by hands, instruments and other fomites in a surgical ward. In most cases, however, it is difficult to trace.

After an *incubation stage* of from three to eight days the illness commences suddenly, with a rapidly rising temperature, headache, chills and often vomiting. The dermatitis is often recognizable from the first. The face is in most cases the situation attacked, and common starting-points of the inflammation are the inner canthus of the eyelids or the neighbourhood of the nostril. The skin becomes deep red in colour, swollen and sometimes shiny. It is tense to the touch and feels hot. The inflamed area is raised above the normal skin and its margin is felt as a raised ledge, the *spreading edge* of erysipelas. There is much local discomfort, a burning sensation and tenderness of the skin being usually complained of. The spread of the dermatitis is most rapid in those situations, such as the eyelids, where the skin is lax. The eyes are nearly always completely closed by the oedema. The advance is often checked in places where the skin is tense, as at the edge of the scalp or the line of the lower jaw. In sharp cases it is usual to see *blebs* or blisters of varying size, and occasionally superficial necrosis takes place in small areas. Desquamation, often very profuse, almost invariably follows.

During the attack the temperature tends to remain high, 102° to 104°, with but little morning remission. With the cessation of the spread of the dermatitis it falls, usually by crisis. The duration of the fever is very

variable. Constitutional symptoms are generally severe. Headache is often persistent. Insomnia and delirium are frequently observed. Albumin is often present in the urine and, as in other fevers, congestion of the lungs and hypostatic pneumonia may supervene in very prostrate patients. Death may occur from this cause or from heart failure.

As apart from facial cases the disease may start from a wound in any situation, and it is not unusual to find it on the extremities. In a small minority of patients the dermatitis wanders over a large part of the body, starting from the face or elsewhere. When it involves the scalp the symptoms are usually severe. The fauces and larynx may also be implicated in cases of facial erysipelas. The disease may also attack the navel in infants, *erysipelas neonatorum*, and occasionally it has been known to follow vaccination. When the deeper structures are involved in the inflammation erysipelas is described as *phlegmonous*, and this condition is probably due to a mixed infection. Suppuration and extensive sloughing not infrequently follow it.

Relapses and second attacks of erysipelas are extremely common.

Diagnosis. The main point is the definitely raised margin. In erysipelas, again, the intensity of the inflammation, the brightest colour, the greatest tenderness, and so forth, are all best marked at the periphery, whereas at the point of origin the inflammation may already be subsiding and desquamation commencing. The presence of bullæ or vesicles is also in favour of erysipelas. Should the swelling spread to the neighbourhood of the ear, the auricle, which is spared by the œdema due to parotitis or alveolar abscess, is almost always involved.

Prognosis. The case mortality of the disease is about five per cent. Newly-born children and alcoholic adults form the two classes of patients in whom erysipelas is most fatal.

Treatment. General treatment may well be limited to an appropriate fever diet, judicious stimulation of elderly patients, and the timely administration of hypnotics should the insomnia be troublesome. The temperature need not be interfered with, but an ice-cap often gives great relief in cases of persistent headache. In "wandering cases" strychnine is of some use as a general tonic. It used to be the fashion to give iron, but its value has been much overrated.

As regards specific treatment, *antistreptococcal serum* may be used, but it seldom gives good results. If employed, the doses should be large, say 40 c.c. at least twice daily. *Vaccines* have been tried, and it is possible that in prolonged wandering cases they might be successful.

Local treatment is often of the greatest comfort to the patient. It seldom limits the spread of the dermatitis. Good preparations to use are: (1) a saturated solution of magnesium sulphate painted on the face or applied on a lint mask; (2) an ointment of one part of ichthyol to ten of vaseline smeared over the affected part; or (3) a simple dusting powder of boracic acid, subnitrate of bismuth and starch. All these, especially the first, can be trusted to allay irritation and decrease discomfort. The methods to prevent the advance of the dermatitis by painting bands of liniment of iodine, or of nitrate of silver, in front of its margin are quite unreliable. In completely untreated cases the duration of the disease is most variable and it is therefore difficult to estimate the value of any method of treatment.

C. B. K.

LOBAR PNEUMONIA

Lobar Pneumonia is a general infective disease, the chief signs of which are to be found in association with the lung.

Typically the disease runs a definite course of short duration, has a sudden termination and may occur in epidemic form. It is due to infection by a well-established organism, the pneumococcus of Fränkel, which may be easily isolated from the sputum and in most cases grown from the blood stream.

There is now increasing evidence to show that other organisms besides the pneumococcus may be responsible for this disease. For in a number of cases the only organism recovered has been the bacillus of Friedländer or the influenza bacillus, though the latter usually gives rise to lesions which have a broncho-pneumonic distribution.

Lobar pneumonia is common to both sexes, but occurs much more frequently in males.

No age is exempt from the disease. It is frequently met with in infants and children up to the age of five years, and after that age is most prevalent from fifteen years to middle life.

The occurrence in children is much more marked than is generally supposed. At the East London hospital for children during the years 1909 and 1910, 574 cases of pneumonia of all sorts were admitted. Of these 326 (56·8 per cent.) were found to be suffering from lobar pneumonia. Of all the cases that died and came to post-mortem examination only 12·9 per cent. were found to have died of lobar pneumonia, and when death did occur it was usually found to be due to the supervention of some complication, such as pericarditis or meningitis.

Thus during infant life lobar pneumonia is

quite a common disease, but one which in itself has a very low mortality.

Frequently, too, a secondary broncho-pneumonia may become engrafted upon a lobar pneumonia and lead to a fatal issue (Eustace Smith). Among *predisposing causes* exposure ranks easily first, and the disease is especially prevalent among those who are subject to great changes of temperature.

Exposure undoubtedly acts by lowering the resistance of an individual to the infecting organism. Pneumococci are to be found in the tonsillar mucus of most persons, but it is only under circumstances favourable to their development that they become pathogenic. The debility common to those who suffer from chronic diseases such as renal disease, diabetes and pulmonary tuberculosis renders them peculiarly susceptible to infection.

Trauma undoubtedly acts as a predisposing cause in some cases, the association between the occurrence of an injury and the onset of the disease being very definite.

The disease may also spread by direct contagion and so may occur in epidemic form.

A previous attack, far from protecting, seems to predispose, for it frequently happens that the disease occurs many times in the same individual: as many as twenty such attacks have been reported, and in the throats of those who have suffered from a previous attack pneumococci are found to be present in much increased numbers; this fact perhaps accounts for the recurrence.

The *onset* is usually sudden, the patient being taken while in apparent health with a rigor of greater or less intensity. In no disease is the rigor so marked and so prolonged as in lobar pneumonia. It may last as long as thirty minutes, the temperature rapidly rising to 103° or 104° F.

Very soon the usual signs and symptoms of an acute illness set in: headache, pain in the back and limbs, anorexia, furred tongue, flushed cheeks and general malaise. Often the flush is most marked on the side of the lesion.

Rarely the onset may be marked by an attack of hæmoptysis. In children a convulsion may replace the rigor and is often accompanied by vomiting.

Pain is nearly always present. It may be referred to the front of the chest just below the nipple or to the axilla on the affected side and is usually very severe. It is due to involvement of the pleura covering the affected lung. The pain may be referred to the epigastrium when the pleura covering the diaphragm is involved or to the appendix region or to the umbilicus: the latter is due to involvement of the intercostal nerves and is referred by them to the abdomen.

Cough is an early and important symptom: it is at first short, dry and frequent, and soon is accompanied by the expectoration of *sputum* which at first is frothy, but later becomes blood-stained, airless and very tenacious: the so-called "rusty" sputum.

The sputum rapidly becomes more viscid and the colour varies from bright red to brown orange or yellow, depending upon the amount of blood contained in it. The viscosity is such that it frequently has to be wiped from the patient's mouth and the vessel which contains it can be inverted without the contents escaping.

This tenacious quality of the sputum is a very important diagnostic point because of its constancy in this disease. In cases that are doing badly this feature will often become less marked, so that its disappearance is to be regarded as a bad prognostic sign. The sputum contains an excess of chlorides and minute fibrinous casts of the bronchioles, and films made from it show pneumococci to be present in large numbers.

Dyspnœa is almost a constant feature of lobar pneumonia, the respirations being increased from the first and reaching anything from forty to sixty or even eighty to the minute. The pulse-rate, though increased, is not increased in proportion to the temperature, so that the pulse-respiration ratio is altered and may become one to two or one to one and a half, this disturbance being of some help in diagnosis. The dyspnœa is due in the main to the effect of the circulating toxin upon the respiratory centre and to the fever. The respiratory movements are less marked and therefore more frequent owing to the pain caused by the pleurisy. The amount of lung thrown out of action and therefore functionless has little to do with the occurrence of dyspnœa, for it is a well-known clinical fact that the crisis may take place and with the disappearance of the fever the respirations may fall to normal, and this without any change in the physical signs.

The temperature rises rapidly with the rigor and may reach its maximum within a few hours, usually about 103° or 104° F. It is as a rule maintained throughout the disease—the daily variation being not more than one degree—and ends suddenly with the crisis, falling as rapidly as it rose. After the crisis the temperature often becomes subnormal and the fall is accompanied by profuse sweating and much collapse. During the next day or two the temperature often rises a degree or so before it finally settles down. Exceptionally, daily intermissions may occur and the defervescence be spread over some days.

Physical Signs. The inflammatory process starts in most cases at the base of the lung and more commonly on the right side. The lung may be first involved posteriorly and the spread

take place forwards, or anteriorly and the spread take place backwards, until finally the whole of one lobe or even of one lung is involved. Both sides may be affected.

The apex may be first involved or the disease may start in the centre of a lobe giving rise to a central pneumonia.

Movement is less marked on the affected side or, with a base involved, movement may appear exaggerated at the corresponding apex. If the lesion be extensive and on the left side, the solid lung may conduct the cardiac pulsations to the chest wall and give the impression of a wide area of cardiac pulsation. The affected base will often show an actual increase in measurement. Vocal fremitus is increased over the affected side and often the pleural friction can be felt.

In the early stages of the disease before consolidation has taken place a note of higher pitch than normal can often be obtained over the affected area and also above a piece of solid lung in the later stages. This is probably due to a spread of the inflammatory process to the lung tissue causing a loss of the elasticity normal to it so that alveoli get over-distended. This is here (as in pleurisy with effusion) a grave prognostic sign when it occurs in the opposite lung. When the lung becomes solid the note to percussion becomes dull, the dullness being not so marked and being not so "flat" as in the case of fluid.

With resolution this dullness often disappears entirely, but it often happens that in those cases which are accompanied by some slight amount of effusion fibrin gets deposited on the pleura and the pleura becomes thickened, thus the note remains impaired for a very long time, if not permanently.

The various sounds heard in the pneumonic chest are best considered firstly in relation to the normal respiratory murmur and variations of it, and secondly with respect to added sounds.

The true vesicular murmur is early altered in quality, being at first partly suppressed and later becoming irregular and harsh in quality as the exudation is poured out. Finally, when the lung becomes solid, true bronchial breathing is established, due to the laryngeal sounds being conducted to the chest wall by means of the patent tubes and solid lung. When fully established the sounds of inspiration and expiration are of equal length, and if the pitch of the note be high it may be taken to indicate that the smaller tubes are still patent. In those rare cases of massive pneumonia where the tubes are filled with exudation the respiratory murmur may be suppressed or almost entirely absent.

The voice sounds are much increased in lobar pneumonia and often sound as though shouted into the end of the stethoscope (bronchophony);

they may have a nasal quality (ægophony), but this latter is not so marked as when heard above a pleural effusion.

The first added sound to be heard is the fine crepitant râle or hair crepitation. This is to be heard at the end of inspiration only at first, but as the inflammatory process extends it becomes evident all through the respiratory phase and then becomes less marked as the lung becomes more solid and bronchial breathing is established. This fine râle is probably due to the separation of sticky exudate in the air cells and not to early pleurisy, as is sometimes maintained. Many coarser râles are also to be heard when the disease is in full blast. Later when resolution takes place and the bronchial breathing disappears many coarse râles are to be heard over the affected area—the *redux* crepitation.

Pleural crepitus is to be heard usually over the site of the pain. It is to be distinguished from the pulmonary added sound by being much coarser and louder and as though just beneath the end of the stethoscope. It ceases when the breath is held.

The heart is not displaced. There is always some amount of dilation but no actual displacement, unless there is effusion present at the same time. In a severe case the right heart may be found to extend well to the right of the sternum, and pulsation may be seen there, in which case cyanosis is usually marked. The apex beat has lost some of its force.

The cardiac sounds must be carefully noted from time to time. The pulmonary second sound is much increased, owing to the greater obstruction in the pulmonary circulation.

With failure of the power of the right ventricle this sound becomes less marked. One of the first effects of the circulating toxin is to increase the frequency of the heart-beat through its action on the myocardium, so that a very frequent pulse is a bad prognostic sign. The first sound becomes shortened, the muscular element in its causation being not so evident. The first sound thus becomes like the second in quality. This is always an indication for the administration of cardiac stimulants.

The blood pressure falls early in the disease, usually from 15 to 20 mm. Hg. The fall of blood pressure is due to the effects of the circulating toxin on the vaso-motor centre.

Cyanosis in lobar pneumonia is usually present to a slight degree and is due to vaso-motor capillary paresis and to lack of efficient aeration of the venous blood. When marked it is of unfavourable import and is a sign of serious failure of cardiac power.

The skin in this disease is usually described as being dry, but in the opinion of the writer a truly dry skin is never met with.

A moderate degree of sweating is the rule, and

this is to be expected when one considers that one is here dealing with a severe infection due to a pyogenic organism. The sweating found in a typical case that is running a favourable course is to be carefully distinguished from the cold and clammy sweat that is met with when death is nigh and vaso-motor paralysis sets in.

An attack of herpes occurs around the mouth or nostrils in about twenty-five per cent. of cases and when found is to be regarded as a favourable sign, though its absence is not to be regarded adversely.

The chief *blood changes* have reference to the white cells.

The pneumococcus being a pyogenic organism, leucocytosis is usually a marked feature of the disease, the cells rising to anything from 12,000 to 60,000 per cm. In a favourable case the leucocytes are maintained at about the same height throughout the disease, dropping a few hours after the temperature.

An absence of leucocytosis or a very slight one is a bad prognostic sign, as is also a diminution in leucocytes without any corresponding abatement of the fever and general symptoms of the disease.

A further increase in the leucocytes may be noticed with a fresh involvement of the lung tissue.

The liver may be pushed down when the lower lobe of the right lung is involved and there may be a slight degree of jaundice present; the spleen is usually enlarged.

The urine shows the usual febrile changes; there is an increase in specific gravity with a high colour, a cloud of albumin may be present, and the chlorides are diminished; these are again brought back to normal with recovery from the disease. There is also an increased output in nitrogenous substances in the urine; these also disappear with the establishment of convalescence.

Nervous symptoms, headache and pain in the back are frequent at the onset, convulsions are common in children, delirium and mania may occur and this more especially in the cases of apical pneumonia. In alcoholics delirium tremens is common. Delusional insanity may come on during convalescence. The prognosis is, however, good.

Lobar pneumonia usually runs its course in five to nine days. In some cases the disease may be much prolonged. In others the course may be much shortened and the crisis may occur within thirty-six hours of the onset; thus the "one day" pneumonia may occur.

Differential diagnosis. Lobar pneumonia throughout its course may be mistaken for many other conditions.

Before the onset of physical signs as in most acute specific fevers, especially *Variola*, the

occurrence of headache and pain in the back together with the fever are suggestive of this disease.

Acute abdominal conditions, the commonest of which is undoubtedly appendicitis. Also the disease has been mistaken for perforated gastric or duodenal ulcer, acute hæmorrhagic pancreatitis, cholecystitis, and any condition giving rise to acute peritonitis. The pain in lobar pneumonia is referred to the abdomen only by means of the intercostal nerves, and is to be distinguished from that of deep visceral disease by the fact that it is not increased on deep pressure but is more of the nature of a superficial hyperæsthesia. A further careful review of the mode and symptoms of onset will usually serve to obviate a mistake.

Occasionally *typhoid fever* may start more or less abruptly, but absence of leucopenia in lobar pneumonia will help to arrive at a correct diagnosis.

Acute follicular tonsillitis and other acute septic conditions must be carefully distinguished.

With the onset of physical signs other diseases which are located to the chest have to be considered.

Acute pleurisy is the commonest disease to be mistaken for lobar pneumonia. Where effusion is not present the differential diagnosis mainly rests on the absence of the characteristic sputum; the onset, too, in pleurisy is usually less acute.

When the pleurisy is accompanied by effusion the diagnosis rests upon the absence of vocal fremitus and resonance, the partial suppression of breath sounds and the *displacement of the apex-beat towards the sound side*. The apex-beat is the keynote to the chest, and it takes very little fluid at one base to bring about some displacement.

The nasal quality of the voice sounds near the upper border of the dullness is more distinctive of an effusion. The dullness, too, is flatter.

If there be any doubt the exploring needle should be unhesitatingly used.

Acute tuberculous consolidation is likely to be mistaken for croupous pneumonia. The broncho-pneumonic process may set in very acutely and become rapidly confluent, and thus give rise to consolidation of the whole or part of the upper lobe of one lung. An initial hæmoptysis is more common in tuberculosis, and the sputum is found to contain elastic fibres—a sure indication of the destruction of lung tissue—and tubercle bacilli.

The pulse-rate in tuberculosis is increased more in proportion to the temperature, so that there is not as marked a disturbance of the pulse respiration ratio. Later, the tuberculous affection does not end by crisis but goes on to cavitation, and the temperature assumes the hectic type.

Complications in lobar pneumonia are not common. Amongst them are—

Empyema.—This is the most frequent complication of lobar pneumonia. It is to be suspected when after about the tenth day the temperature does not come down, or in other cases the crisis may occur and then a few days later the temperature again commences to rise and convalescence is retarded. Under these circumstances a careful watch should always be kept upon the chest and any suspicious patch explored with the needle. Empyema occurs in one to five per cent. of cases.

Pericarditis.—This is a common complication in children. Clinically it is not always recognizable, the physical signs being often difficult to make out owing to their being masked by those in the lungs. Pericarditis should always be suspected in a child when the fever continues and the patient's condition does not improve, whilst there is no exacerbation in the signs to account for it. Post-mortem examination shows that this complication is more often missed than any other, and so it should be all the more carefully sought for, especially as if not recognized the issue is necessarily fatal. Pericarditis is responsible for five per cent. of the deaths in lobar pneumonia.

Meningitis may terminate a case very rapidly; this complication too is most commonly met with in children.

Endocarditis.—Lobar pneumonia being always a septicæmic process, a pneumococcal endocarditis is very apt to become engrafted upon a damaged valve. It is a rare complication.

Icterus sometimes occurs and is probably due to inflammatory obstruction of the smaller bile-ducts.

Other rare complications may be mentioned—arthritis, thrombosis and acute nephritis. Pulmonary abscess is rare, but when it occurs is serious. If the patient survives it is apt to be followed by bronchiectasis. Gangrene of the lung sometimes follows lobar pneumonia and is diagnosed by the characteristic stinking sputum.

Lobar pneumonia may exceptionally run a very short course, the crisis occurring at the end of two or three days. On the other hand it may be dragged out for as much as three weeks. Resolution may be much delayed, and this is probably due to the fact that organization is taking place. Such cases frequently go on to bronchiectasis in later life.

In weakly and debilitated individuals an attack of pneumonia will often run an atypical course in which great prostration is a marked feature, the pulse being rapid and feeble, the mental condition dulled, or a low muttering delirium may supervene. The prognosis in these cases is extremely grave.

Prognosis. There is no illness which medical

men are called upon to treat in which the prognosis depends so much on the habits and mode of life of the patient. The life a man has led is as a rule vividly shown in the way he reacts to a disease such as lobar pneumonia.

Especially deadly is the disease in chronic alcoholics and in those who are debilitated by excesses of any kind.

Grave is the prognosis in the presence of such diseases as Bright's, diabetes, tuberculosis and arterio-sclerosis from any cause. The presence of emphysema is unfavourable.

Of all cases death occurs in from twenty to forty per cent., but if the disease occurs in an otherwise healthy person the mortality drops to about seven per cent.

In early life the prognosis is very favourable.

From the second decade onwards the mortality steadily increases with advancing years until in those over sixty years of age it reaches eighty per cent.

In any individual case the following may be taken as unfavourable signs—

1. A pulse which is rapid from the first. If the rate is constantly over 130 to the minute the outlook is unfavourable.

A rapid pulse is generally the result of a marked toxæmia and is found along with a dilated heart and pronounced cyanosis.

2. Absence of leucocytosis is a grave prognostic sign and may be taken to indicate a very low individual resistance.

The actual degree of leucocytosis seems to depend on the virulence of the infection on the one hand and the individual resistance of the patient on the other, but in a case that is doing well the leucocytes ought to number from 12,000 to 40,000 or even higher. It may be taken as unfavourable if in the course of the disease the leucocytes show a marked decrease without any corresponding improvement in the condition of the patient.

3. The tenacious quality of the sputum is a favourable sign, and this should not disappear until the crisis has occurred. Sputum which is blood stained and watery constitutes an unfavourable omen.

4. Double pneumonia is more serious than single, and the occurrence of œdema in the opposite lung is of bad omen.

General Treatment. There is perhaps no disease in which, from time to time, opinions as to treatment have been so much at variance as in lobar pneumonia. Owing to the fact that the disease is self-limited and that the time of appearance of the crisis is not constant, many different remedies have on occasion been held responsible for bringing about a cure. The fact remains that we have as yet no specific remedy, chemical or bacterial, which is proved

to have any real effect on the course of lobar pneumonia.

The patient, by virtue of his own resisting powers, must overcome the infection and cure the disease, and our line of treatment in each case must be directed towards placing him in the best possible circumstances for doing this.

The patient is of course confined to bed, generally more or less supported on pillows, and should wear a loose flannel jacket only, the bed-clothing not being too heavy. The weight of the clothes may be taken off the patient by means of a cradle.

The room should be well ventilated by day and by night, the patient being protected from draughts by means of screens. The temperature of the room should be about 60° F. The mouth should be frequently cleansed from the tenacious sputum, and every encouragement given by the nurse to bring it up.

The usual tendency is to overfeed a patient with lobar pneumonia. Be it remembered that the normal processes of digestion and absorption are in such a disease much deranged, so that any unnecessary overloading of the stomach can only lead to flatulent distension and discomfort.

The disease ordinarily lasts but a few days, and so a robust adult does not require much feeding. In the very young and in the old more care should be taken in seeing that a necessary amount is taken. The diet should be fluid and should consist mainly of milk, diluted, and in some cases peptonized, or if there is a tendency to flatulence a drier diet is indicated. There is no objection to a little solid food if the patient particularly wishes it. If the thirst be great water should be allowed in plenty.

Apart from purgatives there is no call for any special drug, for there is none known to have any influence on the course of the disease. A purge should be at first given—calomel, five grains—to be followed in six hours' time by a saline, and the bowels should be kept open throughout the disease by means of salines. If a routine medicine must be given, five minims of dilute nitrohydrochloric acid in one ounce of chloroform water every four hours will be found to aid digestion. The seat of the disease is in the alveoli and not in the bronchi, so that there is no call for expectorants. If there is much bronchitis present five grains of ammonium carbonate may be given four-hourly, and stopped when the secretion is free. Alcohol should not be given as a routine practice, but only when the heart is failing or there is some special indication.

The pain in the side which is so frequently present as to almost form a constant symptom of the disease is best relieved by applying six or eight leeches to the seat of the pain. Leeches are more effectual than hot or cold compresses.

Special Indications—

To Lessen the Toxæmia. Excessive toxæmia is evidenced by sleeplessness, restlessness, high fever, delirium, cardiac dilation and weakness of the first sound of the heart. Free purging, bleeding, diaphoresis and diuresis all help in the elimination of the circulating toxin. Saline infusions have a marked effect in some instances, acting by diluting the circulating toxin and promoting diuresis, and so assisting in its elimination. The patient who is restless and cannot sleep, and this for no definite reason, will often find relief after a rectal saline combined with tepid sponging.

Oxygen gas inhalations have a powerful effect in destroying the toxin. The oxygen should be warmed and moistened by passing the stream through a Woulfe's flask containing hot water, and some form of alcohol may with advantage be added to the flask. Oxygen should be commenced early and given freely and often. The funnel by means of which it is given should be held a few inches away from and above the patient's mouth, so as to avoid the feeling of suffocation which is experienced if given in too concentrated a form.

To Support the Heart. Death is generally due to cardiac failure in this disease, owing to the effect of the toxin on the cardiac muscle. A rapid, feeble pulse, with a dilating heart, a short, feeble first sound and increasing dyspnoea and cyanosis, with a cold and clammy skin, are signs that the heart is failing. In the presence of a moderate pulse bleeding should be resorted to, ten to twenty ounces of blood being rapidly withdrawn from a vein in the arm, the median basilic being usually taken.

Of cardiac stimulants strychnine and digitalis and adrenalin are the most useful. Strychnine should be given hypodermically in doses of five minims every four hours or in larger doses where indicated. It is a powerful cardiac stimulant, causes constriction of the vessels, stimulates the medullary centres of respiration and circulation and the spinal cord, aids digestion and prevents abdominal distension.

Digitalis has some action on the cardiac muscle, though it does not act so well on a muscle which is poisoned as on a normal one. It acts more powerfully when given hypodermically as digitalin. Adrenalin is the most powerful of them all, acting chiefly on the peripheral vessels and raising the blood pressure. It is best given beneath the skin in doses of twenty minims of the 1 in 1000 solution every four hours for six doses. It should not be given for too long at a time.

Alcohol should never be prescribed as a routine in lobar pneumonia. In individuals who have been used to taking it in quantity it should be prescribed, but in the non-alcoholic cases

it is better to rely more upon strychnine, digitalis and adrenalin.

Insomnia, if not relieved by measures which are directed towards diluting the toxin, must be treated by sedatives. In the writer's hands veronal has proved the most certain and has been unattended by any ill effects. Chloral-amide, and chloral and bromide, may be used. Finally, resort may have to be made to morphia, for it must be remembered that a patient with pneumonia *must* sleep. Pain due to flatulence is a common cause of insomnia and must be relieved.

The pyrexia may be excessive. A high temperature may indicate great resistance on the part of the patient to excessive toxin formation. A sudden rise of temperature in the course of the disease calls for energetic treatment. Excessive pyrexia should be treated by cradling, ice-cradling, wet pack or tepid sponging. Antipyretic drugs should never be used.

Too low a temperature should be treated by the application of external heat.

Specific Treatment. Much has been written and said with regard to the treatment of lobar pneumonia with specific serum and bacterial vaccines, but as yet the evidence for and against is very conflicting, so that one cannot regard them in the light of really useful additions to our armamentarium. Pane's serum is accredited a certain amount of success. Apparently vaccines do no harm if used in small doses, and in some cases they may do good. If it is decided to use them the autogenous vaccine should be obtained and given in doses of from five to twenty millions. It ought to be possible to obtain an autogenous vaccine in forty-eight hours.

H. P.

TOXÆMIA; SEPTICÆMIA; PYÆMIA

General. As the result of *infection* of the body by bacteria one or more of three processes takes place.

1. **Toxæmia.**—The infecting bacteria remain localised at or near the point of invasion, producing poisons (toxins) which are absorbed into the circulation and lead to certain symptoms. The process is essentially one of *intoxication* by the products of bacterial activity. Most cases of diphtheria, and probably all cases of tetanus, are examples of toxæmia.

2. **Septicæmia.**—The infecting bacteria do not remain localised at the seat of entry into the body, but themselves, as well as their toxins, are taken up into the blood stream. In the circulating blood the bacteria multiply, so that the bacterial content of the body is added to in this way. Most cases of "puerperal fever" are examples of septicæmia.

3. **Pyæmia.**—The infecting bacteria enter the circulation as in septicæmia and tend to become further localised in various parts, setting up secondary foci of infection, these foci sometimes, but by no means always, undergoing *suppuration* and thus forming abscesses. Infective osteomyelitis and ulcerating endocarditis are examples of pyæmia.

It is obvious from these descriptions that a state of septicæmia includes toxæmia, but is more than this. Also that a state of pyæmia includes septicæmia, but is more than this. Of late years there has been a tendency, in teaching relative to the results of bacterial infection, to eliminate the notion of pyæmia altogether, and to speak of all cases in which there is bacteri-æmia as cases of septicæmia merely. But the distinction between the two conditions is really an important one, not only pathologically but clinically: it is a distinction made by nature, and therefore it demands a distinction in nosology.

In this account it will be convenient to disregard the fact that septicæmia presupposes toxæmia and that pyæmia presupposes septicæmia. It will then be possible to deal with each condition separately.

I. **Toxæmia.**—*Causes.* Any of the bacterial poisons are capable of producing toxæmia by absorption from the seat of manufacture. Much work has recently been done in reference to the nature of these poisons; suffice it here to say that they appear to be highly complex protein substances. They are customarily divided into two classes, the *exotoxins* (extracellular toxins) and the *endotoxins* (intracellular toxins). Exotoxins are soluble substances produced by bacteria and taken up readily by the body fluids without necessary disintegration of the bacterial cell body. Endotoxins reside in the bacterial cell body in an intimate form and require disintegration, and possibly actual solution of the protoplasm, in order to get into the body fluids. Instances of exotoxins are the poisons of diphtheria and of tetanus; instances of endotoxins are the poisons of the pyogenic cocci.

The important infective diseases in which the disease process is essentially of the nature of an intoxication in most instances are *diphtheria* and *tetanus*. In both of these diseases the exotoxins poison the tissues, especially the nervous tissues, and lead to the symptoms characteristic of the disease.

But any of the infective processes may take the form of a toxæmia: the gonococcus, streptococcus, pneumococcus, staphylococcus, *B. coli*, *B. typhosus*, *B. tuberculosis*, etc., may all act in this way—causing a focus of infection from which toxins are absorbed.

Diagnosis. From the more grave condition

of septicæmia this is only possible by exclusion in the case of those infections where both processes may occur (see *Septicæmia: Diagnosis*). In other instances the nature of the microbe isolated from the local lesion gives fairly ample guarantee that the morbid process is of the toxæmic kind (diphtheria, tetanus). *Until septicæmia is carefully excluded by blood culture it must never be concluded that toxæmia covers the morbid processes following upon infection by pyogenic micro-organisms.* The leucocyte count is usually much higher than in septicæmia, given that the causal microbe is one causing a leucocytosis.

Symptoms. Certain symptoms are common to intoxication by any bacterial poison; certain other symptoms are more or less specific to the particular poison concerned. The symptoms common to all forms are fever, rigors, "malaise," headache, pains in the limbs, frequent pulse and respiration, coated tongue with diminished digestive secretions, constipation (sometimes diarrhœa), and insomnia.

If the intoxication continues in its acute form the nervous symptoms may become more prominent—delirium or coma may supervene. The kidneys may be affected, leading to albuminuria and the presence of hyaline casts; or acute nephritis may develop.

The *typhoid state* is one of the forms of acute intoxication met with, but is by no means always due to infection by *B. typhosus*. It may follow infection by either of the *B. coli* group of micro-organisms or by the pyogenic cocci.

Treatment. The three cardinal principles of treatment are these:—(1) Removal of the infecting agent, whenever this is possible, by effective "drainage" or otherwise. (2) Specific neutralization of the poisons of the infecting agent. (3) Palliative measures of a non-specific kind directed towards increasing the elimination of poisons and supporting the nervous and circulatory systems. These three therapeutic measures will be dealt with fully under the next section to which they apply still more forcibly.

II. Septicæmia.—Causes. The essential causes of septicæmia are the same as those of toxæmia. But certain microbes are more likely to cause actual infection of the blood stream than are others. They are *streptococci*, *staphylococci* and *pneumococci*.

Symptoms. The symptoms are those of toxæmia, and the patient may not be more acutely ill than he is with the less serious disease. But whereas the initial rigor in an intoxication is not usually repeated, it is a feature in septicæmia that if rigors are present they recur periodically. The leucocyte count, as already mentioned, is apt to be less markedly

raised than in toxæmia. *Hæmorrhage* and *jaundice* suggest septicæmia rather than mere toxæmia.

Diagnosis. In the last paragraph some relative differential points are referred to as between mere toxæmia and septicæmia, but the absolute point of difference is the isolation (in septicæmia) of micro-organisms from the circulation. This investigation is one of supreme importance and has a significance, whether positive or negative, that cannot well be exaggerated. For the technique of blood-culture, see *Clinical Pathology*.

III. Pyæmia.—Causes. These are, again, the causes of septicæmia. But certain cases of septicæmia tend to focal inflammations induced by collections of the causal microbe; when these occur the term "pyæmia" is used to designate them. As a class the *staphylococcal* cases of septicæmia are prone to do this; but streptococcal and pneumococcal cases do the same not infrequently. If the *gonococcus* escapes from the urethra or uro-genital tract into the blood stream it is again prone to induce pyæmia.

Symptoms. In addition to the symptoms already referred to under toxæmia and septicæmia there are those produced by the foci peculiar to the condition. "Pyæmic abscesses" are likely to develop in certain situations more than in others—joints, glands, the pleural sac, the pericardium, the subphrenic region and the kidney; also at situations where pressure occurs—the sacral region. As already mentioned, suppuration is not an invariable sequel to the focal inflammations: these sometimes subside without abscess formation. In addition to the ordinary form of pyæmia there are two special forms of the disease, (a) *arterial pyæmia*, which is another name for ulcerating or "malignant" endocarditis, and (b) *portal pyæmia*, in which an infection of the portal vein occurs as a result of some lesion in the alimentary tract (appendicitis, gastric ulcer, dysentery, etc.), leading to abscesses in the liver; portal pyæmia is a synonym for suppurating pylephlebitis.

Diagnosis. This is made by the discovery of focal inflammations of a specific kind in a case of general blood infection. It is a notable fact that blood-culture very frequently fails to isolate micro-organisms from the circulating blood in pyæmia, especially in chronic cases, and this is a point of difference between pyæmia and septicæmia. The leucocyte count, however, is apt to be higher in pyæmia than in septicæmia.

Treatment of Toxæmia, Septicæmia and Pyæmia.—Reverting to the three cardinal therapeutic principles laid down under toxæmia, these will now be dealt with in detail.

1. *Localisation of the infecting agent to the*

site of invasion and its removal by "drainage." These are the first aims of treatment when the patient comes under observation. To secure localisation the patient is put to bed so as to rest the whole body, and the infected part is given special rest. If possible the infected part is fomented or poulticed or otherwise treated so as to induce local hyperæmia. When the infection takes place through the skin or a mucous membrane, indications for incision are the presence of considerable tension of the superficial parts, or the signs of suppuration. In doubtful cases it is advisable to make the incisions rather than to wait. Care must be taken to permit of free exit for pus or other products of local tissue necrosis; in dealing with abscesses the incisions must be efficient, gravity must be taken into consideration, and tubes or gauze of large size must be used. The same comments apply to the treatment of pyæmic abscesses. The utmost care must also be exercised to avoid secondary infection of the incised tissues, by proper aseptic precautions in all the operations and dressings. To emphasize the importance of *efficient drainage* in the treatment of local infections may seem unnecessary; but quite frequently this fundamental part of the conduct of a case is seen to receive but scanty attention, whilst an elaborate programme of specific therapy is perhaps at the same time being undertaken.

2. *Specific neutralization of the poisons of the infecting agent.* The means by which this can be brought about are the employment of *immune sera* and of *bacterial vaccines*. No definite rules can be laid down for the use of these remedies; individual cases must be dealt with on their merits. Speaking very broadly, it may be said that immune sera are of greatest service at the beginning of the infective process, when the tissues are impregnated with the specific poison; vaccines are of service at a later stage, when the tissues require stimulating in order to enhance the mechanism of immunity. In practice, therefore, it is best to use an appropriate serum, if such exists, promptly and liberally, and to follow this by small and perhaps graduated doses of an autogenous vaccine.

3. *Non-specific palliative measures—eliminative and tonic.* The condition of the bowels, kidneys and skin is of great importance for the elimination of the microbic poison. Hence proper attention to the functions of these organs is definitely indicated. The free use of soft drinking water is of the utmost importance. Abundance of fresh air is called for. The state of the nervous system is important, and depressing influences, whether due to drugs or otherwise, are to be avoided. The tone of the heart and vessels is to be maintained by plenty of

nutritious food, and stimulants are indicated in all but the most mild and short cases of infection. Fever is treated chiefly by hydrotherapeutic measures.

T. J. H.

ACUTE RHEUMATISM OR RHEUMATIC FEVER

Definition. An acute non-contagious fever, characterized by a tendency to multiple arthritis and inflammation of fibrous tissues. The causal agent is as yet unknown.

Present Conception of the Disease. Rheumatic fever is at present regarded by most authorities as an acute infection, and is usually so classed in the modern textbooks. We are, however, quite ignorant of the essential cause of the disease. The claims made on behalf of a "*diplococcus rheumaticus*" are not confirmed by the majority of pathologists, and there are great difficulties in accepting the view that the symptoms of the disease are manifestations of a mild pyogenic infection. It seems not unlikely that the infective agent will turn out to be an ultra-microscopic microbe which has hitherto, on account of its minute size and difficulty of cultivation, escaped observation. Analogies with certain known infective diseases, especially with scarlet fever and streptococcal infections, are extremely close, and no doubt the association of acute rheumatism with the streptococcus group of micro-organisms is an intimate one. But there is no good evidence yet to hand that the cause of the true acute rheumatic process is a streptococcus.

Etiological Factors. *Climate.*—The popular notion that humidity induces rheumatic fever is not supported by statistics. The disease is quite common in a country as dry as Egypt. *Season.*—The curve of incidence, so far as London is concerned, rises during the early spring and again during the early autumn. Newsholme has shown that the disease is most common during a series of comparatively dry years. *Heredity.*—This is certainly a factor; rheumatic families are almost as conspicuous as tuberculous families. *Complexion.*—Blondes are much more often affected than brunettes. Rheumatic families are chiefly blonde. A rufous complexion is the most common of all amongst rheumatic patients, and it is not an unusual thing to be able to pick out the rheumatic cases in the wards of a general hospital because of their complexion. *Occupation.*—Exposure to cold and heat, or to "chills," gives a predisposition to the disease. On this account, probably, *sex* influences the incidence somewhat, more males than females being affected if all ages are taken; up to the age of twenty the reverse is found to be the case. *Age.*—The height of the curve of incidence occurs between

ten and twenty; the next most common decade is from twenty to thirty. The disease, in its modified form, is quite common in little children. But it is unusual in persons over forty, and rare after sixty. If it occurs after thirty there is most often a history of one or more previous attacks, because, far from giving immunity to the disease, a former attack predisposes the patient to others.

Symptoms. The onset is usually abrupt, though a rigour is unusual. General *malaise* may be the initial symptom, or a sore throat, or pain in a joint—most often a knee joint. The temperature rises rapidly; the arthritis invades other joints and causes great pain, the disease evolving so promptly that by the end of the first twenty-four hours the patient is usually bedridden and very ill. The skin is moist and sweating is often profuse; the sweat is "acid" and of a pungent odour, more constantly here than in any other fever; but very similar sweat may be present in diseases that are not truly rheumatic. The urine is very concentrated, but is usually free from albumin unless the temperature is very high, when a faint cloud is present. The joints affected are chiefly the knee, ankles, wrists and elbows, but all the joints of the body may suffer. It is common for other joints to become involved as those earliest affected subside. Swelling, redness and pain are all present on examination of the joints, and the slightest movement intensifies the pain at once. The sore throat is seen to be due chiefly to a tonsillitis. The tongue becomes quickly furred but remains moist. Constipation is the rule. The pulse is frequent and soft. The blood shows a fairly marked leucocytosis (10,000 to 15,000), and there is rapid diminution of red cells and hæmoglobin. Examination of the heart frequently reveals a soft systolic murmur at the apex, whether or no acute endocarditis supervenes. The form of the temperature curve is irregular, often strikingly so, attributable perhaps to the frequency and abundance of the sweats. The usual range of the fever is between 100° and 103° before the effect of salicylic preparations is manifested; under treatment the defervescence is by lysis.

Course. Now-a-days the course of the disease is cut short by prompt administration of salicylate of soda or some similar preparation. It is usually, in these circumstances, from seven to fourteen days. Formerly, when the disease ran its "natural course," it lasted from four to six weeks, and many cases lasted still longer. Recovery, after somewhat tedious convalescence, is the rule. Fatal cases nearly always show one or more serious complications. The mortality in England appears to be about two to three per cent.

Complications. The seriousness of the disease

lies not so much in itself as in the tendency to cardiac inflammation as a complication, a tendency present to as high a degree as fifty per cent. Some authorities believe that the heart suffers by actual inflammation in every case of rheumatic fever.

1. **Endocarditis.**—This is by far the commonest complication. The mitral cusps are most often affected. The inflammation is apt to begin about the eighth day of the disease and is to be suspected if the temperature, after falling, rises again, or if there is increased frequency of the pulse and greater prostration; or if a soft systolic murmur develops at the apex.

2. **Pericarditis.**—Much less common, and not nearly so frequently seen nowadays as formerly. Endocarditis is usually present as well.

3. **Myocarditis.**—In some cases of endocarditis a certain degree of myocarditis is probably always present. And cases of "carditis," in which the whole of the heart structures become acutely inflamed, are by no means rare.

4. **Pleurisy.**—There is probably a true rheumatic pleurisy; i.e. a form of acute non-tuberculous pleurisy complicating rheumatic fever, and going on, not seldom, to serous effusion. Its existence prolongs the disease but does not add seriously to the prognosis.

5. **Pneumonia.**—The same cannot be said for pneumonia. "Rheumatic pneumonia" appears to be either collapse of lung, often associated with pleurisy, or infarction, or a pneumococcal infection complicating the disease.

6. **Chorea.**—The close association of chorea with rheumatic fever will be discussed under *Chorea* (q.v.).

7. **Nodules.**—Small subcutaneous lumps of young fibrous tissue of varying size, specially affecting the regions of the hands, feet, forearms, scapulæ, vertebræ and scalp. They are most common in children.

8. **Erythema.**—Various skin eruptions, chiefly of the erythematous type, occur not infrequently. But they are really much more commonly seen in subacute than in acute attacks. They are, again, common in children.

9. **Hyperpyrexia.**—A complication rarely seen now-a-days. The temperature rises somewhat suddenly, the patient becomes markedly prostrated and later stuporous, and the condition is apt to be fatal. Some cardiac complications are usually present.

Rheumatic Fever in Children.—The manifestations of the disease are somewhat different in children from those usually seen in young adults. In children it is not at all uncommon to find the arthritis latent, or even absent, the brunt of the poison coming upon the heart. This may lead to difficulty in recognition. The skin is often affected and, as already stated, nodules are more common than in adults.

Pleurisy and pneumonia (*vide supra*) are relatively more common.

Relapses. These are not uncommon and must be guarded against by avoiding haste in convalescence.

Recurrences. Rheumatic fever tends to recur, especially if the original attack occurs during childhood. This tendency is apt to continue up to the age of thirty years.

Prognosis. The disease is rarely fatal, and when it is, it is nearly always so in recurrent cases, where there is old-standing valvular disease. The seriousness of the disease, as already stated, is in the production of endocarditis which, failing to resolve completely, frequently goes on to the development of valvular disease.

Diagnosis. There is no absolute criterion of the disease—several infective agents may lead to the cardinal symptoms—therefore the clinical picture is apt to be mistaken for one or other of the following :

1. **Acute Infective Osteo-Myelitis.**—Not at all an uncommon difficulty in children. Here, however, the fever is generally much higher, the onset more abrupt, the tenderness and swelling are confined to one focus, and cardiac signs are absent. Blood culture may detect staphylococci in the blood.

2. **Gout** is occasionally accompanied by fever, sweating and general malaise, and the affected joints may be those most often inflamed in rheumatic fever. This may be so in patients impregnated by lead. The presence of tophi, one or more of which may form during the attack, and the failure of salicylates to do much to relieve the pain, are points of importance.

3. **Pyæmic Arthritis.**—The condition may be one of multiple "septic" arthritis. The variety most likely to cause confusion is *gonococcal arthritis*. Here the joints usually affected are, in addition to the knees, the metacarpophalangeal joints, which are not often affected in rheumatic fever; moreover, the joints are usually more red and definitely arthritic than in rheumatism, and with less synovial effusion. The fever is less high in proportion to the severity of the joint condition. In a doubtful case it may be well to perform joint puncture. This occasionally yields evidence of *streptococcal arthritis*, a much more serious affair.

4. **Acute Rheumatoid Arthritis.**—Unusual cases, but when they occur resembling rheumatic fever very closely. *In any case diagnosed as rheumatic fever, if the free use of salicylates has not reduced the temperature, joint swellings and pain very considerably by the end of the third day, the case is probably not of this nature.*

Treatment. 1. **General.** The patient is confined to bed in a long flannel garment and is put between blankets. His limbs are allowed

to remain in their least uncomfortable position, and the patient can often change his position, by his own efforts, slightly assisted, with less pain than if this is entirely done for him. The skin is frequently dried with soft warm towels and the nightdress changed whenever necessary.

2. **Diet.** To be chosen from milk, gruel, Benger's food and white soups made without meat "stock." When the temperature falls, porridge, bread and butter, rice and other farinaceous puddings and cream may be added; later, eggs, custards, stewed fruit, fat bacon, potatoes and vegetables generally. Fish and poultry still later. Meat late in convalescence.

3. **Local Treatment of Joints.** Hot dry wool, with bandages, is as comforting as most things. Oil of wintergreen or mesotan may be smeared on, or warm lead and opium lotion. But for the relief of pain we must look to the drug treatment, not to the local applications.

4. **Drugs.** Some form of salicylic preparation should be administered at once. Nothing is better than pure sodium salicylate, and it requires no adjuvant, as it is not unpleasant to take. For most cases ten grains dissolved in water should be given every hour for the first forty-eight hours, or an equivalent of this amount. Both amount and frequency may then be diminished, but the drug should not be altogether omitted for three weeks after the temperature becomes normal. Few, if any, other drugs are required for uncomplicated cases. Some authorities strongly recommend alkalies, and a few believe that large doses of sodium bicarbonate "guard" the salicylates and thus prevent undue depression. Others do not confirm this. Salicylates certainly do depress some patients, and occasionally lead to delirium. The dose must, in such few instances, be reduced. It is assumed that the pure drug is being used. The temptation to exhibit iron during the acute stages of the disease must be resisted; it is rarely well tolerated.

For the treatment of the complications see *Endocarditis, Pericarditis, Chorea*, etc.

T. J. H.

ANTHRAX

Anthrax is an epidemic disease of sheep, cattle, horses and deer. Though in Great Britain it is comparatively rare, scarcely a year passes that the papers do not contain an allusion to some small outbreak.

The *bacillus anthracis* is a large square-ended bacillus developing under certain conditions a median spore which is very resistant to heat and drying. The disease is transmitted by means of the bacilli or their spores to men who by their work are brought into contact with hides,

horsehair or wool from foreign countries such as South America, China and Russia, where supervision of animals is not so systematic as in this country.

There are three *clinical forms* of the disease—

1. Malignant Pustule, the commonest form.
2. Wool-sorters' disease—a form of very acute pneumonia following the inhalation of anthrax spores, and which is almost always fatal. In this country it is occasionally met with among the Bradford wool-workers.

3. Gastro-enteritis—due to swallowing the meat or milk of infected animals.

Clinical Characteristics of Malignant Pustule. It appears first as a small red spot on some exposed surface of the body, such as the neck, face, hands or arms. This spot soon develops into a small blister which bursts, leaving a little slough, and around it forms a ring of vesicles, with a surrounding area of inflammation and cedema. Such a manifestation, appearing in a worker in a horsehair factory or tannery, or in a porter engaged in carrying bales of raw hides, should awaken suspicion.

The *diagnosis* is made by collecting some of the vesicular fluid and submitting it to bacteriological examination.

A differential diagnosis is to be made from a pyogenic infection, such as a boil or carbuncle, and from vaccinia.

Treatment. A few years ago the treatment consisted in the immediate excision of the infected area; this has been almost entirely superseded by the injection of the serum introduced by Sclavo and known as "Sclavo's serum." If given in the early stages of the disease the beneficial results are manifest in a few hours. If fluid is taken at regular intervals from the vesicles it is apparent that active phagocytosis is going on, and usually after forty-eight hours or less no further growth of the anthrax bacillus can be obtained.

As regards local treatment the sore place only needs protecting with an antiseptic dressing.

G. E. G.

HYDROPHOBIA OR RABIES

Hydrophobia or Rabies.—Though the specific organism has not yet been demonstrated, there can be no doubt that this disease is due to an infection following on the bite of a rabid animal, such as a dog or cat.

Owing to wise muzzling orders and to stringent quarantine regulations in regard to the importation of dogs, hydrophobia is practically non-existent in this country, though it still flourishes in India. In the dog the condition is shown by its irritability and listlessness; the bark becomes hoarse, and ropy mucus collects about the mouth; difficulty in swallow-

ing and lapping is caused by paralysis of the muscles of the lower jaw and limbs, a condition shortly followed by death. If a person is bitten by a suspected animal it should not be killed until proof of madness has been established. If rabies is proved the patient must without doubt be submitted to Pasteur's treatment, which consists in a series of inoculations with a modified virus, whereby immunity is conferred on the patient and the disease aborted. Luckily the incubation period is so long (about forty days) that there is time for this method of treatment, which has proved eminently satisfactory, to be instituted. The immediate treatment of a wound from an animal suspected of rabies is cauterization, either with the actual cautery or by a strong chemical such as pure carbolic acid.

G. E. G.

GLANDERS

Glanders.—Glanders is due to infection with the *Bacillus mallei*. This organism takes the form of a straight or slightly bent rod about the size of the tubercle bacillus; it can be stained with watery solutions of the basic stains, such as methylene blue or carbol-fuchsin. The disease, though rare, is most commonly met with in the horse, and in man it is found in stablemen who have been tending a diseased animal. Infection gives rise to two types of disease—acute glanders and chronic glanders or farcy; in man the former is more common. There is nothing characteristic about the primary lesion, it is like any other pyogenic infection, such as a boil or pustule. The disease tends to spread rapidly, many pustules form, break down and give rise to irregular ulcers. In the pustular stage glanders may be mistaken for smallpox, and later the patient may manifest all the symptoms of septicæmia and pyæmia.

The *diagnosis* is established by the recognition of the bacillus in film preparations, cultures, and by injection of susceptible animals, such as the guinea-pig. The mallein test may be used for diagnostic purposes in animals, but it is not to be recommended for human use on account of the danger attached to it.

Treatment. General treatment is to be carried out on the same lines as in other infective diseases. There is no specific treatment other than that of vaccines.

G. E. G.

TETANUS

Tetanus is due to infection of a wound with the *Bacillus tetani*. This is a slender bacillus which forms a single large terminal spore, giving it the shape of a drumstick. Its normal habitat is garden soil, manure heaps and stable refuse. It is a strict anaerobe, and it is probably on this

account that the disease is so rare, though there is very little doubt that it must often be introduced into the body. The spores are highly resistant to heat cold and chemical agents, hence the extreme care that has to be taken in sterilizing such substances as culture media, catgut, etc.

Its action in the body is unlike that of many other organisms. The bacillus develops at the seat of infection, grows there and produces its toxins, which are responsible for the contractions and spasms characteristic of the disease. The toxins act on the nerve centres of the spinal cord, which they reach by way of the motor nerve fibres. Their effect on the motor ganglia is to render them hypersensitive, so that they are excited by mild stimuli which under ordinary circumstances would not affect them. The post-mortem examination of patients who have died of tetanus reveals little; the commonest lesions are congestion of the grey matter of the pons and medulla and lacerations of the muscles from the violence of the spasms.

Incubation Period. This is from seven days to three weeks. Roughly speaking, the longer period of incubation the better the prognosis.

Symptoms. Generally the first complaint is of stiffness of the muscles of the neck and face and difficulty in opening the mouth, hence the name "lock-jaw." The angles of the mouth become retracted and stiff, producing the "risus sardonicus." Soon the other muscles of the body become stiff, and to this tonic contraction are added clonic spasms, in which various groups of muscles or the whole body may be involved. These spasms are extremely painful when violent and may contort the body, producing opisthotonus, pleurosthotonus and emprosthotonus. The slightest stimulus, such as a noise, a touch, or attempt to swallow, may be sufficient to excite a spasm, and the condition of the patient is most pitiful, for he remains conscious to the last. The temperature is usually somewhat raised and the general signs of fever are present.

Treatment. This falls under three headings—

1. The prevention of the further manufacture of toxins by removing or destroying the site of infection, by purifying the local wound, or perhaps amputation of a finger or toe.

2. The injection of anti-tetanic serum. As in the case of other sera, its efficacy is uncertain, but as the disease is so fatal no chance should be omitted. If the disease is discovered early it should be injected into the motor-nerve trunk leading from the site of infection in order to "block" the toxins. If general spasms have set in, showing that the spinal nerve centres are involved, it should be injected into the spinal canal, either in the upper or lower part according to the centres chiefly affected. Subcutaneous

injections are of little value. Of the various sera on the market, Tizzoni's is the one that has proved of most value. A large quantity (60 c.c.) should be injected at once, and smaller doses may be repeated for the next few days.

3. Confinement to bed in a darkened room and the avoidance of all external stimuli. If the spasms are very severe, chloroform may be used to allay them.

Prophylactic Use of Serum. It has been suggested that whenever a dirty lacerated wound is met with, small prophylactic doses of serum should be given. On account of the rarity of the disease in this country the suggestion is not often acted on. G. E. G.

ACUTE GONORRHOEA

Gonorrhœa is a contagious disease, and except in the rarest of cases in adults is conveyed directly by sexual intercourse, in children usually by the use of infected material, towels, etc., and in infants at time of birth from vaginal discharge of the mother.

Bacteriology. An organism called the gonococcus was discovered in 1879 by Neisser, as being the cause of gonorrhœa. It is a diplococcus, found in the pus, usually in groups, some of which are intracellular. It is gram-negative but stains well with Pappenheim's stain (carbol-pyronin-methyl green), Loeffler's methylene blue, etc. It grows well on blood agar and ascitic agar, especially on the latter when the fluid has not been sterilized by heat.

In systemic infections the presence of a specific antibody can often be demonstrated in the blood by means of the Bordet and Gengou complement fixation test, using an emulsion of gonococci obtained by culture as the antigen.

All attempts at producing immunization have failed.

The *incubation period* is usually two to six days, although sometimes as many weeks. This may be explained by the fact that gonococci can exist on the mucous membrane of the genitals and only become pathogenic when the patient gets run down, etc., as they have been known to disappear without giving rise to gonorrhœa; a more common occurrence in women than in men. Another explanation is, that the patient has had the disease before, and that the present outbreak is a recrudescence of an old infection and not a fresh attack.

Urethritis.—The first signs noted are that a few hours after passing water the urethra contains a greyish-white viscid fluid, the meatus is reddened and swollen, but the urine is clear. A few days later the secretion thickens and the patient notices a discharge. Micturition

now causes scalding, and at night erections are frequent and excruciatingly painful. The inflammation, which begins at the orifice, now extends backwards along the penile portion, and by the end of the second week the infection has reached the bulbo-membranous junction. The bulbous portion of the urethra being inflamed, pressure on the perineum causes pain. At this stage two courses are possible. Either the inflammation remains localised to the penile and bulbous portions in front of the triangular ligament, and constitutes an *anterior* urethritis only; or it may spread back to the membranous and prostatic portions, constituting a *posterior* urethritis.

In anterior urethritis the symptoms begin to subside at the end of the third week, and have, with the exception of a slight tingling sensation on micturition, disappeared by the end of the fifth. So long as there is a discharge the urine appears turbid when passed. Unless treatment is started early and with irrigations most patients will develop a posterior urethritis. The chief symptom which distinguishes a posterior from an anterior infection is frequency of micturition, which compels the patient to get up two or three times in the night. In employing the two-glass test the urine in the first glass only will be turbid in acute anterior urethritis, and in both in acute posterior urethritis. If a patient passes turbid urine in both glasses and does not have to get up in the night to micturate, the turbidity is almost certainly due to phosphates, which disappears on adding acetic acid.

Treatment of Acute Urethritis—

1. *Hygienic.* First of all rest, both to the part—by wearing a suspensory bandage—and to the person. Bed is seldom necessary, but active exercise must be forbidden. Alcohol must be strictly avoided, and hot foods and condiments—mustard, pepper, sauces, etc.—should not be taken.

2. *Symptomatic.* Pain can generally be diminished by diluting the urine by drinking more milk and water. Decreasing the acidity of the urine by drinking lime water often affords relief. For the acute pain caused by spasm of the compressor urethræ muscle, nothing is better than a warm hip bath, which at the same time relieves the retention, if present. If there is hæmaturia the patient should remain in bed until hæmorrhage has stopped, and cold evaporating lotions be used on the penis.

3. *Local.* Two courses are open: giving, by mouth such drugs as are excreted through the urethra, and direct application of drugs to the urethra itself. The drugs usually given internally are resins and balsams like cubebs, copaiba, sandal-wood oil, etc., the last being the best;

but all are of extremely little value and less useful than sulphate of magnesia, which keeps the bowels well open—which is a most important point in the treatment of gonorrhœa. In acute posterior urethritis nothing is better than sodium salicylate.

For direct application to the urethra potassium permanganate 1 in 4,000, or until the solution is of the colour of red blotting-paper, is the best all-round drug. The abortive treatment by injections three times a day for three days, with either silver nitrate two per cent., protargol three to five per cent., or argyrol ten to twenty-five per cent., may be tried, but usually with very little success and a great deal of pain. It is seldom that a case is seen early enough for the abortive treatment to be successful.

No injections should be given until the pain, redness and œdema of the penis have disappeared. They should then be employed twice daily until the discharge has ceased and for at least ten days after. In quite a large number of cases this will result in cure. The old fear of driving the disease back by using injections is theory, not practice. In anterior urethritis the solution injected goes only as far as the triangular ligament, and returns through the meatus. In order to wash out the whole of the urethra and bladder, which is necessary in acute posterior urethritis, either the column of fluid must be raised higher, or the return opening in the glass tube, which should only be inserted into the meatus, must be stopped up. In both cases about one to two pints should constitute a good wash out. The solution should always be warm, and the three best drugs to bear in mind are potassium permanganate, hegonon and protargol.

The infection may not remain limited to the urethra, but extend into the cavernous and spongy tissue by way of the glands of Littre, giving rise to swellings which may remain to become hard (fibrous tissue) later or develop into an abscess. When the gonococcus is present by itself and not in contact with air, the inflammation caused thereby is far more likely to develop into fibrous tissue than into an abscess. If an abscess forms it often resolves without bursting externally, or if it does, curiously enough, a penile fistula is seldom the sequence. Therefore such abscesses should never be prematurely opened, but reliance placed on cold evaporating lotions and as small an opening as possible made when the abscess actually points. When the urethral follicles in the region of the meatus are affected fistulæ on either side of the meatal orifice very frequently form (paraurethral fistulæ). They can only be closed by electrolysis. Paraurethral fistulæ are also found in the female.

An anterior urethritis extending backwards may affect the ducts of Cowper's glands and then the glands themselves. Acute cowperitis causes the patient acute pain only during the act of sitting down and getting up. Fortunately suppuration is very rare.

The next structure to be affected is the prostate gland, which when once involved may be the root of all future gonorrhoeal complications for years. The gland is the harbour of the gonococci, and it is through the rich veins and lymphatics which surround it that the organisms gain entrance into the system.

Acute prostatitis is usually associated with high fever and great pain when the abdominal muscles are put into action, as in defæcation, etc. Abscess formation is not very uncommon, and in the majority of cases these open into the urethra, with immediate relief to the patient and very often with apparent spontaneous recovery. When an abscess forms other organisms are usually to blame, and, as stated before, their presence kills the gonococci.

If the abscess does not burst and examination per rectum reveals a tender swelling with one or two soft spots, the abscess should be opened per rectum, but not until it is absolutely necessary, for although a fistula is hardly ever left, many cases will resolve by merely keeping the patient in bed and inserting a psychrophore in the anal canal.

Cystitis.—Gonococcal cystitis is regularly mentioned in textbooks, but it is extremely rare. The chief diagnostic sign from acute posterior urethritis, which cystitis simulates exactly, is the pain over the pubes which is so constantly complained of in the latter condition.

Gonococci can only thrive in an acid medium, therefore the urine in a fresh case of gonococcal cystitis is acid, but within a few days the bacillus coli communis gains the ascendancy, makes the urine alkaline and kills the gonococci.

Although no doubt the infection may spread up the ureters, causing a ureteritis, and when reaching the kidney a pyelitis, it is more common for renal complications to follow a hæmatogenous infection. There is a complication, more common than appears from the literature, that follows direct extension, viz. spermatoecystitis. The subjective symptoms vary to such an extent that upon them alone a diagnosis is impossible. Some patients complain of tenesmus in the urethra, others in the rectum, pain in the perineum, painful ejaculations, and itching in the urethra which increases sexual desire; priapism has been known to occur. To make the diagnosis certain a swelling must be felt per rectum above the prostate, the expressed secretion from which contains gonococci and dead or altered spermatozoa.

If an abscess bursts it is usually into the rectum

or into the urethra, but cases are on record of rupture into the peritoneal cavity and bladder. The other genito-urinary complication is epididymitis, and this is of the greatest importance, because, if bilateral, it usually renders the patient sterile. If the gonococcus alone causes the epididymitis no pus is formed, but after the acute inflammation, which causes a swelling of the structures in that half of the scrotum with an exudation of fluid into the tunica vaginalis, has subsided a hard round marble-like swelling is felt in the epididymis; this being composed of fibrous tissue, which as it contracts obliterates all the tubules.

If an abscess forms—a very uncommon result—then a super-infection is to blame. The skin becomes adherent to the epididymis and the abscess points externally. When this is the case it should be opened by as small an incision as possible and washed out frequently with saline solution. Usually it heals very quickly. It is seldom that an abscess in the epididymis bursts otherwise than through the skin.

The treatment of epididymitis is to put the patient to bed, suspend the testicles, use cold evaporating lotions freely, give sodium salicylate internally and let the patient go on with his urethral injections.

If both testicles, or only the functional one, are affected either of the following two methods of treatment should be at once resorted to—preferably the former.

1. The moment the epididymis is enlarged and inflamed, take the scrotum into the hand, make the skin tense over the epididymis and plunge a scalpel into its substance, in its long axis; the pain is momentary, but the relief which so quickly sets in is enormous. Then treat in the usual way with lotions, etc.

2. Inject into the epididymis 1 to 2 c.c. electrargol (Clin. Paris). The epididymis reaches its normal size in one to three days, and only occasionally is a second injection necessary (Asch's method). It is nearly always possible to say when a patient is going to get epididymitis, because the urethral discharge lessens, and the two urines, which are one day turbid, typical of an acute posterior urethritis, the next day become quite or almost clear, the patient may consequently imagine that he is cured.

Adenitis.—Much stress is laid upon enlarged glands in the groin being diagnostic of syphilis. Enlarged in their characteristic way they certainly are, but in nearly every case of gonorrhoea the glands become enlarged and are frequently painful, but not hard. They may even suppurate, but this is probably due to a mixed infection with other organisms.

Balanitis and Phimosis.—If the foreskin is

long the gonococcus becomes pent up in the sulcus coronarius, and the pus so produced causes inflammation and oedema of the prepuce, which may spread along the skin of the penis. If allowed to continue the prepuce may become gangrenous and slough. At the same time the glans becomes acutely inflamed, and small, superficial irregular ulcers, or rather erosions, quickly form on the surface and on the inner lamella of the prepuce. Circumcision should be advised if there is any likelihood of posthitis occurring, or the prepuce should be drawn back three or four times a day and both the under surface of the prepuce and the glans should be well bathed with a weak creolin lotion (one drachm to two pints). The pus which collects in the sulcus coronarius, although primarily due to the gonococcus, is caused mainly by a mixture of streptococci, staphylococci and diphtheroid bacilli, the presence of which destroy the gonococci, but continue the mischief started by the latter.

Paraphimosis.—In the acute stage of gonorrhœa paraphimosis externa is not at all uncommon, caused by oedema of the prepuce and the pent-up pus in the sulcus coronarius. It occurs mechanically, and is not due to the patient having drawn back his foreskin and being afterwards unable to draw it forwards again.

If attempts at reposition fail, then the best treatment is to remove the incarcerated portion of skin and stitch the edges together.

If necrosis has already occurred the less done the better; all that is necessary is to use cold evaporating lotions to reduce the inflammation and swelling, antiseptic lotions to get rid of the discharge and powders to keep the necrosed area as dry as possible, leaving the rest to nature to take as much as she wants.

Systemic Complications.—Although systemic infections are almost invariably associated with a posterior urethritis in which the prostate is affected, this gland being the door through which the organisms gain entrance, toxic manifestations may occur when the inflammation is limited to the anterior part of the urethra, and patients with other troubles—indigestion, neuralgia, etc.—not infrequently have these aggravated. These toxic manifestations are usually limited to the ligaments and joints, and pain is complained of, without there being any swelling or gross lesion which can be detected. The systemic complications are arthritis, iritis, endocarditis, etc.

Arthritis.—Any joint may be affected, the knee most commonly and the sterno-clavicular joint most rarely. Several joints may be involved at the same time, but a point almost diagnostic of gonococcal arthritis is that pain is first experienced in a joint; swelling then quickly

follows, which may subside or last for weeks and months. Then another joint follows suit, in which usually the pain and swelling, if any, of the latter lasts a few days only, and the inflammation finds its way again to a joint not yet affected. A frequent concomitant symptom of arthritis is pain anywhere in the feet, but usually most marked about the heel.

A gonococcal joint should always be treated with the greatest care, since suppuration is not very uncommon, leading to complete destruction and bony ankylosis in an incredibly short time. Absolute rest is essential, and many joints will get well with this and cold applications alone. The local urethral treatment should never be neglected, and especial attention should be directed to the prostate. Vaccines may be extremely useful, as indeed, in any systemic infection and in gonorrhœal prostatitis, epididymitis, etc., but they are valueless when the disease is limited to the urethra.

The vaccine should be made from a fresh culture and be not more than six weeks old. Stock vaccines are useless. An autogenous is more powerful than a heterogenous vaccine. The initial dose should not be more than five millions, and this dose should only gradually be increased weekly until the patient is cured.

Iritis.—Probably all cases of rheumatic iritis are of gonococcal origin. One eye or both may be affected. Like all gonococcal complications the condition is very prone to relapse.

Gonorrhœa in the Female.—The infection usually starts in the urethra, which quickly clears up and very rarely leads to cystitis. The vulva is then affected, when the organisms readily gain entrance to Bartholin's glands, and not infrequently cause an abscess. Although the gonococcus is conveyed up the vagina to the cervix a true gonorrhœal vaginitis probably does not exist. The presence of the organisms in the cervix gives rise to a constant discharge which is extremely difficult to cure. It often spreads farther, involves the Fallopian tubes and may even give rise to a general peritonitis. Other complications are not so common in the female as in the male.

The treatment consists in constant douching with antiseptic lotions and daily local applications of protargol, two to five per cent., to the cervix, if it is affected.

Gonococcal Ophthalmia.—In infants, whom it most commonly affects, both eyes are almost invariably involved, while when adults are affected the disease is usually limited to one eye. The difference is probably due to the presence of the bridge of the nose in the latter. In both the progression is very rapid, leading quickly to blindness. In no condition is it more true that prevention is better than cure,

and all infants immediately after birth should have either a five per cent. solution of protargol or a ten per cent. solution of argyrol dropped into their eyes. Adults with gonorrhœa should be warned never to put their fingers to their eyes.

Treatment must be prompt, and if only one eye is affected the other should be at once protected by a Buller's shield. The affected eye should be almost hourly washed out with a ten per cent. solution of argyrol.

Gonococcal Vulvo-Vaginitis.—The infection is usually conveyed to little girls by the mother's fingers or on towels, and it very quickly spreads from one individual to another. Girls over fourteen years of age usually escape.

The condition is extremely difficult to cure and the treatment is limited to antiseptic baths and injections. J. E. R. McD.

GONOCOCCAL ARTHRITIS

Gonococcal Arthritis may occur in infants and adults; with the latter the condition is more common in men than in women.

Infants. Gonococcal arthritis in infants follows a gonococcal conjunctivitis, and is by no means an uncommon complication. The joints most commonly affected are the knee, hand and foot, the affection being ushered in with a rise of temperature and swelling, pain and redness of the joint or joints commencing as a rule two or three weeks after the conjunctivitis started. The prognosis is good.

Children. Although rarely mentioned, mono- and poly-articular arthritis may follow gonococcal vulvo-vaginitis of children. The most common joint to be affected is the knee, and then the same joints as are affected in infants and adults. As the gonococcal arthritis of infants sets in about the third week after infection, the time when the disease is at its acme, the same is the rule in children. This is often a diagnostic sign, but of still greater value is the simultaneous implication of tendon sheaths—gonococcal teno-synovitis. Both in infants and children the arthritis is metastatic; that is due to the presence of gonococci which have reached the joint through the blood stream.

Adults. In adults the arthritis may be mono- or poly-articular, and the signs may vary from simply pain in a joint to suppuration with complete destruction thereof. So protean may the symptoms of gonococcal arthritis be that there is no one diagnostic point which will enable a diagnosis to be made between this or any other infection. Pain without swelling in one or several joints is not an uncommon complication of acute anterior urethritis, and is no doubt due to the gonotoxin. Pain with swelling and fluid in the joint is usually asso-

ciated with either an acute or chronic posterior urethritis with the simultaneous implication of the prostate gland, and is a metastatic infection, the gonococci reaching the joint either through the blood or lymph stream, gaining access thereto by the plexuses surrounding the prostate.

Pain is not necessarily a feature of gonococcal arthritis, for a joint, most commonly one or both knee joints, simultaneously or at different periods may suddenly swell, due to the presence of fluid, without giving rise to any subjective symptoms—the so-called hydrops articuli. The amount of fluid exuded may be so great as to cause a flail joint. The fluid may either disappear as quickly as it came or remain indefinitely. The fluid withdrawn is perfectly clear and contains no pus cells.

The commonest gonococcal joint affection is the arthritis serofibrinosa. Pain and swelling of the joint set in, with fever, and the patient usually looks very ill. After the first attack the joint may become restored, but what most frequently happens is that the patient gets recurrent attacks, which cause a thickening of the capsule and surrounding ligaments, with a great restriction of the joint's mechanism. Further, owing to the presence of fibrin, adhesions commonly form. At any time the fluid may become purulent; this may cause either destruction of the periarticular structures or complete destruction of the joint itself, with resolution in bony ankylosis. When several joints are affected it is more common for one joint first, and then another when the former has quieted down, to become involved, than several joints at the same time.

If an affected joint becomes chronic it is not uncommon for changes to supervene which are indistinguishable from the so-called rheumatoid arthritis—a disease not *sui generis*, but a condition which is usually caused by a chronic infection of several organisms.

After the knee the tibio-tarsal joint is most frequently affected, then the wrist joint, finger joints and metatarsal joints. In none is the condition more chronic or persistent than in the tibio-tarsal joint, for the reasons that the tendon sheaths round about are generally involved and because adventitious bursæ almost invariably arise. The shoulder joint is not uncommonly involved, but rarely severely; the elbow joint is quite frequently the only joint affected; the hip joint fortunately usually escapes, but when it is involved, destruction with subsequent bony ankylosis has generally to be feared.

Glandular enlargements may occur in the region draining any joint affected, but they are always most noticeable with gonococcal arthritis of the hip.

The mandibular joint is involved more often than the sterno-clavicular, but neither so frequently as the textbooks would have us believe.

The vertebral joints may not escape, and pain in the lumbar region simulating lumbago is not at all infrequently experienced.

Owing to the fact that in many cases the aspirated fluid from a joint has not revealed the gonococci, it has been assumed that the arthritis was not of gonococcal origin. Although gonococci may be found in the fluid they are most abundant in the superficial layers of the granulation tissue, which it is seldom possible to examine. In a cold abscess the tubercle bacilli are not found in the pus but in the walls of the abscess. Again, a joint primarily infected with gonococci very quickly becomes secondarily infected with streptococci and staphylococci, the mere presence of which tends to exterminate the gonococci; when a joint suppurates the suppuration is dependent not on the primary but on the secondary infection. Systemic gonococcal infections give rise to the formation of antibodies, which can be demonstrated by means of the Bordet and Gengou reaction, the employment of which is extremely useful from a diagnostic point of view in a doubtful case. The antigen used is an emulsion of gonococci which have not grown for more than forty-eight hours; about 300 to 400 million gonococci to one c.c. being the strength.

Treatment. First and foremost, treatment should be directed to the urethra and prostate or other source of infection. Internal medication is practically limited to sodium salicylate and potassium iodide, but quinine is occasionally of use. The best general treatment is vaccination, concerning which the following points should be acted upon when possible.

1. An autogenous is better than a heterogenous vaccine.
2. The vaccine must be freshly prepared from a culture which is not more than forty-eight hours old.
3. The first culture is better than subcultures.
4. Heat should not be used to sterilize the vaccine, as it destroys the potent qualities thereof.
5. The primary dose should not be more than five millions; which dose is gradually increased as the patient improves.
6. If the patient does not react or improve, increasing the dose is hardly likely to benefit; it is then better to make a vaccine from the prostatic secretion, which may contain diphtheroids, streptococci and staphylococci; the affection being due to, or kept up by, this secondary infection.

The local treatment in the acute stage is

rest; in the subacute, antiphlogistic measures should be adopted with the aim of bringing about absorption of the fluid. This is best achieved by painting with iodine or alcohol poultices and the free use of massage and baths. For chronic cases hot-air and hot-water baths, with active and passive movements of the joints, are the best forms of treatment. In all forms Bier's treatment may be of the greatest use. When pus is present in a joint, operative measures must be undertaken, and the joint washed out continuously with saline.

J. E. R. McD.

PULMONARY TUBERCULOSIS

Etiology

Historical. From the days of Hippocrates (b. 460 B.C., d. 357 B.C.) human tuberculosis has been known to exist. As to its prevalence, however, there is but little information, and no doubt under the term "phthisis" many diseases were included which were not tuberculosis. Except in its later stages the words "phthisis" and "consumption" are not descriptive of the disease.

Since the term "tuberculosis" indicates a definite pathological entity, it would be well always to adopt this title, prefixing the anatomical situation of the lesion, so that "pulmonary tuberculosis," for example, invariably should be held to mean "tuberculosis of the lungs," whilst the older terminology may be allowed to fall into disuse. In addition to the nomenclature advocated being correct, the fresh knowledge at our command will be more easily understood, and the heavy stigma of being styled "consumptives" which is so often felt by patients afflicted with the disease will be removed.

The earliest descriptions of the disease associate its symptomatology with blood-spitting, cough, wasting, fever and bulbous fingers. The inclusion of this latter sign strongly suggests that many non-tuberculous cases, such as bronchiectasis, etc., were included in the original classification. In the present day clubbing of the fingers is seldom seen in patients with definite pulmonary tuberculosis.

The Tubercle Bacillus. The disease is due to infection by the tubercle bacillus, which was discovered by Robert Koch in 1882. He was at this time able to obtain pure cultures, and all the work since done has confirmed the accuracy of his discovery.

From this it follows that the sole cause of pulmonary tuberculosis is the tubercle bacillus. This organism grows most readily on Dorset's egg medium; it will also reproduce itself on

agar-agar, or bouillon to which has been added five per cent. glycerine, at a temperature of 38° C.

It is non-motile and is a parasite, having no other habitat than man or animals.

There are various forms of the bacilli, some short, others long. In addition there are differences in virulence and in strains.

The bacilli are difficult to stain, owing to the large amount of fatty matter present; but, once stained, they are difficult to decolorize, and this feature makes it possible to distinguish them from the majority of other bacilli, so that this characteristic can be depended upon in the examination of what is definitely *known to be* sputum. The technique of Ziehl-Neelsen carbol-fuchsin staining is as follows:—A thin film is made of the suspected sputum, which is then “fixed” by passing the slide three times through a Bunsen or other flame. The stain made as below is next poured on to the slide—

Saturated alcoholic solution of fuchsin, 11 parts.

Aqueous solution of carbolic acid five per cent., 100 parts.

The slide is then warmed for about five minutes until it steams. It is now decolorized and washed, the decolorization being effected by twenty-five per cent. hydrochloric acid.

Since acid does not affect the staining of the tubercle bacillus, it is therefore termed “acid fast.”

The specimen is next counterstained in Löffler's methylene blue for about twenty seconds; when dry it is ready for the microscope. The bacilli appear as red rods on a blue field.

It should not be overlooked that a negative examination is not of much importance, for Klebs states that sputum in which no bacilli could be demonstrated produced tuberculosis when inoculated into animals.

It is quite a frequent occurrence to have to examine sputa four or five times before finding bacilli, and I have known them to be found only on the twentieth examination.

The tubercle bacillus is killed when the boiling-point of water is reached; it, however, can live for many months under favourable conditions, but it is killed in a few hours if exposed in a thin film to the sun's rays. It is more resistant to heat when dry than when wet.

Formalin and carbolic acid also kill the organism, if they come in direct contact with it, but this, of course, is not the case with a lump of sputum, since only the superficial bacilli are rendered inert.

Disposing Influences. There are naturally many disposing influences which, by lowering the general resistance of the body, render it

a more easy prey to the bacillus. Such causes are living unhealthy indoor lives, want of sleep, septic teeth and gums causing indigestion and interference with nutrition—in fact any chronic disease may dispose to tuberculosis.

Occupations which claim an unduly large proportion of victims have often had the reason of the prevalence wrongly attributed. For instance, laundresses have been said to have become ill from the steamy atmosphere, whereas the sputum on the handkerchiefs in the dirty sorting-room is a much more likely cause. Barmen, too, are said to have had their resistance lowered by alcohol, whereas their duty of sweeping and cleaning a room that has been shut up all night with sputum drying on the floor has been lost sight of.

On the other hand, outdoor occupations are supposed to prevent tuberculosis, but the most likely conditions for infection out of working hours are frequently overlooked, and many outdoor workers contract tuberculosis.

Sources of Infection. The chief source of infection is dried sputum carried by air currents. Such sputum is often distributed by handkerchiefs. Another avenue of infection is afforded by the ingestion of milk and butter from tuberculous cows.

The part played by milk is difficult to estimate, because adults seldom drink milk which has not been at a temperature of over 160° F., owing to the fact that they usually drink it mixed with tea or coffee.

The United States Department has collected statistics showing that of 775 samples of butter tested, twelve per cent. were found to contain virulent tubercle bacilli, and it was also ascertained that these bacilli could remain virulent for at least ninety-nine days.

In this country milk can be fairly well controlled, whereas our butter comes from all over the world. These facts are significant, and help to explain the finding of the Royal Commission on Tuberculosis on the third question, as to whether or not the disease can be transmitted from animals to man, which runs as follows—

“That a considerable proportion of the tuberculosis affecting children is of bovine origin, and is due to cows' milk.” It would appear possible, therefore, that practically all persons are exposed to bovine infection in childhood, and either contract bovine tuberculosis or obtain immunity to that disease.

From tuberculous meat the risk is small, as all meat which has changed from the bluish colour of raw meat to the bright red of “underdone” has passed the temperature of 170° F.

The findings of the Royal Commission on two of the three questions left to them are—

1. “That with regard to the disease in animals and man being the same, there does not appear

to be sufficient evidence for answering it in the affirmative."

2. "That whether animals and man can be reciprocally infected," they report that with the exception of avian tubercle they can be so infected.

Infection may occur by inhaling the bacilli or by swallowing them; which method is the commoner has not yet been settled. Probably inoculation rarely occurs. Personally I do not believe in children being born with tuberculosis. A child born in a house with one or both parents suffering from the disease is born into a hot-bed of infection, and it is hardly surprising that tuberculosis develops. This is a much more likely explanation than heredity. On the other hand, children born of weakly parents are often apt to be weakly, and therefore more liable to contract disease than those children who are robust.

Undoubtedly many points of the etiology remain unknown. We have, however, some very concrete facts to work upon. We know the cause of the disease, we know the methods of infection, we know the conditions which favour the growth of the bacilli, and what is best of all, we know how to prevent this disease, and of no subject is the old adage more true that "Prevention is better than cure."

Symptomatology

Causes of Lung Symptoms. In order to realize the full value of symptoms it is advisable to give here a brief outline of their causes. In the past too much attention has been focused on the pulmonary condition, to the exclusion of other symptoms which are at least of equal importance.

It is doubtless true that the bacilli act on the tissues of the lung, and so actually destroy the area available for respiration. In the lung, however, there is such a large reserve area that this destructive action is but little noticed by the patient unless it becomes extensive, when it causes dyspnoea. This constitutes the local action on the lungs.

While the bacilli are in process of active attack upon the lung tissue, substances are produced which, passing as they do into the blood stream, have an influence on the general health of the patient. These bacterial products usually give rise to many symptoms long before any extensive destruction of the pulmonary area occurs. Such bacterial products are influenced by rest and exercise.

The connecting-link between rest and exercise and the control of movements is, so far as is known, the quantity of blood going to the lungs in response to the mobility of the body. It follows that diminished blood supply (rest) tends to decrease these bacterial products,

whilst augmented blood supply (exercise) tends to increase them. Hence there are two sets of effects which have to be considered, namely the local and the general.

(a) *Local symptoms* caused by pathological changes in the lung tissues. They are interpreted by the physical signs ascertained by examination of the chest, or by means of the Röntgen rays.

(b) *General symptoms* are produced by absorption of bacterial products into the general blood stream, being evidenced by variations in the temperature and general health of the patient.

Acute Miliary Tuberculosis. This almost invariably follows as a secondary disease from a primary infection. It is sudden in onset, with pyrexia, general malaise, dyspnoea, slight or no expectoration and rapid pulse. On examination of the chest the chief signs are those of acute bronchitis over one or both lungs. The temperature remains high, and there is frequently profuse sweating. The tuberculous process usually becomes disseminated over the body, and the termination is generally fatal by meningitis. The course of the disease is rapid, and the patient dies, as a rule, within three months from the onset, the body, however, usually appearing well nourished until the end.

PULMONARY TUBERCULOSIS—ONE DISEASE ONLY

Hitherto it has been the custom to classify pulmonary tuberculosis into three divisions—

- Acute pulmonary tuberculosis.
- Subacute pulmonary tuberculosis.
- Chronic pulmonary tuberculosis.

These divisions, however, cannot be said to have now the significance which formerly was attached to them. Apart from acute miliary tuberculosis of the lungs it is difficult to classify the most ordinary cases under the above headings, since, on one day the temperature may be 102° F. and the disease therefore "acute," whilst ten days later the patient is found to be doing six hours' hard manual labour with normal temperature, and the condition is of the chronic type.

For practical purposes the only classification that will serve is the following one—

1. Disease active.
2. Disease inactive.

Activity of disease can be determined by constitutional symptoms and physical signs; inactivity can only be ascertained by tests to be described later under the heading of *Treatment*. The following instance will afford an explanation for the moment the differences indicated. A patient may be "inactive" as

long as he is in a bath chair, the inactivity being determined by want of signs or symptoms; but let this patient walk six miles, and so influence the bacterial products by increased blood supply, then his temperature will rise to 100° F. with symptoms. He is now said to be "active," whereas in the bath chair he was "inactive." A truer classification for such "inactivity" would be "potential activity."

It has been usual to describe an exacerbation of temperature and increase of signs and symptoms in ordinary pulmonary tuberculosis by the term "acute." When the temperature is normal it is termed "chronic." The disease is the same and the only question involved is that of activity. The deaths of most persons afflicted with pulmonary tuberculosis occur after several weeks of fever, and the disease does not then appear as "acute" pulmonary tuberculosis on the death certificate, although post-mortem evidence would show a recent acute spread.

In consequence there is but one form of the disease to describe, and its symptoms vary with its activity or inactivity.

Onset. The onset may occur in many forms. It may be insidious, the after-effect on the patient being that quite unconsciously he loses weight and his general health is below the usual standard. Later there is slight cough with sputum; this may contain bacilli, but as yet no physical sign can be detected. This condition often goes on until the patient makes some extra exertion and exerts such influence upon the bacterial products in the lungs that a larger dose is poured out than can be dealt with by the blood fluids. The result is a toxæmia, accompanied by rise of temperature, general malaise, loss of appetite, pains in the limbs, and symptoms precisely similar to those of influenza. This condition is sometimes followed by pleurisy with effusion. Consequently many patients believe influenza to be the beginning of their illness.

Earliest Physical Signs. The earliest definite signs of tuberculosis of the lung are slight impairment of note at one apex, together with feeble respiration and often bronchial breathing. When the patient is made to cough and take a breath, some slight crepitations can frequently be heard. Such signs localised in this region are almost invariably due to tuberculosis, and this suspicion increases if lassitude and loss of weight are present, even though there is no fever. From the patient's point of view the best symptom is an hæmoptysis when he is feeling quite well. The occurrence of this symptom frequently causes the sputum to be examined, and bacilli may then be found. The presence of the bacilli alone may not convince the patient of the necessity for treatment, but

the fear induced by the hæmoptysis will generally overcome his reluctance. If no signs or symptoms are evident hæmoptysis should not be said to be non-tuberculous without the strongest evidence to the contrary, for in most cases the disease develops later.

From the point of view of differential diagnosis the only other disease likely to cause genuine hæmoptysis is bronchiectasis. In tuberculous hæmoptysis the quantity of blood expectorated is usually small, from one to five ounces, whereas in cases of bronchiectasis it is more often a pint and is frequently repeated in large quantities. Repetition such as this is much rarer in pulmonary tuberculosis.

Fever. The presence of fever is evidence of bacillary activity and indicates that large quantities of bacterial products are entering the blood from the lungs.

The temperature chart, the extent of lung involved and the sex of the patient must be considered in conjunction with the constitutional disturbances. In men, a mouth temperature of 99° F., together with the slightest feeling of malaise or headache, is an indication of distinct activity, 99·6° F. in women is the corresponding temperature to 99° F. in men. Patients with long-standing disease and cavities may have rises in temperature to 99·6° or 100° F. without any constitutional symptoms; these readings may therefore be disregarded.

In some rare cases patients will run a temperature which registers anywhere between normal and 102° F. for months, and feel perfectly well, suffering no loss of weight. The more familiar type for the unprogressive patient is a normal reading in the morning, followed by a rise in the evening to 100° or 102° F. There is a still further type of activity in which the temperature does not fall to normal, but remains above 99° F., and varies from one to two degrees, *e.g.* 100° to 102° F.

For most patients who are not confined to bed use of the thermometer twice a day is sufficient, but the temperature should never be taken less frequently. In a case not making progress, if no pyrexia is apparent, the temperature should be taken every three hours. It will usually be found that the temperature has risen for some part of twenty-four hours. The thermometer should be kept in the mouth for at least five minutes.

Many physicians contend that the mouth temperature is not reliable: but I must say that I have relied upon it for treating hundreds of patients and that it has been a thoroughly practical working method. Rest and exercise have definite effects upon the temperature both below and above normal. The menstrual period does not, as a rule, however, show in a twelve-hourly chart.

It is difficult to describe a diagnostic type of temperature. When the disease is inactive the temperature may resemble that of any ordinary healthy person, but upon the disease becoming active the temperature often remains up for months, eventually dropping to normal. This is a type which is confused with acute tuberculosis, whereas it is simply an eruption of the disease. It should not be overlooked that all fever in tuberculous persons need not necessarily be due to the tubercle bacilli; the fact of such patients having tuberculosis does not confer upon them immunity to all other febrile diseases.

The final temperature chart preceding death is usually very irregular, going up to 103° or 104° F., but as a rule it is normal for some part of the twenty-four hours, and for the last day or two it is often normal.

Night Sweats. When I was house physician at Brompton Hospital all the windows were closed and the hospital was systematically heated and ventilated. Night sweats were then both common and severe. It was no unusual thing for the nurses to have to change the whole of the bedding. Nothing could be done to relieve these sweats. Now that the windows are freely open sweats are uncommon and less severe.

When making a physical examination of the chest of a tuberculous patient, a thin stream of sweat sometimes runs down the thorax on either side. This sign I always associated with an unfavourable prognosis. The sweat has a peculiar smell and gives rise to the so-called odor phthisica. Severe night sweats generally occur only during the last few months of a patient's life, and even then can be controlled by adequate ventilation.

Languor. This is one of the earliest symptoms, and is frequently overlooked or wrongly attributed to neurasthenia. Languor is due to the absorption of bacterial products which, though not sufficient to produce fever, by their effect upon the blood induce a feeling of slackness. This is the moment to diagnose and to treat the disease, but the association of this important symptom with tuberculosis is so often unrecognized that the golden opportunity is lost.

A common history is: the patient wakes up feeling well after the night's rest; by the end of the day he feels done up; the day's exercise or work has affected the bacterial products in the lungs, and the rest at night again restores the balance.

Loss of Weight. Languor in conjunction with continuous loss of weight is a ground for greater suspicion, and some definite effort to confirm or disprove the provisional diagnosis should instantly be made. Continuous increase

in weight has hitherto been the sole criterion of successful treatment. I conscientiously followed this lead for many years, and have been guilty of the stuffing system. The practice is entirely a wrong one, the patient becoming over-fat. If excess of milk is given it is deposited in the omentum; the abdominal cavity thus becomes full of adipose tissue, impeding the descent of the diaphragm, with resulting dyspnoea.

The initial loss of weight is probably due to the anorexia induced by the presence of bacterial products in the blood. In the late stages of the disease loss of weight is due to the same cause, as well as to the metabolic processes associated with fever. Some patients eat enormous quantities of food with no resultant effect upon their weight. A rapid gain of weight in a person taken from bad hygienic conditions and placed in a sanatorium is very suggestive of tuberculosis.

Anorexia. This is a sign that the blood fluids are being influenced by the lungs. When this influence is removed the appetite returns. Loss of appetite and slackness should always arouse suspicion, whilst a good appetite is an excellent sign in prognosis.

Dyspnoea may be caused in two ways; in early cases it is in all likelihood due to the bacterial products having some toxic effect on the circulatory system. As the activity of the disease grows less, so will the dyspnoea decrease. This also affords an explanation of the dyspnoea at the onset of miliary tuberculosis. The second cause is the destruction of the tissues through the activity of the bacilli. In most cases dyspnoea is seldom evidenced when the patients walk on level ground, but appears with added exertion. The amount of dyspnoea has some relation to the amount of lung involved.

The dyspnoea of a dying patient is due to a combination of both causes. Even in advanced cases, with extensive destruction of lung tissue, the degree of dyspnoea is astonishingly little. I have known a man with hydropneumo-thorax capable of performing the hardest work with no distress and little dyspnoea.

Cyanosis. Cyanosis in tuberculosis usually indicates that extensive signs are likely to be found in the lungs.

Pulse. The characteristics of the pulse are influenced by the fever and the amount of toxæmia. Personally I have not derived much information from it; there is, however, a type of person who, while never looking wholly well, can undergo treatment without any rise of temperature or other adverse symptoms, other than a continuously rapid pulse. This is a bad prognostic sign.

Displacement of the Heart. In cases of some standing this may occur. The healing lung has

its normal tissues replaced by fibrous tissue, which contracts and pulls the heart usually upwards and towards the affected side. Displacement also takes place if pleural effusion or pneumo-thorax further complicates the condition. Cardiac lesions may occur in association with pulmonary tuberculosis, in spite of statements to the contrary, but such lesions usually do not materially affect the course of the lung malady.

Intestinal Canal. In the latest stages of the disease ulcers appear in both large and small intestine and set up a very troublesome form of diarrhoea. This diarrhoea is sometimes due to amyloid changes in the liver. In the earliest cases of infection tubercle bacilli can be found in the fæces. Hæmorrhages are very uncommon.

Generative Symptoms. There is a generally expressed opinion that tuberculosis increases sexual feelings. I think the probable explanation of this is as follows—

The majority of patients are young when sent for treatment to sanatoria, where, under ideal hygienic conditions and with plenty of food, they soon feel wonderfully fit. It is only natural that such feelings should occur, especially as many sanatoria offer small opportunity for outlet of energy in the way of work.

The Skin. In early cases there is nothing of interest to be noted, but as the disease progresses some few cases develop a dry scaly skin. The hectic flush is most positive in the latest stages.

Mental Condition. At the outset most patients are depressed and gloomy. As they regain health they lose all trace of despondency, becoming lively and cheerful. Patients dying of tuberculosis are said to be optimistic. This does not confirm my observations.

Cough. Cough is almost always present at some stage of the disease and occurs chiefly in the morning. The usual cough of tuberculosis has for its object the bringing up of sputum; there is, however, another variety produced by an irritation of the lung due to inflammation, and this is not accompanied by expectoration. Cough is usually increased by humidity of the atmosphere—decreasing in drier weather. High breezes are also said to cause greater coughing. Morning cough is due to the sputum which has collected during the hours of sleep.

Sputum. Expectoration occurs except in the very earliest stages. For some unaccountable reason women have much less expectoration than men. The sputum is usually thick and yellow. In bronchiectasis sputum has similar characteristics, so that there is nothing that is pathognomonic. Sputum is practically odourless. It increases with the activity of the

disease and decreases as it becomes less active. Rest and exercise also influence its quantity and character.

Microscopic Examination. The presence of tubercle bacilli in the sputum is definite evidence of pulmonary tuberculosis; the absence of such bacilli is not evidence that the patient is not tuberculous. I have known many sputa, examined seven times with negative results, yielding a positive result on the eighth examination; it is not uncommon to find bacilli after as many as twenty fruitless searches. It is important to see that the patient sends for examination the amount first expectorated on waking in the early morning.

The number of bacilli present in a specimen does not appear to have any regular connection with the general health or progress of the patient. One patient may be prostrate with active tuberculosis and few bacilli be found in the sputum, whereas another may be performing the hardest work and the expectoration be crowded with germs.

The form of the bacilli is, however, significant. When the disease is active the bacilli are usually of the long shape, whilst as improvement takes place in the general condition there is a decrease of sputum and the bacilli in appearance become beaded and broken.

Pneumococci, streptococci and staphylococci are frequently, either separately or together, seen in tuberculous sputum. They certainly play some part in complicating the disease, but there is not yet sufficient evidence upon which to base conclusions.

It is necessary that some person whose constant work it is should examine the sputum; only thus will reliable results be obtained.

Pain. There are two varieties of pain to which patients refer; the first is a dull aching pain which frequently occurs in cases of some standing, and has probably to do with contraction of the lung. The other pain is sharp and stabbing and is nearly always associated with inflammation of the pleura. It may occur at the apices, axillæ or bases, and is not necessarily followed by effusion. Patients suddenly prostrated by a large dose of their own bacterial products will frequently complain of acute pains in their joints and limbs. Adhesions after effusion also cause pain. Severe abdominal pain with a disinclination to take food is frequently associated with inflammation of the pleura covering the diaphragm.

Physical Signs. For some years it has been the custom, from the point of view of physical signs, to divide pulmonary tuberculosis into three stages.

This is an erroneous classification. The respiratory powers of the individual are affected

by the destruction of lung tissue, and so long as the patient's health is not interfered with, the local signs are of little value *once* a diagnosis has been made. It is necessary to repeat that the *general* effect of the disease is caused by bacterial products passing from the lung into the general blood stream. This affects the patient's health, and a careful study of such processes is much more important in the treatment of the patient than frequent examinations of the chest. When the general symptoms are fully grasped, it is possible to tell whether or not the patient is making favourable or unfavourable progress without the use of the stethoscope. Tuberculosis is a general disease with a local manifestation. So is a carbuncle. It is impossible to tell the effect of the local condition on the general health of the patient by looking at the carbuncle, and so equally is it impossible to gauge the effects of local tuberculous lesions on the patient's general health. One should not underestimate the use of physical signs. They are of the utmost value in making a diagnosis in pulmonary tuberculosis, but in treatment they have not the value which is commonly assigned to them.

Inspection. The first sign under this head is loss of movement at one apex, and this loss will increase with the area of lung involved until fibrosis commences to flatten and contract the chest. *Palpation* will help to detect loss of movement. Diminished fremitus at either base should suggest past or present pleural effusion. Alteration of fremitus is not often of much use in early diagnosis. The apex beat of the heart should always be made out, since any displacement should be accounted for if possible by such agencies as effusion or fibrosis.

Percussion. Impaired resonance at one apex is usually the earliest sign under this head. When it is remembered how small are the lesions of early tuberculosis it is hardly to be wondered at if this sign is of little help in the earliest cases. The percussion note can be intensified if the patient is made to stand with the head and heels touching a wooden door.

In percussing a chest in suspected tuberculosis, begin below and work upwards so as to get a standard note to compare with the apices. As the disease advances so the dullness increases, but other signs should show more readily the increase in the area of lung affected. When a large cavity is formed in the front of the lung and the area over it is percussed whilst the mouth is open, the sound will resemble that which results from tapping a cracked pot.

Auscultation. This is the most valuable aid to

diagnosis and to estimation of the extent of involvement of lung, but the other signs should all first be carefully considered. Here the earliest signs of tuberculosis are alterations in the normal character of the breath sounds at one or either apex. I am aware that signs sometimes first appear elsewhere than at the apices, but these cases are so exceptional that for all practical purposes they may be disregarded. The earliest sign of all is a certain roughness in the breath sounds, the "*rauhes Athmen*" of Dettweiler & Turban. The next stage consists in wavy or jerky inspiration; this is followed by prolonged expiration and later still by definite bronchial breathing.

The breath sounds, as a rule, are more feeble than those produced in a healthy lung. As a rule none of these signs alone are recognized as constituting definite evidence of tuberculosis, but taken together with others they are exceedingly useful in confirmation.

The most definite pulmonary sign is the presence of a few râles at either or both apices. I do not advocate putting off treatment until these appear, but affirm that if diagnosis is to be made by physical signs alone, such râles afford the most definite evidence. They are of three kinds—

1. Those present with inspiration and expiration.
2. Those present with inspiration only.
3. No râles present with either inspiration or expiration, but showers of fine râles heard immediately the patient has coughed.

No. 3 is the earliest type of râle, Nos. 1 and 2 being present later on with increase of disease. When the disease is progressing the extent of lung involved is easily determined by listening to such râles.

With rapid spread of the bacilli the râles become moist and numerous. The distinction between râles due to pleural adhesions and râles produced in the lung are thus differentiated. On hearing râles with inspiration, direct the person to cough. If pulmonary, they will be increased: if pleural, hardly any will be heard, but the moment the next breath is drawn they will appear as numerous as ever. Râles heard over a wide area of lung causes one to wonder how the patient is so well with such extensive signs of tuberculosis. The explanation has been given. As cavities are formed the breath sounds will become hollow, and whispering pectoriloquy will appear.

Cavernous breathing is heard in large cavities, and rather resembles the sound produced by blowing across a wide-necked bottle.

Post-tussive suction is diagnostic of a cavity and is due to sudden expansion of the cavity after compression in coughing.

The importance of excavation has been

overestimated in regard both to prognosis and treatment. A person may have a large cavity and be capable of twelve hours' hard labour every day. On the other hand, a patient may have no physical signs and tubercle bacilli in his sputum, and be confined to his bed for weeks, so that the kind of signs and the extent thereof should not mislead us, as it is not the lung we are really interested in, but in raising the patient's resistance to fight the tubercle bacilli.

To revert to cavities, a patient is much better off if he is able to cough up a mass of ulcerated lung tissue containing bacilli than he would be if it remained in his body. This natural process finds its parallel in the artificial methods of the surgeon who removes caseous matter with the knife.

Diagnosis and Prognosis

The true value of physical signs must next be considered in respect both of diagnosis and of prognosis.

We have already dealt with physical signs from the point of view of diagnosis. As regards prognosis we may take as an example the two cases just mentioned. On the one hand there is the man with many signs who is able to work hard. Here we infer that the man has a good resistance to tuberculosis and should do well. On the other hand, let us take the man in bed with fever and no signs, who nevertheless at the very outset of the disease is prostrated. Here we may safely deduce that his powers of resistance are not in fighting trim.

Röntgen rays are often of considerable value in showing the extent of the disease, which may have progressed further than the other physical methods of diagnosis indicate. This point is often clearly manifested on the Röntgen plate.

When tuberculosis has thoroughly obtained hold of its victim diagnosis is simple and treatment difficult. The detection of early indications is of the utmost value and importance.

The earliest suspicious symptoms have already been detailed. These are slackness, a feeling of ill-health, coupled with loss of appetite and consequent loss of weight. These symptoms should at once suggest the application of one of the tests to be described. Influenza accompanied by expectoration should demand that the sputum be examined. It is not easy to differentiate clinically between these diseases. Pleurisy should suggest examination of the fluid for bacilli as well as the performance of one or more of the tests. Hæmoptysis of small amount is very suggestive, as are early physical signs such as have been described in detail.

Any of the signs or symptoms demand careful observation of the patient. First, then, keep a four-hourly temperature chart and watch for any rise to 99° F. or over, accompanied by constitutional symptoms. If still no signs appear, increase the amount of exercise and watch for these signs, or for a marked deviation between morning and evening temperatures, a deviation which disappears with cessation of movement.

Confirmatory Tests. Confirmatory tests of the above signs and symptoms being tuberculous are as follows—

(1) *Von Pirquet's Reaction.* This is done in much the same manner as vaccination with calf lymph, Koch's old tuberculin taking the place of the lymph. It is usual to make three short horizontal scratches, the upper and lower only being inoculative, whilst the middle one is used as a control. In twenty-four to forty-eight hours, if the patient is tuberculous, the two inoculated scratches will be red and inflamed, while the control will present the appearance of any ordinary scratch.

(2) *Tuberculin Tests.* For this test Koch's old tuberculin is generally used, but T.A.F. (albumose-free tuberculin) is probably better, as the toxic effects of the albumens are eliminated. The first test dose is '001 c.c. If this meets with no response '005 c.c. may be given. Persons not reacting to this amount of toxin are as a rule considered to be non-tuberculous.

A reaction is considered to have taken place when there has been a local reaction with signs of inflammation and the temperature rises to 99·5° F. or over, accompanied by constitutional symptoms, headache, giddiness and the like. Should the dose of '001 c.c. cause a slight rise of temperature to 99° F. or over, but no constitutional symptoms, it would then be better to re-test with '003 c.c. rather than with '005 c.c.

The measuring of the doses is simple. Take a 1 c.c. syringe divided into tenths. From the bottle of tuberculin take one-tenth of a cubic centimetre, put this in a bottle marked O.T. 1 in 10 and to it add nine-tenths of the diluting fluid. From the dilution 1 in 10 take one-tenth of a c.c. and discharge into a bottle marked 1-100. To this add nine-tenths of the diluting fluid. To give a dose of '001 give one-tenth of the 1-100 solution, whilst '005 would be five-tenths or half the 1 c.c. syringe. If the solution is to be kept, the diluting fluid has an antiseptic added to it, such as one-half per cent. carbolic acid, otherwise sterilized water is all that is required. Strict asepsis must of course be observed.

Both these tests are usually accepted as evidence of tuberculosis. They do not, of course, indicate the organ affected, nor do they

give evidence of the activity of the disease. They mean that the reacting subject is or has been infected by tuberculosis, and such a test is confirmatory of physical signs, or constitutional symptoms.

(3) *The Opsonic Index.* This shows evidence of activity under certain conditions, but if these conditions are not properly observed it may give no evidence of tuberculosis, although the patient may actually be infected by that disease.

The opsonic index varies with the presence in the blood of bacterial products. If, therefore, the blood be taken when the patient is at rest and this specimen compared with a sample taken after walking six miles, it is not unusual to find that such exercise has caused bacterial products to be given off, with the result that the opsonic content of the blood differs from the one first taken.

This form of reaction tells us two things—(a) that the patient is tuberculous and (b) that the lesion is capable of being influenced by exertion and is therefore “open,” or more properly “potentially active.” Suppose, however, that the two samples of blood have indices within normal limits, does this mean that the patient is free from tuberculosis? Certainly not. And here is the possible source of error; six miles may not be enough to influence the lesion and to cause it to give forth the products, therefore, in order to make sure that a patient is not tuberculous, the index should be normal after the patient has performed the hardest physical exercise of which he or she is capable.

The presence of tubercle bacilli in the sputum is definite evidence of tuberculosis. Absence of them means little. No one can say a person is non-tuberculous because no bacilli are found in the sputum. It is far from uncommon to have patients in bed for weeks with fever and no sputum, whilst two or three months afterwards they have sputum with bacilli.

On the other hand, the presence of bacilli does not necessarily mean activity, for patients with bacilli in their sputum can enjoy excellent health, perform the hardest work and give a normal opsonic index. Such patients seem to be parallel to typhoid carriers; they are infectious to others, but are not themselves suffering from the effects of bacillary products.

At the time of an acute onset it is difficult to differentiate clinically between acute infective diseases, such as tuberculosis, influenza and typhoid, but a few days or weeks will leave little doubt as to the true nature of the illness.

Prophylaxis

(a) *General.* Of late years the question of prophylaxis has grown in interest and im-

portance. A realization of the necessity for immediate prophylaxis of the individual has directed the attention of the community to those larger measures of social reform which aim at the eradication of the disease. Whilst considerable advances have been made in the treatment of those already the subjects of the disease, it is now accepted that the solution of the problem lies in the furtherance of more efficient and widespread measures of administrative control under State supervision. Public sanitary authorities are now proceeding in a more energetic and direct way to deal with the prophylaxis of tuberculosis as affecting the working and middle classes of society. The movement is international and is not confined to a few countries. The International Anti-tuberculosis Association, which has its headquarters in Berlin, has as members a total of eight hundred representatives from twenty-two countries in which systematic war against tuberculosis is being waged.

Tuberculosis is solely due to infection, the main sources being the expectoration of tuberculous individuals and the milk or milk products of tuberculous animals. Since tuberculosis is spread by tubercle bacilli, which may be either of human or of bovine origin, the more success we are able to attain in reducing the infectivity of these, the greater will be our hold upon the spread of the disease. Which of these two great groups play the more important part in spreading infection is still a matter which admits of some controversy. Personally, I am of the opinion that human sputum is the factor of greater importance in dissemination. The facts upon which this view is based are as follows:—Considering in the first place various articles of diet, whilst it is true that the supply of milk can be more or less subjected to control, butter now comes from all parts of the globe. Butter, even when one hundred days old, is known to be capable of infecting guinea-pigs with tuberculosis, and since we all eat unsterilized butter it is probable that risks are run from this source. On the other hand, children of the poor, in point of fact, suffer more from tuberculosis than children of the rich, and children of the well-to-do classes are usually found to drink more milk than children of the poor. The incidence of tuberculosis, then, is actually least where the greatest spread of infection might be expected.

Again, take the case of infection by means of sputum from human sources. There are thousands of persons journeying to and fro daily who are themselves the subjects of more or less active pulmonary tuberculosis, and the question arises as to what becomes of the sputum of these people. How often is a sputum flask produced in an omnibus or train? Many sufferers from tuberculosis, in spite of numerous warnings

conspicuously posted in the public streets as well as in vehicles, and in spite of the increasing education of the lay public by the medical profession in this matter, are quite unaware that their own system is a source of danger to their neighbours. The sputum, as a rule, becomes deposited in a handkerchief which is placed in a warm pocket. The sputum dries, and when next the handkerchief is used, dried tubercle bacilli are scattered broadcast. This is a single instance, but reflection will show that many other practices are rife which ignore the rule that dry sputum is dangerous, whereas wet sputum is innocuous.

Whilst our attention is concentrated upon the immediate sources of tuberculosis, we must take care, at the same time, not to overlook preventive measures of general hygiene based on sound common-sense. Such are, in brief: cleanliness, domestic as well as personal; diet, which should be properly regulated both as to quantity and quality; proper housing of the working classes; efficient ventilation of dwellings, factories and public buildings; the limitation of excessive hours of labour; the hygienic care of schools; the preservation of the teeth and prevention of oral sepsis; all these are of the highest utility in raising the health of the community. The fact that many persons recover from a slight infection of tuberculosis without ever being aware that they have had this disease makes for the presumption that the better the general health of the community, the less liable will individuals be to attack.

The compulsory notification of cases of pulmonary tuberculosis under the Public Health (Tuberculosis) Regulations, 1908, and the Public Health (Tuberculosis in Hospitals) Regulations, 1911, is a step in the right direction, but only a small part of the necessary work of prevention is accomplished if the public authorities do not coincidentally with registration provide sanatoria for the early cases and segregation hospitals for those which are more advanced and where no adequate provision can be made for treatment at home. As in the case of school hygiene, medical inspection and notification are only of limited service unless proper facilities be given for efficient treatment.

The second main source of infection is to be found in the milk and butter of tuberculous cows. These points have been dealt with in the section on etiology, and are again referred to in order to emphasize the danger of infection to children from milk and to adults from butter. State control can partially check this source of danger; supervision of dairies and state-regulated conveyance and distribution of milk and milk-products by responsible experts would do much to ensure a pure and wholesome home supply.

The risk of infection from tuberculous meat is slight, for meat usually becomes sterilized in the process of cooking; it is only in steaks, which are raw in the centre, that germs may survive. It is possible, nevertheless, for raw meat to infect other articles of diet which are eaten uncooked. The danger from this source of infection could be largely removed by enforcing more stringent regulations in regard to the inspection of slaughter-houses. It would be well if private slaughter-houses were abolished, for under the present system the holders of slaughter-house licences are under no obligation to notify the authorities of intended slaughtering, which not infrequently takes place out of the sanitary inspector's ordinary working hours. The French and Belgian systems minimize the possibility of abuses by ensuring that all slaughtering is done in abattoirs in the presence of inspectors. Reform in this country should aim at securing efficient inspection of cattle on every occasion at which slaughtering takes place; either notification to the sanitary authorities should be made compulsory, or slaughtering should be made legal only within certain fixed hours. In the meantime offences should be punished by imposing penalties severe enough to deter the unscrupulous from attempting to profit by dealing in tuberculous meat, and by giving adequate compensation to the honest trader who inadvertently buys cattle which are subsequently found to be tuberculous.

(b) *Individual.* As regards the individual, much may be done to prevent the risk of infection to others if such patient will take definite and systematic precautions. Each patient who from time to time expectorates must carry and use some variety of spitting flask, containing a weak antiseptic solution such as 1 in 500 Cyllin or Izal. After use, the flask and its contents should be placed in a special saucepan containing cold water, which is slowly brought up to boiling-point, and kept boiling for at least five minutes. The sputum, rendered harmless by this procedure, is then emptied down the drain and the flask rinsed out. Few sputum flasks are satisfactory and many are, in practice, dangerous. Those made of glass are easily broken, and the hole provided in the bottom of some flasks to facilitate flushing is a frequent source of leakage, and, if the flask is sterilized, superfluous. Dettweiler's flask is the best form. It is designed on the principle of the unspillable ink-bottle, and, if used with an ordinary amount of care, is quite effective, since, even though it is turned upside down in the coat pocket, no sputum can be deposited on the lid. Most flasks are not designed to secure this elementary precaution; consequently, when they are opened small particles of sputum adhering

to the lid are scattered about. All patients must be taught to spit cleanly into a flask and to wipe the lips with a handkerchief after coughing, and never with the hand. Patients should also learn to refrain from coughing except when absolute necessity arises, and *whenever* they do cough, always to hold a handkerchief in front of the mouth in order to prevent any possible dissemination of bacilli in the spray, but on no account actually to expectorate into this handkerchief. In brief, the key-note of prophylaxis for the tuberculous person is personal cleanliness, which must be thorough in order to be effective. The hygiene of the mouth must be given careful attention, and the patient should carefully brush the teeth night and morning. The sputum must not be swallowed, and the individual is better clean-shaved, since sputum is apt to dry on a moustache or beard. The face and hands should be washed frequently with plenty of soap and water, and if possible each patient should have his own meal and toilet service.

The object of these precautions is to prevent the consumptive person from becoming or being a source of danger to others, and from this point of view it is not wise, speaking generally, for tuberculous subjects to marry until two years after their recovery.

Treatment

Before commencing any form of treatment it is essential to find, if possible, answers to the two following very important questions, viz.—

1. What was the probable source of infection?
2. What was the probable course through which the patient's general health became impaired, and thereby his resistance to tuberculosis diminished?

If replies can be vouchsafed to both these queries, every effort should be made to take appropriate measures to deal with the above conditions, and the main principles to be kept clearly in mind in combating tuberculosis, in whatever form it may appear, are: (a) to restore to the normal the general health of the patient as well as (b) to raise the specific resistance to tuberculosis of the individual.

For practical purposes we may divide all patients infected by the tubercle bacillus into one of the four following classes—

Class 1. Those patients who have become infected and who recover without knowledge of their infection.

Class 2. Those patients who recover after a holiday at the seaside or in Switzerland.

Class 3. Those patients who require their specific resistance raising by methods additional to those of general hygiene.

Class 4. Those patients for whom no treatment does any good.

With *Class 1* we are but little concerned, since such patients do not usually come for treatment. *Class 2* includes those individuals who in the past have recovered after no other treatment than abundance of fresh air combined with nutritious diet. As regards *Classes 2* and *3*, taken together, at present we have no means of determining to which class a given patient belongs, so that, until we have this knowledge, every patient must be treated as potentially belonging to *Class 3*. It may be that the patient does not belong to this class, but by placing him there we are doing everything that we can to ensure his restoration to health.

The actual methods of treatment to be employed differ widely according to the condition of the patient at the time, and in order that treatment may be effective it is necessary to classify the patients into the following two main divisions—

1. Those patients who are febrile even when at rest in bed.

2. Those patients who are free from fever.

By a "febrile" case I mean one which has a temperature of 99° F. or over, together with constitutional symptoms such as headache or malaise and like signs of hyper-intoxication in *men*: in *women* a temperature of 99·6° F. or over, with constitutional symptoms. If no general symptoms are present such temperatures can be ignored, since they are evidence that auto-inoculation is taking place, but not in excess. Temperatures registered in the mouth are perfectly satisfactory, provided always that the mouth has not become cooled by talking, etc., immediately beforehand; that the patient has been at rest, and that the thermometer is left in the mouth for a sufficiently long time. Patients with cavities in the lung will often exhibit a temperature of 100° F., which can be disregarded in the absence of constitutional symptoms. If, however, the temperature goes above 100° F. it is usually safer to put the patient to bed. The great point to remember is that it is not so much the position of the mercury in the thermometer which matters, as the constitutional symptoms in association with the rise in temperature.

(a) *Home or Hospital Treatment of the Febrile and Afebrile Patients.* The reader is referred for full details of treatment of this class of patient to the article on *Sanatorium Treatment* (Special Forms of Treatment).

(b) *Treatment of the Totally Disabled Invalid.* If the patient is completely disabled one should aim at increasing his general comfort, and all other treatment having had little or no beneficial effort when continued for some months, he should be allowed to get up or remain in bed, to go out for a walk, sit or lie down, indoors or out, as his fancy may dictate. The risk of

hæmoptysis is not great enough to counter-balance the increased amount of comfort. Food or stimulant may be given according to the invalid's fancy, and he may talk or smoke as he chooses, whether the throat be affected or not, since he is certain to give up any practice which will cause him discomfort. He should invariably use a sputum flask and avoid placing a soiled handkerchief beneath his pillow, but, apart from these absolutely necessary precautions, the relatives in charge of the patient who is absolutely incapacitated should remember that to him nothing matters save comfort. They should bear in mind the absolute importance of taking care of their own health by ensuring regular hours of rest and exercise together with proper meals.

If for various reasons, however, a patient is unable to go to a sanatorium, home treatment can be carried out by means of graduated exercises. Beginning with walking, increasing distances together with physical exercises, the patient can later on play golf, with due regard on the part of the medical attendant as to whether the links are easy or difficult to play on, and the number of holes to be played per day. As a standard of the final grade three rounds, each of eighteen holes, can be played.

From the above it will readily be seen that no restriction is now placed on swinging the arms, which in former days was thought to be injurious and tending to promote hæmorrhage from the lungs. We have learnt by experience, however, that this is not the case.

Other forms of exercise which can be recommended are riding and cycling. Tennis and various other competitive games are bad, for the reason that the patient gets keen on the game and forgets that he is undergoing a course of treatment.

Fresh pure air and an open healthy environment are to be sought at an altitude preferably of about 300 ft. to 400 ft. above sea-level in a bracing climate on a well-drained gravel soil. The immediate surroundings should be as bright and cheerful as possible, and a regular daily routine should be mapped out. If the patient needs one or more nurses, these should have had some experience of sanatorium treatment and should themselves be of a cheerful disposition.

Sea voyages nowadays are prescribed far less frequently than heretofore, the reasons being that if the patient goes in some working capacity he is liable to be shut up for the greater part of the time, whether by day or night, in a small and stuffy cabin, and for those who can afford to travel as passengers the alternation of cold and heat on a long voyage, with possibly high winds, stormy weather and the risks of sea-sickness, together with the

absence of any organized supervision or attendance, together act as deterrents.

That mere going to sea is no cure for consumption is proved by statistics of the navy and mercantile marine. Tuberculosis is far from uncommon among ships' stewards, and any one desirous of keeping his berth is unable to use a sputum flask owing to fear of detection, so that opportunities of infection are in some cases even greater than on shore.

The other definite method of raising the patient's specific resistance, besides graduated exercise in the fresh air with good feeding, is treatment by means of injections of tuberculin, a good account of which is given in the handbook by Bandelier and Rœpke, to which the reader is referred for fuller information.

The Sick Room. In small houses, where there is a garden or even a yard attached, the most suitable position for the sick room is on the ground floor, since the patient can easily walk out or be carried out if too weak to walk.

Fresh air and sunlight are inimical to the tubercle bacillus, so that the windows should be kept open as far as possible both by day and night, and the door should be opened widely for part of the day and whenever the patient is out of the room. Draughts may be avoided by the use of a screen between the window and the bed. If the patient is likely to be in bed for some considerable time, it is advisable to take out the ordinary form of sash-window and replace it by long Venetian shutters or jalousies, which keep out the wet and at the same time admit plenty of fresh air. Patients must be taught to recognize that there is no danger in night air, and that the freshest possible air is the best. Neither damp nor night air are harmful, but are actually beneficial.

The floor of the patient's room should be polished or covered with linoleum. If the patient be poor, the floor may even be left bare, but carpets and rugs should be taken away, the floor being well scrubbed daily with soap and water. The furniture should consist only of what is necessary for the patient's comfort, and preferably such as can be easily washed down. There should be a bed with bedding and four blankets, an additional one being provided for use as a wrap during the time when the patient is lying down and resting. A clothes locker, which also serves as a bedside table, washing apparatus, a chair, a mirror, and a toilet basket, complete the furniture of the patient's room. Curtains and other window hangings should be avoided, for these act as dust traps and obstruct the free entry of air and light. Dusting-brushes and brooms are entirely out of place, all dusting being done daily by means of a damp cloth, which should afterwards be boiled in order to destroy any

germs which may adhere to its surface. Plenty of soap and water should be used everywhere, and the house as a whole kept spotlessly clean.

A coal fire causes an up-draught of air and so affords useful aid in ventilating the room, and in drying the clothing after profuse sweats. In the last stages, when the patient is too weak to use a sputum pot, the pieces of rag with which the expectoration is wiped from the lips can at once be burnt.

The nurse or person in attendance should, unless absolutely necessary, never sleep in the patient's room. Food must be daintily served, and should not be left lying about after a meal, and any remaining on the plate after a meal should be burnt, and plate, knife, fork, etc., washed in boiling water and washing soda. Separate articles should be kept for the patient's use. Every endeavour must be made to keep away flies. These may settle on sputum and then on food. A great help in this direction is to see that no food or crumbs are left exposed between meals.

Thus it will be seen that the essential features of domestic hygiene are simple common-sense and scrupulous cleanliness. No elaborate or expensive methods are necessary, and every detail can be carried out by persons of ordinary intelligence.

Complications

Hæmoptysis.—Hæmoptysis occurs in about forty per cent. to sixty per cent. of patients who have, or have had, tuberculosis of the lungs. This complication is generally supposed to result from sudden strain or exertion, but after considerable experience I am strongly of opinion that even heavy manual labour has little or no influence on hæmoptysis, since in practice we find that hæmorrhage of the lungs most frequently occurs when patients are either resting or in bed. The explanation may be as follows:—When a patient is on hard work there is more blood in the muscles and in the lung capillaries than when the muscles are at rest. Hence it is probable that the blood pressure is lower than when the patient is at rest in bed with very little blood in the capillaries.

As regards its significance, hæmoptysis does not necessarily indicate activity of disease. Hæmoptysis may be, and more often is, purely a mechanical rupture of an unsupported or ulcerated blood-vessel from which the patient rapidly recovers, the resultant fever, I believe, being due to the residual blood left in the lung. As soon as fever disappears, and the sputum is no longer tinged, the patient may be allowed to get up, and after a few days' walking exercise to return to that grade of work on which he was engaged prior to hæmoptysis.

Many patients, after sanatorium treatment, have hæmoptysis months or years after their discharge, and whilst engaged in sedentary occupations. These patients are usually able to return to work within a few days, and it is not necessary for them again to undergo sanatorium treatment. Here, again, physical signs in the chest should not be taken as the sole criterion, the more important points to find out being whether there has been an increase of sputum and whether the patient was well able to work before the hæmoptysis occurred.

Symptomatic Treatment

There is no drug which is known to have any specific effect in arresting the disease, those which are in common use having as their effect the improvement of the patients' digestion and general condition, together with the alleviation of special symptoms. Hence treatment must be largely symptomatic.

Pain due to pleurisy is best relieved in its lesser grades by painting with linimentum iodi or the application of a mustard leaf to the painful spot. In the more severe forms the pain is best relieved by strapping the affected side. Patients with fibrosis of the lung often complain of a dull aching, which is probably due to processes of contraction. For this little can be done.

Cough. In the first place search the nose, pharynx and upper air passages in general, and if the cause can be found, remove it. Removal of a long uvula is occasionally necessary, but this is rare and occurs only in about one half per cent. of cases. There is a form of irritative cough which does not result in the bringing up of sputum. This useless cough may be of neurotic origin and can often be suppressed by the patient's own efforts. If still persistent, however, inhalations do good, either continuously by means of Burney Yeo's inhaler, or two drachms of glycerine of carbolic acid to a pint of boiling water inhaled from Maw's form of apparatus.

The helpful form of cough attended with expectoration, unless very violent and excessive, is best left alone, but if long paroxysms occur, which end in the bringing up of only very little sputum, these are controlled well by heroin hydrochloride $\frac{1}{12}$ gr. or codeina $\frac{1}{4}$ gr. These drugs are also of service in promoting a good night's rest, and since they are both sedative in their effect, so long as the doses are not increased so as to hinder the expulsion of secretion, they aid in immobilization.

Dyspnœa. Shortness of breath results on the one hand from destruction of lung tissue and on the other from toxæmia. The toxic form of dyspnœa disappears when the bacterial products are controlled (the treatment with

this object has been described). The form resulting from tissue destruction will, in all probability, be compensated on the patient's recovery, the drugs most to be relied upon being the diffusible stimulants, viz. alcohol, ether and ammonia, together with strychnine, which is also beneficial.

Night Sweats usually cease when the windows are kept freely open to the external air, and so do not require other treatment. If, however, they do occur, belladonna is the only drug which is of value.

Anorexia. Loss of appetite is due to the poisoned condition of the blood, and every effort should be made to induce the patient to take food, and when we speak of food we do not mean that solid beef is to be excluded. If the patient is unable to take more than a light diet, this must for the time suffice, but a more solid diet should, if possible, be aimed at, with plenty of milk and eggs. The patient, however, should not be unduly worried, since, with the fall of temperature the appetite will return. In the matter of diet it is important to bear in mind that the patient is not suffering from a disease of the alimentary tract, and that a much greater amount of solid food can be taken than is generally supposed.

Treatment of Complications

Hæmoptysis. On the occurrence of hæmoptysis the patient should be kept at rest, lying flat on his back. The head should be turned a little on one side, but the patient should not be sat up or stimulants administered.

The traditional treatment is by rest, semi-starvation, limitation of liquids, and the administration of morphia when necessary. This form of treatment is, however, not altogether to be recommended, since the patient rapidly loses weight and becomes depressed. Rational treatment is, therefore, rest in bed, a saline purgative to lower the blood pressure and to facilitate the action of the bowels; morphia, $\frac{1}{4}$ gr. hypodermically, repeated if necessary; ordinary food, as much as the patient can take, it not being necessary that the food should be cold or that the amount of liquid should be limited; calcium lactate should be given in four doses of ten grains each, repeated every four hours, which in some cases appears to do good.

Pleurisy. Pleurisy with effusion, so long as it does not cause distress by pressure, is best left alone. As a rule it speedily clears up under treatment by complete immobilization.

There is nothing to be gained by tapping, and there is the additional risk of causing an auto-inoculation. If distress be present the withdrawal of about one and a half pints of fluid will ease the condition. Such purely tuberculous effusions seldom become purulent.

Pneumothorax. This somewhat rare complication is almost invariably accompanied by a sudden onset of fever and dyspnoea. The patient looks acutely ill and the pulse is small and rapid. Oxygen is of use, and the severe symptoms are usually recovered from in about three weeks. The lung, however, which has become collapsed, remains in this condition, and the patient may live for a month or even for some years. This condition frequently develops into *Pyopneumothorax*. The question of operation immediately arises. I have seen a number of these cases opened and drained; and provided the condition was tuberculous, do not know one in which recovery was effected; even when the resection of the rib was followed by an extensive Estlander operation. For my own part I should prefer to be left alone and have the pus aspirated whenever it caused distress rather than spend the rest of my life with a poultice of smelling pus covering one side of my chest. I regard this condition as hopeless.

Tuberculous Laryngitis. This is a serious complication. At one time I taught the house physicians at Brompton that it was almost a fatal sign. My views have altered since I have seen many good recoveries under treatment by laryngeal rest. The serious nature of this condition should be explained to the patient, and he should be informed that nothing can be done without his loyal co-operation. He must cease to talk altogether and must carry book and pencil for written conversation.

Pain when swallowing can be relieved by spraying the larynx just before meals with two and a half per cent. cocaine. A properly designed spray should be used—one that sprays vertically downwards, not backwards on to the pharynx, and insufflations of orthoform are also useful when the pain is less severe, having this advantage—that the patient can perform the operation himself.

The use of cocaine I consider bad. It renders the tongue analgesic, spoiling taste and appetite, and after being dissolved is swallowed, not coming in contact with the affected larynx. An irritable larynx can be relieved by inhaling two drachms of glycerine of carbolic acid added to a pint of boiling water in a "Maw" inhaler.

Surgical interference with active laryngeal tuberculosis is certainly attended with grave risks; it is better to wait and see what results can be obtained by three months of complete rest before embarking on an operation. If either the knife or cautery are used a reaction must follow in the lesion unless all diseased portions are removed or destroyed. This argument refers to laryngitis in its active condition; it does not apply to chronic ulcers

of the cords, etc., which practically are cut off from the blood-fluids.

Ischio-Rectal Abscess. This complication is rare. If opened at once and dressed with iodoform the abscess almost invariably heals, and as far as one can tell does not affect the prognosis of the case. I am not in favour of scraping, as it may interfere with the local protective mechanism.

Sanatorium Treatment

The modern treatment of pulmonary tuberculosis was originated and developed in institutions to which the term sanatorium was applied. Sanatorium treatment, therefore, is in its widest sense the kind of treatment which conforms to the principles and methods so evolved, whether the patient be in his own home or in an institution.

Before proceeding to describe this system of treatment it is necessary to recall the classification of patients on page 116.

For practical purposes we may divide all patients infected by the tubercle bacillus into one of the four following classes—

Class 1. Those patients who have become infected and who recover without knowing of their infection.

Class 2. Those patients who recover after a holiday at the seaside or in Switzerland.

Class 3. Those patients who require their specific resistance raised by methods additional to those of general hygiene.

Class 4. Those patients for whom no treatment does any good.

Classes 2 and 3 are important for our purpose at this point. We have no means at present of determining to which of the two classes any given patient belongs, so that every patient must be treated as potentially belonging to *Class 3*, that is, suitable for the special treatment known as sanatorium treatment. It may be that the patient does not belong to this class, but by placing him there we are doing everything that we can to ensure his restoration to health.

Cases are divisible into two classes—

1. Those patients who are febrile even when at rest in bed.

2. Those patients who are free from fever. A "febrile" case is one which has a temperature of 99° F. or over in men, and in women a temperature of 99·6° F., accompanied in both sexes by constitutional symptoms (see p. 109).

1. *Home or Sanatorium Treatment of the Febrile Patient.* The treatment of the febrile patient should be precisely the same whether treatment is carried out in the home or at a sanatorium. Except in the case of those patients who belong to the well-to-do classes, treatment in sanatoriums is usually found to have better results

than treatment at home, since, if complete immobilization of the patient is to be attained, the services of two trained nurses are necessary, one for day duty and the other for night duty. At home the expense of this necessary nursing becomes great, whereas, in sanatoriums the management is considerably more economical, since two nurses are easily able to look after more than one patient.

The home or hospital treatment of the febrile patient may be subdivided into (a) *treatment of the partially disabled invalid*, and (b) *treatment of the totally disabled invalid*.

(a) *Treatment of the Febrile Patient.* Here we have to bear in mind that irregular pyrexia in pulmonary tuberculosis is associated always with irregular and spontaneous absorption of bacterial products. Persistence of this fever can only end in the death of the patient, and it is therefore obvious that every possible means must be taken in order to control it. The first objective is to bring the patient's temperature back to normal, and this is effected most readily by enforcing complete immobilization. If this condition is realized the motivity of the lungs will be diminished and the scattering of bacterial products into the blood stream markedly lessened.

Complete immobilization consists in placing those patients with a temperature as low as 99° F. and with constitutional symptoms not only in bed, but also in treating them, *apart from their diet*, precisely like a typhoid patient. They are not allowed to move in bed, to read, to wash themselves, to cut up their food, or to go to the lavatory. They are instructed to talk as little as possible, and every means is used to prevent unnecessary coughing; thus in no case is a patient examined with a stethoscope made to take deep breaths, or allowed to sit up in bed, or to cough for purposes of physical examination. Irritable cough can best be relieved by the wearing, as continuously as possible, of a Burney Yeo's inhaler, containing a solution of equal parts of oil of creosote, spirits of menthol (twenty per cent.) and spirits of chloroform. Visitors are prohibited, and letters should be censored to prevent patients being worried by bad news. Each case, however, must be judged on its merits, since the capacity of different individuals to endure restraint varies within wide limits. Patients who have been in bed with fever for a month or more should be kept in bed on complete immobilization for about six to ten days after the temperature has returned to, and remained at, the normal level, followed by three days propped up in bed with the privilege of reading. If the temperature remains normal they may be allowed to sit up in bed for half an hour on the following day, the period being again increased

little by little until, if without fever, they are able to be up all day fully dressed.

If after some months' trial immobilization is found to have produced little or no effect as regards disappearance of fever and untoward symptoms, the question of producing still more complete immobilization by means of the introduction into the pleural cavity of nitrogen gas may then be legitimately considered. This method in some cases proves to be of considerable utility, since this gas, not being readily absorbed, checks the movements of the lung by abolishing the intrapleural negative pressure.

The objections which may be urged against the use of this remedy are, however: (1) that it is not always possible to tell with certainty in which lung the disease is active; (2) that the patient may suddenly die, the reason for this not being as yet clear. Although such fatality is of very rare occurrence, it must, nevertheless, be borne in mind.

The technique may briefly be described as follows:—A measured bottle is filled with water, and the water is then displaced by nitrogen gas, so that one has a known quantity of gas in the bottle. The bottle is connected by tube and cannule with the pleural cavity on the one side, and on the other side with another bottle filled with water. This latter bottle is then raised, and the water, running into the nitrogen-containing bottle, displaces nitrogen into the chest. It will be well for the general practitioner to see this operation performed before attempting it himself. The operation may have to be repeated several times before the desired object is attained.

2. *Treatment of Patients who are Free from Fever.* The patient who, after immobilization, has become afebrile should gradually increase the movements which he makes until he is able to live in a house as an ordinary invalid. He should begin by walking about his room; next he may be allowed to go out to the lavatory; after this to walk up and down stairs; and when he has attained the position of an ordinary person in the house he may begin walking exercise, starting on the plan of a quarter of a mile each day for a week, half a mile each day during the following week, in succeeding weeks walking respectively two, four, six, eight or ten miles, provided always that a temperature of 99° F., together with constitutional symptoms, remain absent. If these appear, immobilize again as already described, when the temperature usually falls to normal within one to three days. As soon as the patient improves he is tested in various ways. When able to get up he can resume exercise, beginning with half the distance previously reached, *e. g.* if the temperature rose after walking four miles, he can start

again with two miles, and if one day of two miles exercise does not greatly influence the temperature let him return to four miles each day for a week. As strength is restored hill-climbing may be done gradually at the beginning of the walk, the patient resting if fatigued. Following upon this, graduated exercise together with labour, varied to suit the requirements of the individual case, may next be prescribed.

There are four grades of graduated labour—

Grade 1. Picking up wood, carrying baskets of mould or other material, watering plants, etc.

Grade 2. Using a small shovel for excavation, painting, cutting grass, hoeing, chopping wood, etc.

Grade 3. Using a large shovel, digging broken ground, mowing grass, sawing trees into firewood, etc.

Grade 4. Working with pick and shovel, breaking ground, excavation, mixing concrete, planing wood, etc.

Each of these grades, whenever practicable, is further subdivided into several sub-grades. Thus in the basket work there are three sections: in the first the patient carries a load of about 12 lb. in weight a distance of fifty yards up a gradient of 1 in 10·7; in the second the weight carried is about 18 lb., in the third the weight carried is 24 lb. Indoor painting is divided into two or three sections: one includes painting of the walls, the other the ceiling, etc.

The hours of work are four and a half per day, but as soon as the patient is fit to be discharged he is put to work at his trade, if he has one, for six hours a day for three weeks, and, if he stands this exertion, he is sent home to his respective occupation.

The women patients do the same kinds of work as the men, with the exception that they use implements of smaller size and are not allowed to work hard. They keep in trim their own part of the grounds, cultivate a kitchen garden and have charge of the poultry.

If at any stage in this treatment a rise in the temperature to 99° F. or over is developed, the patient is put to rest until the fever subsides, and then returned either to the same or a higher grade of work. The fever under these circumstances indicates that the patient has received an overdose of toxin and his system must be given an opportunity of getting rid of it. (Further details of graduated exercise and labour can be found in my book on *Auto-Inoculation in Pulmonary Tuberculosis*.)

Whether in bed or at exercise the patients should at all times have a good supply of pure air, and should conform to a routine rigidly enforced. The daily routine which I carried out at Fernly Sanatorium was as follows. It is a rational method and consistent with modern

conceptions of the nature of tuberculosis, and has been adopted by many sanatoriums both here and abroad.

6.45. Patients rise, clean wards, dress and shave.

8.15. Breakfast.

9-9.30. Those who use tobacco, smoke.

9.30-10.0. Clean brass work.

10-12.0. Work.

12-12.45. Rest for all except those who are to leave within three weeks.

1.0. Dinner.

1.45-2.30. Rest. Those who use tobacco, smoke.

2.30-5. Work, except those on walking exercise, who commence at 3.

5-6.30. Recreation.

6.30. Supper.

7.15-8.0. Rest : smoke.

8.0. Prayers.

8.30. Lights out.

9.0. Silence.

Inoculation with Tuberculin. For raising the resisting power of a patient to the inroads of the tubercle bacillus the injection of tuberculin has an important place. There are two schools with variant methods—the German school and the Almoth Wright school.

The method followed by the German school is the inoculation of the patient with carefully increasing doses of tuberculin, and the procedure thereafter is much as in a system of auto-inoculation by graduated labour. A rise of temperature and other constitutional symptoms are awaited. If none follow, the dose is increased; if, however, they should appear, the patient is at once rested until all trace of fever has disappeared. The treatment is then renewed at the point of interruption.

The Wright school inoculates with small doses of tuberculin, making use of the opsonic index as the control.

Diet. Consumption has come to be recognized as a disease of bacterial origin. The wasting and loss of flesh by which it is characterized should therefore not be considered the result of malnutrition, but rather the consequence of the loss of appetite which is caused by fever and other constitutional disturbances.

Diet has somewhat dwindled from its paramount place of importance. During the last decade dietary has assumed various phases, resulting in a valuable increase in experience. In the early days of sanatorium treatment the dietary was chiefly a milk routine. Three and a half pints a day were consumed by the patients. Fat was deposited as a consequence upon the omentum and the free movements of the diaphragm were hindered by the increase in weight. Corpulence and shortness of breath

followed. Among the distressful consequences of this tedious routine was a lazy temper and a disinclination to do the work upon which the patients' recovery depended. During the last five years this abnormal quantity of milk has been reduced to the normal amount consumed by patients under ordinary conditions in their own home, and has been given in the usual forms—in tea, in puddings, etc. Few departures from this rule are permitted, and in no case is a milk routine prescribed as a "cure."

I have been guilty myself of excessive stuffing, a system which I abandoned for an attempt to raise the standard of the bodily health of the patient by providing exceptionally nutritious foods. This method also had to be rejected. The milk diet was found to have a disastrous psychological effect on the discharged patient. The great increase in weight gained under unnatural conditions was rapidly lost and the patient fell into despair. The criterion of bodily health to be applied to a discharged consumptive is not weight but hardness of physical condition. Weight is no test of "arrest." Only a severe trial of the lesion can possibly establish that.

A not inconsiderable objection to a milk diet is its cost. With one hundred and fifty beds full it means for a sanatorium where these quantities of milk are consumed an extra expense of £700 per annum.

Stuffing, again, has little to recommend it. The patient is unable to absorb the great quantities of food and digestive disorders are frequent. The patient unaccustomed to dainty foods is none too grateful for them.

The modern method is to provide patients with the quality and quantity of the food which are within their means at home. (For a table of diet divided into summer and winter menus consult *Auto-Inoculation in Pulmonary Tuberculosis*.) The diets are different according to the season, and the menus are so arranged that patients are unable to tell with certainty what is to be provided on any particular day. The reason is a mental reaction which is liable to set in when the meal is known beforehand.

A method of my own is a simple one to ensure this variety of menu and allows of the calculation being made a month in advance. Metal tickets bearing first, second, third or fourth week upon them are attached to the menu frame in the kitchen to show what week's menu is in force. It is necessary to take care that food is served hot and appetizingly. The antecedent mental attitude of the patient has considerable influence upon the digestive glands, as has been shown by Pavlov.

The system of graduated labour is a splendid incitement to a good appetite. On Sundays in

the sanatorium, when work is at a standstill, patients consume much less food than during the week. This increase of metabolism is an additional recommendation to a system of graduated labour, since it may have some effect upon the resisting properties of the body.

The medical superintendent must be present at meals. They are part of the treatment. His presence stimulates both patients and kitchen staff. The superintendent should carve, since it gives him the opportunity of personally observing how each patient is consuming his food. He gathers in this way immediate knowledge of any loss of appetite and can watch for the early signs of excessive auto-inoculation.

Three meals a day is sufficient. Under the old régime they were four, but were cut down some years ago. The times are given in the daily routine table.

This system is successful. Patients have good appetites and enjoy their meals. Moderate helpings are found to stimulate the patients to come again. If the patients are suffering from fever they are given the same meals. If their appetite, however, is not keen enough, lighter foods such as fish, rabbit, chicken, milk puddings, etc., are prescribed. If patients will they are encouraged to drink two to three pints of milk a day, but no pressure is put upon them.

In some, control of auto-inoculation is the important point, and consequently the food of consumptives should be based upon ordinary rules and should conform to local and individual tastes.

It is true that the food should be abundant because the loss of tissue necessitates rapid constructive metabolism, but there is no need for excess.

Hard physical condition is the aim, and diet should be made to co-operate with the other forces towards that end.

Advantages of Sanatorium Treatment. Other things being equal the patients are better in a sanatorium, by reason of the companionship and because they soon become acclimatized to their surroundings and get to disregard cold, wet and draughts. A strictly quiet life is impossible at home on account of the friends who casually come to call; further, a person who does not feel ill is much inclined, especially in the colder weather, to keep his windows shut. In a sanatorium the new-comer gains the stimulus of seeing those in whom the disease has become arrested and who are engaged in active work, and he gains further encouragement from the moral support of others in like condition with himself who are undergoing treatment. Again, it is easier to educate patients in the proper use of a sputum flask, which at first is always objectionable. Patients are found not

to mind using a flask when companions are doing likewise.

In a sanatorium, if a rise in temperature occurs, the patient can be immobilized at once and direct continuous medical supervision exercised, whereas if at home, in all probability the patient is unable to obtain the essential nursing.

In a sanatorium, too, lectures and general instruction in practical hygiene can be given, and under these circumstances it is as easy for the doctor to teach fifty or a hundred patients as it is to teach one, and, in addition, he is on the spot to supervise meals and give a direct impetus to sluggards.

M. S. P.

SYPHILIS

The Medical Aspects of Syphilis

Syphilis is an infective disease caused by the entrance into the body of the spirochæte *pallida*, which has now been obtained from primary, secondary and tertiary lesions, has been grown in pure culture outside the body, and has produced the disease again by re-inoculation into the anthropoid apes.

Modes of Infection. The disease can only be acquired by contact of the skin, usually slightly abraded, with the living spirochæte. The site of entry is usually on the genital organs, but not necessarily on the parts accessible to examination, *e. g.* in the penile urethra. Digital infections are sometimes seen in medical men from surgical or gynæcological practice. Lip chancres may occur from using an infected drinking cup or, as with mouth, lingual or tonsillar chancres, from improper practices. Syphilis may be transmitted to the offspring either from the father or the mother. The father may transmit the infection whether the disease in him be active or not. The mother may transmit it, whether she be infected before or after conception. The immunity of the apparently healthy mother of a syphilitic infant (Colles's Law) is now known, as determined by Wassermann's test, to be due to the mother being already infected, and the immunity of the child suckled by a syphilitic mother is probably the result of a prenatal infection, for fifty-five per cent. of children born of syphilitic mothers give a positive Wassermann test.

The primary stage lasts for six to twelve weeks from the appearance of the initial sore, one to four weeks after inoculation, until the onset of constitutional symptoms. The chancre begins as a reddened papule, ulcerates and finally becomes indurated. Multiple chancres are sometimes seen, especially when the infected part touches another portion of the skin. The glands draining the infected area become enlarged and may break down.

The *secondary stage* consists of constitutional symptoms, of which the most important are: fever, anæmia, which may be very marked, headache, loss of appetite, sore throat, jaundice and arthritis; but notwithstanding that any of these symptoms may be marked, they may also be so slight as not to arrest the attention of the patient. The lesions of the skin and mucous membranes are the most important for diagnosis, but the differential diagnosis cannot here be gone into.

The *tertiary stage* is the stage of gummata or gummatous infiltration in different organs, and amyloid degeneration.

Congenital Syphilis affects the offspring of syphilitic parents in the same way as the acquired disease. The child may be born with a rash or a rash may appear soon after birth (secondary stage); the tertiary stage consists in a gummatous affection of different organs or amyloid disease similar to that in the acquired disease.

The Visceral Manifestations of Syphilitic Disease

Syphilitic Fever.—Syphilitics may have fever in any stage of the disease. During the period of incubation it is occasionally present and a rigor may be the initial manifestation. In twenty-five to thirty-five per cent. of cases there is fever during the invasion; all types of fever are met with, and until the chancre is sufficiently marked to call for notice the physician may find difficulty in diagnosis. Fever in the tertiary lesions is often of long duration and may be very misleading. Of all syphilitic lesions fever is most often seen in hepatic syphilis. The fever may be mistaken for any one of the following:—(1) Rheumatic fever; gummatous nodules may be so near joints as to be indistinguishable from this affection; a careful examination of the bones may reveal isolated periosteal nodes. It is not certain if the Wassermann reaction can be relied upon in this condition. (2) Malaria can be distinguished by the effect of quinine and by finding the parasite in the stained blood film. (3) Typhoid fever should cause no difficulty if the agglutination test be performed when the fever has lasted some time and against not only the typhoid organism, but against *B. paratyphosus* and *B. coli*. (4) Tuberculosis may be extremely difficult to distinguish; a thorough search should be made for tubercle bacilli in the sputum if there is any; the presence of an enlarged, irregular and tender liver is important. In all suspected cases of syphilitic fever it is essential to make a thorough examination of the organs for any sign of past or coexistent syphilitic disease.

Syphilis of the Trachea and Bronchi.—The affections of these organs are chiefly tertiary,

though during the secondary stage lesions similar to the skin rashes may be present in the mucous membrane of the trachea and bronchi. The tertiary lesions include gummata, ulcers, endotracheal or endobronchial fibrosis, with narrowing of the lumen and peritracheitis.

The *symptoms* are: cough, sometimes paroxysmal, usually with expectoration; the sputum is not distinctive, and it is well to remember that there may be severe hæmorrhage and discharge of portions of tracheal or bronchial cartilages; dyspnoea may be paroxysmal, associated with exertion, or constant; cyanosis, with mild asphyxia, may be present; the stridor in these cases is often very marked, more often inspiratory than expiratory, and death may follow. Pain may be present behind the sternum or in the larynx, and the trachea may be tender. There is alteration of the voice and indrawing of the supraclavicular tissues in inspiration. The signs in the lungs are not constant.

The *diagnosis* in the early stages rests on the location of the lesion and a careful examination of the sputum from day to day to detect cartilaginous elements and to eliminate the possibility of tuberculosis. Syphilis has a special predilection for the bifurcation of the trachea, but may also be found in the larynx or in one or both bronchi. Laryngeal obstruction can be eliminated by direct observation. Other forms of obstruction, such as from a tumour or retropharyngeal abscess, must be eliminated by a careful examination from without and from within; a lesion in one bronchus will reveal itself by altered breath sounds on that side.

The *prognosis* is not good, but is better the earlier the disease is recognized and anti-syphilitic treatment employed. The *treatment* is by giving large doses of potassium iodide, carefully graded so as to prevent a dangerous œdema of the larynx. Tracheotomy may be needed, or a soft catheter passed beyond the obstruction may give relief. Mechanical dilatation should be done by specialists.

Bronchiectasis may be the result of a syphilitic affection of the lung or bronchi. The symptoms, signs and diagnosis offer no special features. The syphilitic origin can only be determined through methods used for the detection of syphilis elsewhere.

Pulmonary Syphilis.—The “white pneumonia” of the morbid anatomists, seen in syphilitic infants, is of minor clinical importance, since the other features of the disease in the skin, liver and general nutrition overshadow the signs in the lungs. In the acquired form three types exist; first, the latent, in which a small gummatous infiltration, not being sufficiently large to

give symptoms, ultimately heals completely; secondly, the ulcerating gumma, affecting chiefly the lower lobes—a febrile wasting illness with the presence in the sputum of organized tissue; and, thirdly, syphilitic phthisis, indistinguishable in its general clinical features from tuberculous phthisis and only to be separated from it by the undoubted evidence of syphilis elsewhere and by repeated failure to find tubercle bacilli in the sputum. Much help in diagnosis may be obtained by the X-rays; syphilis almost always attacks the lower parts of the lung, especially the lower lobe, leaving the apices free, while tuberculosis seldom attacks these regions without first invading the apices. Again, marked improvement in suspected cases follows the administration of antisyphilitic remedies. Finally, the two diseases may co-exist, and under these circumstances it is necessary to treat the more serious disease, namely tuberculosis.

Syphilis of the Liver.—The disease may be entirely latent, and is often discovered accidentally post-mortem. It is met with under several forms, of which the following may be mentioned—

1. **Syphilitic Jaundice** occurs in the secondary stage and in the tertiary due to compression of the bile ducts by a gummatous lesion; in the former it is mild or acute with fever and presents the picture of catarrhal jaundice. Acute yellow atrophy is occasionally the direct result of a syphilitic infection beginning with severe symptoms or following mild jaundice. The symptoms are not different from other forms of acute yellow atrophy. The disease is fatal and specific treatment of no avail.

2. **Hepatic Tumour due to a Gumma.**—The tumour may be due to the swelling of a gumma itself or to the islands of liver substance left after cicatricial healing, the so-called botryoid liver. The symptoms are indigestion, pain in the right side of the abdomen, loss of weight and strength and occasionally jaundice. The cases must be distinguished from cancer of the liver or bile ducts and from hydatid disease.

3. Cases with the features of cirrhosis, wasting, ascites, etc., may be due either to a gumma or to an actual cirrhosis.

4. Other cases resemble gallstones, splenic anæmia or leukæmia or amyloid disease.

A careful search must be made for evidence of syphilis in other organs, the effects of potassium iodide should be watched and a Wassermann test performed.

Congenital Syphilis attacks the liver either soon after birth or later, in which case it may present most of the features of the acquired form in adults. In infants the common form of general syphilitic hepatitis makes the child fretful, it cries as if in pain and has vomiting

and diarrhoea; jaundice, wasting, anæmia and lack of elasticity of the skin are other common symptoms. Ascites, enlargement and hardening of the spleen and liver may be present. In later childhood the *symptoms* are gastro-intestinal, with wasting and loss of spirit. The child is frequently very much undergrown. There is pain and distension of the abdomen, diarrhoea, a subicteric tint of the skin and ascites. The liver is enlarged, deformed or atrophied, and the collateral circulation is obvious. The spleen is enlarged; jaundice is rare. The gummatous form and amyloid disease of the liver are not different from these in the adult. The *diagnosis* of congenital syphilis of the liver rests on the presence, together with the special symptoms attaching to liver disease, of signs of syphilis in other organs, head and face, bodily development, bone, skin, eyes, ears, testicles and teeth.

Renal Syphilis.—Syphilis of the kidney produces many varieties of clinical manifestations. A large proportion of syphilitics have renal disease, not always fatal or serious. Diabetes insipidus is frequently due to cerebral syphilis. Nephritis in the secondary period is the form most easily diagnosed and most frequently met with; it may be seen as late as two or three years after the first infection. The evidence of the renal affection may be a transient albuminuria or a more severe condition with lumbar pains, oedema, fever, nausea and vomiting such as is seen in the acute nephritis due to cold. The onset and type may be more insidious but no less severe in its effect upon the kidney. The quantity of urine lessens, its specific gravity is raised, and it contains albumin, often in very large amount, blood, leucocytes and cellular casts. The blood pressure is not always high. The course of the disease, if untreated, is not different from that of other forms of acute nephritis. The points in which this variety differs from others is in the slight lessening of the total amount of urine and in the relative rarity of casts compared with the amount of albumin, which is large.

In the tertiary period of the disease there are three clinical forms: first, when the infection has been severe and very chronic, amyloid changes in the kidney will produce the anæmic, yellow and puffy condition of the skin. The urine contains much albumin, but the amount is variable. There is no increase of blood pressure, the liver and spleen are large, and there may be diarrhoea. The casts in the urine may show the amyloid reaction (reddish-brown with iodine in potassium iodide). Secondly, the form simulating chronic Bright's disease; it has no features marking it off from other forms unless evidence of syphilis is found

elsewhere. Thirdly, cases with abdominal tumour originating in the renal region due to gumma of the kidney. Very large tumours have been described. The *symptoms* are either latent or due to the size of the tumour and its encroachments causing pain and a sense of weight, or occasionally attacks of pain indistinguishable from that of renal calculus. In hereditary syphilis the affection is very chronic and is usually serious on account of the great damage to the kidney substance.

Nephritis in the secondary period need not be due to the syphilitic infection, for it is sometimes unaffected by antisyphilitic treatment and may recover completely under restriction to bed and a careful diet. In any suspected case it is advisable to try the effect of a milk diet for some days, and if no improvement shows itself to put the patient on a thorough course of mercury by inunction. In the tertiary period large doses of potassium iodide are necessary, but the beneficial effect may be limited by a large amount of damage to the kidney. Salvarsan is not contra-indicated in syphilitic nephritis if the eyes are unaffected, though its administration should be in skilled hands and it should be controlled by the Wassermann reaction.

Cardiac Syphilis is only of importance in the tertiary period and is due almost wholly to gummata, which may be found in any part, or to syphilitic arteritis. The *symptoms* are hardly, if at all, different from those of cardiac disease due to other causes, but certain forms being more common in syphilis would excite suspicion; these are: (1) left heart failure, with giddiness, fainting, failure of strength and a mitral leak coming on in men of middle age without any previous cardiac disease and without evidence of renal or arterial disease. Right heart failure under similar circumstances may be due to syphilis. (2) Cases with the features of angina pectoris at an age when angina is not usually found are often due to syphilitic affections of the coronary arteries. (3) Cases with the features of Stokes-Adams disease, with fainting or convulsive attacks, a slow arterial and a quick venous (jugular) pulse.

Antisyphilitic treatment with potassium iodide, especially in the arterial lesions, often effects a remarkable cure, but in other cases, *e.g.* gummata, the damage done may be extensive and may be irreparable. Treatment by salvarsan is not without danger and should only be done by specially qualified persons.

Arterial Syphilis.—The processes which damage the arteries as conducting tubes are briefly: (1) a weakening of the media in the larger arteries resulting in either a general or a local dilation (aneurysm) or hæmorrhage (rupture). (2) In the medium-sized arteries local

gummatous lesions may give rise to hæmorrhage or thrombosis, with the evidence of local arteritis. (3) In the medium and smaller blood-vessels the syphilitic process usually narrows the lumen and gradually interferes with the blood supply to the organ, or owing to the irritation of the muscular walls a spasm is set up.

The Value and Limitations of the Wassermann Reaction in Medical Syphilis.—This reaction is an extremely important help in the diagnosis of syphilis, but it cannot be relied on in all stages and in all clinical types of syphilis. A positive reaction, with a few exceptions, always means the presence of the syphilitic infection, but a negative reaction may be given in the case of healed syphilis, cured syphilis or even in active syphilis in some cases. In secondary syphilis the number of positive reactions is over ninety per cent. In tertiary syphilis the number of positive reactions is between eighty and ninety per cent. In latent syphilis, *i. e.* persons known to have had syphilis in their youth but without present symptoms, the number giving positive reactions is under fifty per cent., the percentage diminishing as the period from the date of the infection increases. In congenital syphilis with manifest symptoms over ninety per cent. give a positive reaction, while in latent cases over fifty per cent. give a positive reaction. Over fifty per cent. of infants born of syphilitic mothers give a positive reaction, and if a child born of a syphilitic mother gives a negative reaction it implies a much more favourable outlook for the child. As a result of investigations with this reaction it has been shown in explanation of Colles' Law that the mothers of syphilitic children are immune against syphilis, that between seventy and eighty per cent. of such mothers react positively. In general paralysis nearly one hundred per cent. of cases react positively, and in tabes dorsalis sixty-three per cent. Treatment of all forms of syphilis, whether by mercury, iodide or salvarsan, tends to render the reaction negative, and to be certain that treatment has been effective it should be controlled by this reaction.

W. O.

A. G. G.

INFECTIOUS DISEASES OF DOUBTFUL NATURE

Febricula (Ephemeral Fever or Indeterminate Fever).—Osler defines ephemeral fever as a febrile paroxysm lasting for twenty-four hours and then disappearing completely, and febricula as one that persists for three, four or more days without local affection. Improved methods of diagnosis have greatly reduced the number of cases thus classified and have referred them to their proper group. Such cases usually occur in the first two decades, for during that time

the thermotaxic mechanism is unstable and easily upset. Probably the following different conditions have been thus described.

1. *Larval or Abortive Forms of Specific Fevers.* Of these the commonest is *pneumonia*. In children the crisis may occur on the third to fifth day, and there may be no physical signs in the chest. There is often an initial convulsion, and the ratio of the respiration to the pulse is definitely increased. Cerebral symptoms may be present, and herpes on the lip is common. Sometimes, however, the diagnosis is cleared up by quite transitory signs in the chest just before the crisis. *Influenza* is another common cause of brief pyrexia, but the tendency is to take too full an advantage of this fact in diagnosing an indeterminate fever. That certain cases are of this nature is shown by the discovery of *B. influenzae* in the nasal and bronchial secretions. Some cases appear to be *typhoid fever*, which in a child is generally atypical and may be abortive. *Paratyphoid* infections may also be responsible. Diagnosis can only be made by Widal's agglutination test after the tenth day, by which time the fever may have subsided. The possibility of a mild *B. coli* infection of the urinary tract must also be borne in mind. The urine will be acid, but may present a curious silky appearance, and microscopic examination will reveal motile bacilli. *Malaria* as a cause of transitory fever must be thought of in those who have been abroad, but should not be diagnosed unless malarial parasites are found in the blood, as there is too great a tendency to conclude that any fever is due to malaria in any one who has once suffered from it.

During an epidemic of almost any acute specific fever, cases of febricula occur which are very probably abortive examples of the prevalent fever.

2. *Gastro-intestinal Disturbances* are apt to be febrile in children, especially when caused by the ingestion of decomposing food. A "carbohydrate fever" is described, due to excess of carbohydrates in the food. The stools are pale, fermented and offensive.

3. *Noxious Vapours and Sewer Gas* are reputed to set up a fever with nausea, colic and vomiting. Yet workers in sewers are not specially liable to such a disease, and the evidence that an effluvium without organisms can cause fever is by no means conclusive.

The diagnosis of febricula is always unsatisfactory, simply meaning that a transitory fever cannot be referred to its proper group. It follows that the clinical picture is inconstant, and it would be misleading to describe one form as typical. The above suggestions may help to decide to which group a case really belongs.

Simple Continued Fever.—This name has been

given to cases of fever without physical signs, of too prolonged a duration to class as febricula. It was much used in the Army Medical Returns as a provisional or non-committal diagnosis. My experience in the South African War led me to conclude that the following types were so described.

1. *Exhaustion Fever* due to prolonged marching with inadequate food.

2. *Cases with Sudden Onset.* In these abdominal symptoms were generally lacking and rather rapid defervescence occurred between the fifth and seventh day. They were more like influenza than anything else, and probably correspond to the disease known as Pretoria fever or Johannesburg influenza.

3. *Cases with Gradual Onset.* It is generally agreed that most of these are typhoid fever. It was not infrequent to find a mild attack of continued fever followed by a relapse typical of typhoid, or on resumption of a meat diet a rise of temperature resembling the "febris carnis" of typhoid. In this type of fever the temperature is raised for a week or a fortnight; no enlargement of the spleen may be detected and no spots seen. Another type which appears to be typhoid is a continued fever lasting at least three weeks, often longer. The temperature often remains at 103° F. for several days, but beyond the pyrexia and a very furred tongue there may be no symptoms at all. The patient may feel quite well, his appetite is good and his sleep sound; yet I saw more than one case where after a fortnight a crop of rose-coloured spots appeared, the spleen was felt to be enlarged and the chart was that of a relapse in typhoid fever.

4. *Malta Fever.* The blood of some of the cases of continued fever in South Africa agglutinated the micrococcus melitensis and were therefore presumably cases of Malta fever.

In addition to the above causes of continued fever and febricula Horder gives the following—

(a) *Physical Signs overlooked or latent.* Cholecystitis, pyorrhoea alveolaris, perigastritis and subphrenic abscess, acute rheumatism and slight sepsis following surgical operations.

(b) *Physical Signs entirely absent.* Septicæmia, meningococcal meningitis, intestinal parasites, acute and subacute colitis, and rat-bite fever. (See each of these under appropriate heading.)

Glandular Fever was first described by Pfeiffer in 1889. It occurs in localised epidemics which are few and far between. The subjects are almost always children. The incubation period is five to ten days, most commonly seven. The onset is sudden, with fever, headache, stiff and tender neck and general malaise. The temperature ranges from 101.5° to 103° F. The fauces may be reddened, but the throat symptoms are quite transient. The tongue is furred, there

may be nausea and vomiting, constipation is commoner than diarrhoea. On the second or third day the cervical glands, usually those on the left side first, enlarge and become very sensitive, the skin over them remaining unaltered. The swellings become symmetrical, discrete and firm, suppuration being quite exceptional. Torticollis and pain on swallowing may occur. The fever subsides in about a week, but the swellings last about three weeks. There may be recrudescence. Respiratory symptoms are generally entirely absent. Acute nephritis is an occasional and important complication. Rarely if ever is the disease fatal.

Diagnosis. Mumps may be distinguished by the fact that the salivary, especially the parotid, and not the lymphatic glands are involved. The characteristic appearance of the swollen socia parotidis over the ramus of the jaw can be easily recognized. Other causes for swollen lymphatic glands must be excluded, such as dental caries, dental abscesses, thrush, follicular tonsillitis, diphtheria, otitis media and pediculi capitis. Tuberculous adenitis is distinguished by slow development, persistence and less pain. If a case of glandular fever is first seen after the fever has subsided it is apt to be taken for tuberculous adenitis. The history and course of the case will soon enable the diagnosis to be made. The possibility of the onset of an acute form of lymphadenoma or lymphatic leukaemia must be borne in mind. Treatment consists in isolation, rest in bed (especially in view of the dangers of nephritis), light diet, fomentations to the neck, a laxative and a simple febrifuge mixture.

Weil's Disease (Acute Infectious Jaundice).—Weil first described this condition in 1856 as attacking principally males between ten and thirty in small epidemics. The subjects have most frequently been butchers or those exposed to contact with foul water. It has occurred after eating rancid cheese and partially decomposed meat. A specific organism, *B. proteus fluorescens*, found in drinking or bathing water has been described as the cause, but this is not really settled. The *symptoms* resemble in important particulars those produced experimentally by drugs such as toluylene diamine, which cause hæmolysis. The onset is generally quite sudden with a rigor, though there may have been premonitory lassitude, headache and loss of appetite. The temperature rises to 103° or 104° F., and the pulse is rapid at first, slowing with the onset of the jaundice. There are marked gastro-intestinal symptoms such as colic, nausea, vomiting and diarrhoea. As in hæmolytic jaundice, the stools first contain much bile, and then as the catarrh of the bile duct develops, become clay-coloured. Jaundice appears from the second to fourth day, rapidly

becoming intense. The liver is slightly enlarged and tender, and the spleen swollen. Herpes, erythema or urticaria may occur. There is a tendency to hæmorrhage. There is usually marked albuminuria, and the urine contains much bile pigment and occasionally erythrocytes. Nervous symptoms soon develop, headache, dizziness, pains in back and calves, and delirium. Prostration is rapid and extreme, and the patient passes into a "typhoid state," with drowsiness and even coma.

The temperature begins to fall in four to nine days, defervescence occupying about five days more. The jaundice and the muscle pains disappear more slowly, the enlargement of the liver and spleen subsides and the nephritis clears up. There is considerable loss of weight, and convalescence is protracted. A relapse milder and shorter than the original attack occurs in forty per cent. of the cases three to eight days after the temperature reaches normal. Fatal cases are rare, but may result from heart failure, uræmia or the intensity of the intoxication.

Diagnosis. The disease occupies an intermediate position between catarrhal jaundice and acute yellow atrophy, and no hard-and-fast line can be drawn. The signs of a general infection are absent in the former, and in the latter the liver is not enlarged but shrinks. Leucin and tyrosin may be found in any severe hepatic insufficiency and are not pathognomonic of acute yellow atrophy. Usually there is not sufficient catarrh of the bile ducts to render the stools clay-coloured in acute yellow atrophy. Dengue occurs in large epidemics and the joints are much more involved. Yellow fever is restricted to certain districts, where the intermediate host—the *stegomyia*—is also found.

Treatment. Absolute rest is imperative. Fomentations are grateful for the muscular pains. Saline enemata and infusions may be required in the very toxic cases. Intestinal antiseptics have proved useless. Strong purgatives are injurious and alcohol is contra-indicated. Care must be continued into the prolonged convalescence.

Miliary Fever (Sweating Sickness).—This disease prevailed extensively in England in the Middle Ages, but is now confined to Picardy and Italy. The epidemics are brief but widespread. There is fever, general malaise, profuse sweats, erythema and a miliary vesicular eruption. The severer cases present signs of an intense infection, delirium, prostration and hæmorrhages. The mortality at the outset of an epidemic is high and death may occur in a few hours.

Foot and Mouth Disease (Epidemic Stomatitis; Aphthous Stomatitis).—This disease, which usually occurs in cattle, sheep and pigs, is not infre-

quently transmitted to man by the use of milk, butter or cheese from infected cows or by direct contamination of a wounded surface; it is not conveyed by cooked meat from a diseased animal. As in poliomyelitis the virus is ultra-microscopic and can pass through a porcelain filter. In man the symptoms are fever, digestive troubles and vesicular eruption on the lips, and buccal and pharyngeal mucous membranes. Hæmorrhages may occur in severe cases. The mortality is eight per cent., but it is chiefly in children that fatal cases occur. During epidemics among cattle all milk should be boiled, butter and cheese from suspected areas avoided, and isolation of infected animals and individuals practised.

Rat-bite Fever.—Horder has described the following sequence of events sometimes occurring in persons who have been bitten by a rat;

after an incubation period of three or four weeks fever appears, with much constitutional disturbance and sometimes an eruption of large indurated erythematous plaques. A high leucocytosis is present. After three or four days, a quiescent period follows, during which the patient regains his normal state. The fever recurs after a variable interval, usually three to four days, and this alternation goes on for a variable time up to several months. Ultimately recovery takes place, apparently independently of treatment. O'Carroll has described the occurrence of nephritis as a complication. No microbic or other cause has hitherto been discovered, but the resemblance to relapsing fever suggests that a spirillum is the cause, which is the more probable since rats are known to be frequently infected with hæmatozoa.

W. L. B.

DISEASES OF THE RESPIRATORY TRACT

DISEASES OF THE BRONCHI

Bronchitis

By bronchitis is meant catarrhal inflammation of the bronchial tubes.

The following clinical types are recognized: (1) acute bronchitis of the larger tubes; with this is usually associated acute tracheitis; (2) acute bronchitis of the smaller tubes, or capillary bronchitis; (3) chronic bronchitis, which includes (a) ordinary chronic bronchitis, (b) dry catarrh (catarrhe sec of Laennec), (c) bronchorrhœa, (d) fetid or putrid bronchitis, and (4) plastic bronchitis.

Acute Bronchitis of the Larger Tubes—

Etiology. The disease is most prevalent where the climate is cold, variable and moist. For this reason it is commoner in winter. It occurs most frequently amongst infants, young children, and elderly people. Impurity of the air, whatever its cause, former attacks of bronchitis, especially if they have caused emphysema, and alcoholism, are important factors. A chill, from exposure to wet or cold or both combined, is the immediate exciting cause in many cases of bronchitis. Bronchitis may occur as a complication or result of other morbid conditions, including acute febrile diseases (such as whooping-cough, influenza, measles, typhoid fever, typhus fever, scarlet fever and smallpox), gout, Bright's disease, syphilis, pulmonary and intra-thoracic disease (such as lobar or lobular pneumonia, tuberculosis, emphysema, pleurisy, aneurysm of the aorta, mediastinal tumour, mitral diseases) and rickets. Gout is of great importance from the point of view of treatment. Bronchitis occurs not only

in those cases of gout in which there is arthritis, but also in those persons who suffer from what is called "suppressed gout." In gouty subjects bronchitis generally occurs in middle or later age and associated with emphysema.

Symptoms and Physical Signs. With this condition acute tracheitis is usually associated. An attack may vary greatly in severity, from a mild catarrh lasting only for a few days to a serious and possibly grave illness with considerable constitutional disturbance. In any case cough, expectoration and shortness of breath are each present in some degree. Cough commences early in the disease. At first it is dry and hard, and it may be painful and paroxysmal, the expectoration being scanty and consisting of viscid mucus which is difficult to expel. In a few days the cough becomes loose, the expectoration, which is expelled more easily, becomes larger in amount, less viscid, and consists of a colourless fluid secretion which is frothy and intermixed with whitish streaks and sometimes streaked with blood. As the disease advances the expectoration further increases in amount, averaging from six to twelve ounces in the twenty-four hours, is muco-purulent or purulent, opaque, and yellowish or yellowish-green in colour. The dyspnoea varies greatly in degree; it may be very slight, or considerable—especially when there is either emphysema or cardiac failure present, and in these cases there may be marked cyanosis. Attacks of spasmodic dyspnoea may be present.

In regard to the onset, very frequently the disease commences as an ordinary nasal, pharyngeal, or laryngeal catarrh. A feeling of rawness behind the sternum means that the trachea is

implicated. There is often a sensation of tightness in the chest, especially in emphysematous patients. In these, as well as in children and old people, the patient may quickly become severely ill.

A rigor is rare, but general malaise and pains are common. The temperature does not often rise above 101° F., excepting in children. Other indications of the febrile state, such as a coated tongue, scanty high-coloured urine and a quickened pulse, are usually present. In severe cases there may be delirium, especially during the night.

On inspection of the chest the breathing is seen to be quickened, and on inspiration there is well-marked elevation of the chest, but lateral expansion is usually deficient, and in children there may be recession of the ribs and interspaces laterally and even of the supraclavicular areas. On palpation rhonchial fremitus is often to be felt. Percussion is normal, except that occasionally there is slight hyper-resonance due to temporary over-distension of the air vesicles, and there may be slight impairment at the bases due to the presence of collapse, or congestion and cedema. On auscultation there are harsh breath sounds, with prolonged expiration, and sonorous and sibilant rhonchi, most marked during expiration. As the disease advances and the mucus becomes more or less liquid, large, medium or fine bubbling râles are frequently heard, especially over the bases. If cedema, hypostatic pneumonia or bronchopneumonia is present, there may be fine crackling râles. The physical signs of emphysema and dilatation of the right heart may also be present.

Diagnosis. As a rule the diagnosis is easy. Pneumonia, miliary tuberculosis of the lungs and acute congestion of the lungs from cardiac failure secondary to mitral stenosis should be excluded.

Prognosis. If the attack is mild, convalescence is usually fully established in about a fortnight. If the attack is severe, it rarely occurs before double that time. When the patient is already the subject of emphysema he may be even confined to bed for a longer period. A fatal termination may ensue in young children, in old people, and in those who are the subjects of emphysema, heart disease or Bright's disease. Cessation of expectoration, severe dyspnoea, cyanosis, a very rapid pulse, distension or pulsation of the jugular veins, coldness of the extremities, profuse clammy sweating, and delirium are all unfavourable signs. Lastly, it should be remembered that an attack of acute bronchitis renders the patient more liable to a recurrence, and chronic bronchitis is apt to be set up.

Treatment. In the treatment of bronchitis, both acute and chronic, it is very important that

the etiological factor should never be lost sight of. An endeavour should be made to discover and treat the underlying cause. It may be readily understood that merely to prescribe for the patient's cough is a very small part of the treatment of bronchial catarrh. For example, the matter of the patient's occupation and habits should be considered in great detail and with scrupulous care. Our endeavour should be to promote the general health and maintain it at the highest possible level, and to secure immunity from frequent "colds." Thus plenty of fresh air night and day, a cold or tepid bath every morning, systematic exercise, moderation in eating, drinking and tobacco, a sufficient but not excessive amount of warm clothing, and the avoidance of cold feet and exposure to cold or sudden variations in temperature should be enjoined. It is also important to remove any possible source of the catarrh in the upper air passages, such as nasal polypi, deflected septum, adenoids, enlarged tonsils and chronic pharyngitis. Any disease of organs other than those of the respiratory tract, especially chronic heart and kidney disease, should be carefully attended to. Change of climate to a dry and warm atmosphere is always advisable whenever possible.

Passing to the treatment of acute bronchitis of the larger tubes, prompt and energetic measures in the early stages of a "common cold" will often prevent an extension of the process. The patient should be given an initial purge, calomel, followed by a saline, to be preferred. The skin and kidneys should be acted upon by hot baths, vapour baths, hot drinks or Dover's powder. The patient should remain in bed in a room the temperature of which should be from 60° to 65° F.; care being taken at the same time to see that the room is well ventilated. It is well to moisten the air by steam from a bronchitis kettle, to the water in which may be added compound tincture of benzoin (one drachm to the pint), or eucalyptus oil (five minims to the pint), or thymol or menthol. The clothing should be light and warm; a gamgee or Shetland wool jacket is useful. A hot linseed poultice, not heavy, and changed about every two hours is probably the best local application. Stimulating liniments, such as lin. terebinth. acet., lin. camph. co., turpentine stupes, or portions of a mustard leaf, may be substituted. In the earlier stages the diet should be fluid and warm, such as hot milk, beef tea, chicken-broth, and clear soup. Later, such solids as milk puddings, white fish and chicken may also be given as the appetite returns. Barley water, flavoured with lemon, is useful both for the thirst and cough. In the early stage of the disease, before the bronchial secretion occurs, ipecacuanha is the best drug, and should be

combined with purgatives and diaphoretics. In young adults antimony may be substituted for ipecacuanha, as long as its effect on the circulation is carefully watched. Opium or morphia is only allowable in the early stages of acute bronchitis of a mild type, where a frequent, irritating and useless cough is due to mere increased sensibility of the mucous membrane and not to the presence of secretion. On no account should either be given in severe cases, where the bronchi are extensively obstructed, in cases where there is any degree of cyanosis, or in young children, and both are always contra-indicated in old people. Pulv. ipecacuanhæ co. (10 to 15 gr.) combines ipecacuanha and opium. Whenever opium is given, it is important to see that there is a regular daily action of the bowels. If the cough is troublesome at this stage, inhalations of menthol, chloroform and alcohol are useful. When free bronchial secretion becomes established, sedative expectorants should be abandoned, and their place taken by remedies which promote expectoration in conjunction with alkalies. Of the former, ammonia and senega are the most useful. Chloride of ammonium is particularly useful when the expectoration is very viscid. In those cases in which there seems an asthmatic element, iodide of potassium combined with stramonium or belladonna should be given. For the sleeplessness, paraldehyde is the best drug. Otherwise, trional, veronal or sulphonal may be given.

It is very rarely necessary to administer stimulants. Brandy with hot water, sugar and lemon, or with hot milk, is the best. If cardiac failure is present it should be treated on lines laid down elsewhere. When convalescence is established, iron, arsenic, quinine and cod liver oil are useful.

Acute Bronchitis of the Smaller Tubes, or Capillary Bronchitis. This is always a serious condition, and not infrequently terminates fatally. The disease may have either extended downwards from the larger tubes or may be primary.

Symptoms and Physical Signs. The onset is usually well defined, and there may be a rigor, or in the case of a child a convulsion. The cough occurs with variable frequency. Often it is very frequent and sometimes it is paroxysmal in character. At first it is dry, and not infrequently this dryness persists, or the expectoration may be small in quantity and isolated viscid sputa are brought up after long-continued paroxysms of cough. The dyspnoea is as a rule severe, and orthopnoea not infrequently occurs early.

The temperature is considerably higher than in bronchitis of the larger tubes, and may reach 104° F. The pulse is rapid, 110 or more, even 140 in children. The face is anxious and

pallid, with cyanosis of the lips, nose and cheeks, which may be marked, and the *alæ nasi* are widely dilated. There is great prostration, the extremities are cold, and profuse clammy sweating is common. The patient is restless, and delirium and nervous twitchings are not infrequent.

The respiration is very rapid and short, and there is retraction of the lower intercostal spaces, of the epigastric and hypochondriac regions, and it may be of the supraclavicular regions during inspiration. The percussion note may be slightly hyper-resonant from temporary over-distension of the air vesicles. There may be slight impairment of note over the bases due to the presence of collapse; this is especially apt to occur in children. On auscultation over the bases the air entry is found to be feeble. Sibilant rhonchi are audible, especially on the posterior aspect and particularly at the bases, and small bubbling râles are present. Fine crackling râles are audible if œdema, hypostatic pneumonia, or broncho-pneumonia is present. The physical signs of emphysema may also be present.

Diagnosis. This form of bronchitis is diagnosed from that in which the larger or medium-sized tubes are affected by the character of the cough and sputum, the dyspnoea, lividity, the greater frequency of the pulse, the more grave constitutional disturbance, and the difference in physical signs. Acute caseous tuberculosis of the broncho-pneumonic type may be distinguished by the less-marked dyspnoea, the higher and more continued fever, the early occurrence of muco-purulent expectoration, in which tubercle bacilli are usually found, the absence of signs of over-distension of the right side of the heart, by the physical signs being more distinct at one portion of the chest, especially at one apex, and the longer duration of the disease. It is not always easy to diagnose between miliary tuberculosis of the lungs and capillary bronchitis. Evidence of previous involvement at one apex, an insidious onset, and the fact that the dyspnoea, cyanosis and prostration are out of all proportion to the physical signs, are in favour of tuberculosis. Tuberculosis also is rarely, if ever, limited to the lungs. If expectoration is present, help is afforded by examining for tubercle bacilli.

Prognosis. Acute bronchitis of the smaller tubes is always a serious condition. The more near the extremes of life the worse the prognosis. Emphysema and heart disease add to the gravity of the condition. When a fatal termination takes place it usually does so within the first fourteen days, and in the extremes of life it may be within a day or two. When recovery takes place, it is always slow.

Treatment. The patient should at once be put to bed in a room the temperature of which

should be from 60° to 65° F.; care being taken at the same time to see that it is well ventilated. It is preferable that the room should have an open fire. The air should be moistened by steam, as described under acute bronchitis of the larger tubes. It is advisable to have large curtains at the sides of the bed. Trained nurses, night and day, are essential. The patient should not lie on his back for hours at a time, but a frequent change of posture should be attended to. In children a warm bath containing mustard is often useful at the onset. The clothing should be light and warm; a gamgee or Shetland wool jacket is serviceable. Poultices should be continuously applied to the chest, care being taken that they are not heavy and that they are changed every two hours. When this is not possible stimulating liniments may be substituted. The diet should be fluid, such as milk, beef tea, chicken broth, egg albumin, the white of egg in cold water with a little sugar, gruel and koumiss. The bowels should be attended to; the best initial purgative is calomel followed by a saline. Antimony may be given every three hours for eight or ten doses in the early stage of the disease, before the bronchial secretion occurs, as long as the pulse is good and there is no prostration and provided its effects on the circulation be carefully watched. Later on, stimulant expectorants (such as carbonate of ammonia, tincture of squills and infusion of senega), combined with ipecacuanha, should be administered. When there is a spasmodic element present, nitrite of amyl is indicated. Opium is absolutely contra-indicated. If the patient cannot secure sleep, ammon. bromid. (15 gr.) with sp. ammon. aromat., or bromidia, sulphonal (30 gr.) or paraldehyde (5 i-ii) may be given, as long as there is no urgent dyspnoea, or signs of engorgement of the right heart or bases of the lungs, and provided the patient is awakened every two hours, and then encouraged to make special efforts to expectorate. When there are cyanosis, lividity, extreme dyspnoea, and over-distension of the right heart, six or eight leeches may be applied on the upper part of the sternum in adults or two or three in the case of children. If suffocation threaten venesection may be necessary, though it is very rarely so in children. It may be repeated if the heart again becomes engorged. Any flatulent distension of the stomach and tympanites should be treated. Stimulants may be required early. Brandy with hot water, sugar and lemon, or with hot milk, is the best. If brandy or whisky are not well borne, champagne may be tried. Should the symptoms increase in gravity, and collapse and cyanosis come on, and the secretion be abundant while the cough is feeble and there is much difficulty in expectorating the phlegm, brandy or whisky as already

noted should be given, as well as ether and ammonia by the mouth every four hours, hypodermic injections of strychnine every three or four hours, and the inhalation of oxygen for ten minutes at intervals of half-an-hour or less are indicated. If secretion is abundant, but the cough feeble and there is much difficulty in expectorating the phlegm, the respiration of a child may be stimulated by a sudden affusion of a small quantity of cold water on the chest whilst the patient is in a hot bath, or the child may be placed in a mustard bath and vigorous rubbing and squeezing of the chest when the child is in the bath be employed. Or an emetic may be given (a drachm of vin. ipecacuanh. every fifteen minutes till vomiting occurs). This method of treatment should not be used where there is much prostration or stupor; we should carefully watch its depressing effects, and it cannot be often repeated. Sulphate of copper has the reputation of being a reliable and rapid emetic without having the depressing effect on the heart of ipecacuanha. If hyperpyrexia comes on, it should be treated on the lines laid down elsewhere. When convalescence is established, such tonics as iron, arsenic, quinine and cod-liver oil, as well as gymnastic and deep breathing exercises, are useful. Great care should be exercised in regard to possible exposure to chill, and a change to a warm, dry and equable climate may be necessary.

Ordinary Chronic Bronchitis. This is usually due to a recurrence of acute or subacute attacks of bronchitis, and therefore all the predisposing and exciting causes hold good here. It is most common in advancing age, and in the great majority of cases is associated with emphysema, of which it is the commonest cause and which itself helps to establish the permanence of chronic bronchitis.

Symptoms and Physical Signs. It should not be thought that the term "chronic bronchitis" means that the course of the disease is necessarily continuous. Indeed, the most typical variety is the chronic winter cough, that is, the affection develops yearly at the commencement of the winter and ceases when the climatic conditions become favourable.

The affection occurs in very diverse forms.

The cough varies in degree. It may be largely confined to the period just after getting out of bed in the morning, and may also occur just after getting into bed at night, with occasional exacerbations in inclement weather. The expectoration is moderate in amount and muco-purulent. There may be some wheezing, and also some degree of dyspnoea on exertion—the degree of dyspnoea depending on the amount of emphysema present. Emphysema is absent or only slight.

As the disease progresses the symptoms in

the winter become more severe, and the period of intermission in the summer becomes shorter. Ultimately the symptoms become continuous all the year round, being more severe during cold, damp, foggy weather. Instead of this method of evolution, however, occasionally this ultimate picture is the result of merely one or more acute attacks. Whichever of these two causes be in action the ultimate result is the same. The clinical picture is pitiable. The cough is persistent, though often fitful. During a paroxysm of coughing the face becomes markedly cyanosed, and the patient is very breathless for a time afterwards. Usually the expectoration is profuse, frothy, partly viscid and partly fluid, and muco-purulent. It may consist of a large liquid portion containing yellowish-green nummulated masses which sink or float submerged; or it may consist of a single and very viscid mass. During an exacerbation it may be scanty and sticky.

The shortness of breath increases, until at last it is present even when the patient is at rest. The breathing becomes laboured and rhonchi are heard during expiration. There may be attacks of bronchial asthma at night. Later there is loss of flesh and strength, night-sweating, and it may be digestive disturbances. The patient has to be propped up in bed on account of the severity of the dyspnoea, or may have even to get out of bed and sit in a chair. There is cyanosis, the fingers and toes become clubbed, the veins of the neck become distended, and pulmonary oedema, especially of the bases, oedema of the feet and legs and even of the trunk, signs of congestion of the liver, and scanty albuminous urine supervene.

The physical signs of acute bronchitis are present in the chronic form; besides this, however, there may be considerable or marked emphysema, in which case instead of being harsh, with prolonged expiration, the breath-sounds are feeble, and in advanced cases there may be impairment at the bases from cedema, collapse or hypostatic pneumonia. Sonorous and sibilant rhonchi, and large and medium bubbling râles are present. Crackling râles may be audible over the bases, and do not necessarily mean cedema, hypostatic pneumonia or broncho-pneumonia, as they are often found in emphysema alone.

We should be on the look-out for symptoms and physical signs of bronchiectasis. Fœtid sputum does not necessarily mean bronchiectasis. It occurs also in fœtid bronchitis. Physical signs of a failing right heart may also be present.

Diagnosis. It is of great importance that in every case of supposed simple chronic bronchitis the sputum should be repeatedly examined for tubercle bacilli. It will be found that the

two diseases co-exist in by no means a small proportion of cases.

Prognosis. As already stated the sputum should in every case be repeatedly and systematically examined for tubercle bacilli. The prognosis will depend upon whether or not the patient is able to spend the winter in a warm equable climate. Failing this, much will depend upon whether he is able to protect himself from the variations of the British climate in the winter months. In both events life may be prolonged to old age. Whatever degree of emphysema may be present remains, except in young subjects.

Treatment. Some general principles have been laid down under the treatment of acute bronchitis of the larger tubes. Also it may be stated at the outset that the constitution of the patient should always be taken into account in the treatment of this disease; for example, the presence of gout, heart or kidney disease, when the general measures for the respective diseases should be thoroughly carried out. Chronic bronchitis may be largely due to heart failure, with long-standing congestion of the mucous membrane of the bronchi, or to asthma, or to emphysema. Furthermore, it is of great importance to have a thorough investigation of the nose and upper air-passages, since pathological conditions here are a common cause of chronic bronchitis. When a person is the subject of chronic bronchitis it is obviously an important indication to shield him from inclement weather. Whenever possible, he should winter abroad, or at some dry, sheltered place in the country. Madeira, on account of its moist and equable climate, is excellent, especially for cases of chronic bronchitis associated with much secretion. The climate of the Canaries is drier and more bracing. Algiers and Corfu are good. The dry climate of Egypt may be advised for those who are fairly robust and without marked catarrh. Of the places on the Riviera Mentone is the most suitable. On account of the great difference between the sun and shade temperature and the prevalence of winds on the Riviera, the patient should be reminded to have an ample supply of warm clothing and to exercise the greatest care. If the patient goes abroad for the winter he should not return to England until the end of May. In this country the best places for the winter are Falmouth, Torquay, Penzance, Sidmouth, Bournemouth, Ventnor, and Colwyn Bay. In the summer months a course of muriated alkaline waters at Mont Dore is useful. Systematic breathing exercises are worthy of a trial. When the patient is unable to change his place of residence, woollen underclothing should be worn, the extremities especially should be warmly clad, and as far as possible he should

avoid exposure to inclement weather. If he can be persuaded to wear a respirator or a woollen muffler over his mouth when he goes out of doors, all the better; failing this he should be advised to breathe only through his nose. In some cases it is necessary to confine the patient to the house or even to one room in inclement weather and after sunset or even throughout the whole winter. He should not go into a cold bedroom after sitting in a hot room. The rooms should be large and airy and the temperature as nearly uniform at 65° F. as possible. If the patient's occupation be dusty or otherwise deleterious, he should change it when possible. The general health should be promoted and maintained at the highest possible state of efficiency. The diet should be light but nutritious. The bowels should be kept open. In many cases a blue pill and saline are often of great value. Flatulence and constipation should be carefully avoided or treated. If the cough is troublesome at night, a little warm milk is useful, but stimulants should be avoided unless there are definite indications for them. Cod-liver oil is of very great service in chronic bronchitis; indeed, in the experience of the writer it is almost of as much service in this disease as in tuberculosis. As well as cod-liver oil, a good general tonic is a combination of tinct. ferri perchlor. and spirit of chloroform.

When there is merely a morning cough, a good mixture is that of sod. bicarb. (15 gr.), sod. chlor. (5 gr.), sp. chlorof. (5 min.), aq. anisi ad 1 ounce, in warm water on rising. If it is advisable at the same time to stimulate expectoration, am. carb. (3 to 5 gr.) may be added, and when the sputum is viscid pot. iod. (3 to 5 gr.) may also be added, or both. Should cough also occur on lying down at night, this prescription may be given. Such an alkaline treatment is sufficient for a case of mild degree of winter cough. When the condition is further advanced, if there is moderate secretion a good combination is that of am. carb., tincture nuc. vom., tinct. scillæ, sp. chlorof. and infus. senegæ. As senega is nauseous, serpentary, cloves or gentian may be substituted. If the nux vomica causes irritability of the bladder, as it sometimes does in old people, its place may be taken by tincture of belladonna. When the sputum is scanty, dry and tenacious, iodide of potassium is of great value. When there is an asthmatic element, besides iodide of potassium, belladonna or stramonium should be added. When the cough is useless and harassing, being out of all proportion to its results, sedative remedies should be administered (as long as they do not produce lividity or drowsiness), such as glycoheroin (1 dr.) or a linctus such as liq. morph. tart. (3 min.), acid hydrocyan. dil. (1 min.),

oxymel scill. ad 1 dr. If expectoration is profuse, tar in the form of tar water or pills is useful. In chronic bronchitis of old people, am. chlor. in 5 gr. doses may be included in the prescriptions. If cardiac failure is present, it should be treated on the lines laid down elsewhere, as should recurrent acute attacks of bronchitis.

Dry Catarrh. In this form of bronchitis there is chronic congestion of the mucous membrane, especially of the smaller bronchi. The cough is frequent, paroxysmal and very intense and distressing, and the expectoration is absent or scanty, and consists of globules about the size of hemp or millet-seeds, and are viscid, airless, semi-transparent, and pearly grey in colour. Emphysema is very liable to be set up.

Treatment. Iodide of potassium is beneficial in these cases.

Bronchorrhœa. In this condition there is excessive bronchial secretion; indeed, it may be extremely abundant, even amounting to four or five pints in twenty-four hours. It may be thin and transparent, resembling white of egg (bronchorrhœa serosa), or it may consist of thin puriform mucus (broncho-blennorrhœa).

Treatment. Volatile expectorants which are excreted by the bronchial surface (such as tar, copaiba, terebene, ammoniacum), combined with ammonia and senega, should be prescribed.

Fœtid Bronchitis. Fœtid or putrid bronchitis is characterized by fœtor of the expectoration. There may be pyrexia. The clinical features of the condition, including the character of the sputa, resemble bronchiectasis. This condition is rare, as fœtid expectoration is generally due to bronchiectasis or some other condition. The sputum is abundant, usually thin, and in the sputum vessel it separates into three layers. The other clinical features, such as a tendency to pyrexia, lobular pneumonia, abscess, gangrene, are the same as in bronchiectasis.

Diagnosis. This condition must be distinguished from other causes of fœtid expectoration (see *Bronchiectasis*).

Treatment. The disease should be treated in the same way as bronchiectasis.

Plastic Bronchitis. This disease, also known as fibrinous or croupous bronchitis, is rare, and is characterized by the exudation of a plastic fibrinous material into the bronchial tubes, which is expectorated in the form of casts.

The true pathology of the condition is unknown.

Symptoms and Physical Signs. Acute cases, which are rare, may set in with rigors, high fever, severe paroxysms of cough, and it may be with hæmoptysis. The clinical picture

resembles that of acute bronchitis, excepting that casts are expectorated.

In the chronic variety the condition is for months or even some years not to be differentiated from ordinary chronic bronchitis. Then, at varying intervals, the patient begins to expectorate casts. For some hours before the casts are brought up the cough is violent and usually paroxysmal, the dyspnoea may be intense, there is cyanosis, and it may be hæmoptysis. When the casts have been expectorated there is great relief. With each attack a mild degree of pyrexia may be present. For some days after the attacks fragments of casts may be brought up. Otherwise in the intervals the expectoration of ordinary bronchitis may be present.

The casts are expectorated as rounded masses, covered with mucus. When unravelled in water they are found to be moulds of the bronchial tubes. A perfect cast may be as much as seven inches long, and the maximum diameter be as large as that of an ordinary writing pencil. It is white or pearly grey in colour. The larger may be hollow cylinders: the smaller are usually solid. On microscopical examination, the coagulated material is seen to be arranged in concentric laminæ, amongst which leucocytes and it may be Curschmann's spirals and Charcot-Leyden crystals are embedded. Formerly it was thought that they were all composed of fibrin. Now it is believed that at least some are composed of mucin. On physical examination, in exceptional cases, catarrhal signs are limited to a certain area, and subsequently there may be signs of complete bronchial obstruction and pulmonary collapse of that area. After the cast has been expectorated, there is a return of the breath sounds.

Diagnosis. We should be on the look-out for the condition in all cases of paroxysmal dyspnoea without obvious cause, which are suddenly relieved by expectoration, and the sputa should be carefully unfolded in water. By microscopic examination we can exclude blood clots which are occasionally expectorated after hæmoptysis and diphtheric membrane.

Prognosis. A fatal termination during an attack is rare. The tendency of the disease, however, is to recur.

Treatment. The general indications are those of ordinary bronchitis. Inhalation of steam, or a warm moisture-laden atmosphere, as well as large doses of iodide of potassium, are useful. It may be necessary to administer an emetic.

F. W. P.

BRONCHIECTASIS

By **Bronchiectasis** is meant more or less localised dilatation of the bronchi. As a clinical

entity it is by no means a common disease. As a pathological accompaniment of chronic pulmonary tuberculosis it is common.

Etiology. Excepting the rare cases when it is congenital, bronchiectasis is never a primary condition. It is secondary to some disease of the bronchial wall, the lung or pleura. It is most common between the ages of ten and forty. It occurs much more frequently in males than in females. Affections of the bronchial wall play the most important rôle in the causation of the condition. Of these chronic bronchitis is by far the most common, and accounts for about half of all cases of bronchiectasis. Bronchial stenosis (whether due to tumour, foreign body, syphilitic stricture or pressure from without as by an aneurysm or a new growth), pneumonia, especially bronchopneumonia, and pleurisy are other antecedents of bronchiectasis.

Morbid Anatomy. Anatomically, there are two chief forms of the disease: the cylindrical or fusiform (which is commoner) and the saccular. In advanced cases both are often found together in the same lung. The cylindrical variety affects chiefly the larger and medium-sized tubes, the saccular chiefly the terminal bronchi. At autopsy, in more than sixty per cent. of cases both lungs are found to be affected. The lower lobe is more often first affected. Localised bronchiectases are common in pulmonary tuberculosis (especially at the apex), and in chronic pleurisy (especially at the base). Usually more or less general bronchitis is present. As a rule also pleuritic adhesions are present, the adherent pleura being much thickened; the interlobar septa appear as dense fibrous bands, and the interlobular connective tissue may be increased. Ulceration of the inflamed bronchial mucous surface, septic bronchopneumonia, perforation of the pleura and pneumonia, cerebral abscess and other complications, may be found.

Symptoms. Cough, expectoration and dyspnoea are the three cardinal symptoms, but it is the peculiar character and combination of the two former that make the characteristic clinical picture. In the limited dilatation of pulmonary tuberculosis, and it may be in the dilatation associated with chronic bronchitis and emphysema, the symptoms are often for the most part limited to those of the original disease.

The characters of the cough and expectoration are distinctive.

The cough is paroxysmal. In the intervals between the paroxysms the patient is usually comparatively free from cough, unless there is emphysema present. The reason for this is that the dilated tubes to a large extent lose their sensibility and consequently cough is not excited

until the accumulation of secretion is so great as to irritate healthy parts of the mucous membrane. The paroxysms occur principally when the patient lies down at night, when he rises in the morning, and when he adopts some particular position—generally the recumbent on the healthy side. At these times the secretion overflows into healthy or less diseased bronchi. He then expectorates a large quantity of purulent and often offensive secretion, usually diffuent, but sometimes nummulated. When the condition is fully developed the sputum is horribly foetid. The breath is similarly affected, and its odour may be recognized at some distance from the patient. For some years prior to this stage there may be merely a faint putrid smell and perhaps for years before that there may be no smell at all. The quantity expectorated is usually large, amounting it may be to twenty or thirty ounces or more in the twenty-four hours. After standing in a conical glass for about twenty-four hours it separates into three layers, an upper frothy layer, a middle layer of thin fluid which may contain strings of mucus, and a thick lower layer of pus, the lower layer containing among other things the bodies known as Traube's or Dettrich's plugs. These plugs are soft foetid bodies, which vary from the size of a millet-seed to a bean, and under the microscope are found to contain pus-cells, granular detritus, oil globules, hamatoidin crystals, and many organisms, including the spirals and filaments of *leptothrix*. The sputum also contains among other things fatty crystals (palmitic and stearic), leucine and tyrosine. Elastic fibres are only present in cases of ulceration.

In the early stages there is not as a rule much dyspnoea present and it may be absent altogether. It is apt to be severe when there are co-existent bronchitis, emphysema, fibrosis, and cardiac complications.

Hæmoptysis occurs in about one-third of the cases, being usually a late symptom. Occasionally it is the immediate cause of death. Pain in the chest may be present. As a rule there is an absence of pyrexia in the early stages of the disease; it is apt to be present when secretion is retained. Further, septic broncho-pneumonia may occur towards the end of a case, in which event there is usually high fever of a remittent type. Clubbing of the fingers and toes may be a marked feature of the disease. Diarrhoea and albuminuria occur when there is amyloid disease of the intestines or kidneys. Diarrhoea may also result from septic infection of the bowel. Abscess of the brain occasionally occurs. Indications of failure of the right heart are apt to supervene, especially in the later stages of the disease.

Physical Signs. Besides the physical signs of the primary disease or associated condition, such as emphysema and fibrosis, there are physical signs of the dilated tubes and of the associated catarrh. These vary in different cases, and no one is pathognomonic of the disease. The physical signs are more marked over the lower and middle parts than over the apex of the lung. There may be diminution of expansion, especially over one or both bases, and increase of vocal fremitus and vocal resonance. The percussion note may be of higher pitch and deficient resonance or, where the tubes are filled with secretion and there is surrounding fibrosis, the impairment may amount to actual dullness, and where an area of lung near the surface is converted into a mass of sacculi it may be tympanitic, amphoric or cracked-pot. On auscultation, in the cylindrical form there may be bronchial breathing, and in the saccular form cavernous breath sounds and Skoda's "veiled puff," as well as pectoriloquy, may be heard. Skoda's "veiled puff" is a sound of a puffing character occurring at the end of inspiration; it is more often heard in bronchiectasis than in any other condition. Bubbling and crackling râles may be present, and in the saccular form gurgling râles may be audible. It will be observed that there is nothing peculiar in the signs themselves; their chief feature is their variability and inconstancy, being at one time marked and at another time slight, according as the bronchi are filled or empty.

Diagnosis. The character of the cough and expectoration, the absence of elastic fibres and tubercle bacilli from the expectoration, together with the physical signs of vomica, and the gradual disappearance of these signs as the secretion reaccumulates, afford pretty certain evidence of the disease, as long as an empyema which has ruptured into the lung can be excluded. As already indicated, it is the alteration of physical signs over a certain area before and after the bringing up of a large quantity of expectoration—which means the emptying of a cavity—which affords such important evidence of the disease. Foetid expectoration is not sufficient evidence of bronchiectasis, since this may merely be indicative of foetid bronchitis. In these cases the way the sputum is brought up, the absence of characteristic paroxysms, and the character of the physical signs are amply sufficient evidence whereby to make a correct diagnosis. The diagnosis from gangrene of the lung should not be difficult if the history, the severe constitutional symptoms, and the character of the sputum be carefully taken into account. It should be remembered, however, that in bronchiectasis there may be ulcerative and

destructive changes in the bronchi, and also that gangrene may be the result of bronchiectasis. It is sometimes necessary to distinguish pulmonary tuberculosis, especially basal, from dilatation of the bronchi. This may be done by repeated examination of the sputum, but furthermore the whole clinical picture of the two diseases is different. It should be remembered that both diseases may co-exist, as pulmonary tuberculosis may be engrafted on to bronchiectasis. It is sometimes very difficult to diagnose bronchiectasis from a localised empyema which has ruptured into a bronchus, especially when the empyema is at the diaphragmatic surface of the lung and is small. The differential diagnosis is important, as operative interference is advisable here. In a ruptured empyema there is a history of an acute illness, with probably little or no expectoration, and then suddenly a large flow of strictly purulent material without mucus. Help may also be obtained from an X-ray examination.

Prognosis. Unfortunately a cure cannot be expected. At the best all that can be done is to arrest the further progress of the disease. As a rule, even in spite of treatment, the disease gradually advances. Some patients, however, live for twenty or thirty years or even longer.

Treatment. In regard to the treatment of bronchiectasis, the main indications are to attend to the general health and nutrition of the patient, to empty the dilated tubes, to diminish the amount of catarrh and degree of fœtor, and to prevent the recurrence of attacks of bronchitis.

The treatment should be begun early, whether fœtor is present or not: it should be carried out energetically (it is not sufficient merely to try to allay symptoms as they arise); and it should be perseveringly continued for a prolonged period, a period of a few weeks being quite insufficient. Furthermore, one particular form of treatment should not be relied upon exclusively, but a combination of several forms employed.

In some instances the treatment will include that of the cause of the disease. The general health should be promoted and maintained at the highest possible level. Thus, a liberal supply of varied and nutritious food should be given, mineral acids and bitters if the appetite is poor; if anæmia is present it should be treated, and prolonged courses of iron, arsenic, quinine, the hypophosphites, cod-liver oil, and in children the syrup of the iodide of iron, are of advantage. Whenever possible a warm and equable climate should be taken advantage of, so that the patient may be in the open air most of his time. When the secretion is excessive in amount a dry climate is preferable, as, for example, South California or the tablelands of South Africa.

In some cases a winter spent in Egypt or at one of the warm sheltered health-resorts along the Mediterranean coast may be serviceable. The most suitable health-resorts in this country are probably those of the south coast, such as Falmouth, Torquay and Bournemouth.

Among special forms of treatment that of creosote baths is the most efficacious. Common commercial coal-tar creosote is used. Any chamber, even an outhouse, which can be set apart for the purpose and cleared of furniture will do. It should be situated some distance from the doors and windows of other buildings on account of the penetrating odour of the drug. It should be made as airtight as possible. About five or six ounces of creosote should be placed in a fairly deep open metal dish, which is placed in the centre of the room on a ringed iron tripod standing on a flat stone slab or in a large tin vessel, and under the dish a spirit-lamp with a regulating mechanism is put. The eyes should be protected, the nostrils should be filled with cotton-wool, and an over-garment, as well as a bathing bag or a towel over the hair should be worn. The spirit-lamp should be lighted and regulated to give only a gentle heat at first, and the patient should stay in the chamber for from a few minutes to half an hour every other day. Later the heat, frequency and duration are gradually increased until the exposure is from one to two hours daily in an atmosphere in which objects can be distinguished with difficulty. The sittings should be continued for at least three or four months; then bi-weekly sittings should be continued.

The postural method of treatment, by affording mechanical aid to the bronchial outflow, is very useful. The patient may periodically lean over the side of the bed or table and place the hands on the floor; or he may adopt the genupectoral position; or lean down with the head low and a slight inclination away from the affected side; or indeed he may be inverted, or adopt prone recumbency, without any pillow, the foot of the bed being later on progressively raised until the castors are fourteen inches or so from the floor. In all these positions the patient should be encouraged to cough and expectorate. In place of the preceding intermittent method, the continuous method may be employed. Supplementary treatment by means of exercises may be used.

A third special form of treatment is that of intra-tracheal injections of suitable drugs. A frequent prescription is menthol, ten parts; guaiacol, two parts; and olive oil, eighty-eight parts. The dose is one drachm at each sitting at first, gradually increased, even up to six drachms two or three times a day. To facilitate the gravitation of the fluid to the side desired,

the patient may recline on the side after the injection, or the mechanical chair designed by Dr. Colin Campbell, and supplied by Messrs. Baxendale & Co., of Manchester, may be employed. This form of treatment is not advisable in children. Among other methods of treatment are the internal administration of deodorizing and antiseptic agents, such as creosote (one to three minims in capsules or mixed with cod-liver oil thrice daily after meals), guaiacol, turpentine, terebene, myrtol, the balsams, thymol and garlic. The inhalation of deodorizing and antiseptic agents is often useful, either in the form of vapour impregnated with the drug, by means of a respirator, or of sprays, or fumigation, or the "dry inhaler" bottle. When a dominant micro-organism is present in bronchiectasis, vaccine treatment may be employed. Surgical treatment is advisable only when a single cavity exists which can be located and is comparatively superficial, and where there is obliteration of the pleural cavity. In all other cases it is contra-indicated. A patient suffering from bronchiectasis should be carefully instructed in prophylactic measures in regard to recurrent bronchitis. F. W. P.

BRONCHIOLECTASIS

In this condition there is dilatation which is limited to the bronchioles. It occurs in young children as a result of acute bronchitis.

The lung presents a curious worm-eaten or honeycombed appearance, owing to the innumerable small saccular cavities distributed throughout. These also appear on the surface of the lung as small transparent-looking vesicles.

Clinically it is difficult to distinguish the condition from the antecedent bronchitis. It is possible that at least partial recovery takes place in some cases.

Foreign Bodies in the Bronchi.—The circumstances under which foreign bodies find their way into the bronchi are very varied. Thus portions of solid food may be aspirated during eating, or pieces of toys during play, or a tooth during dental operations.

In cases of ulcerative destruction of the epiglottis or larynx, and in paralysis of the glottic appendages, as from diphtheria and bulbar paralysis, the accident is more liable to occur. It is more common in children and young people than in later life, and in males than in females.

Foreign bodies enter the right bronchus more frequently than the left—judged by the records of fifty-six cases collected by the writer from the English journals—in the proportion of four to three. Among explanations offered is the position of the inter-bronchial septum, the greater size of the right bronchus, and the fact

that the right bronchus more closely follows the line of the trachea.

The nature of the secondary results of the impaction of a foreign body in a bronchus in considerable measure depends on the character of the foreign body. If it be hard, smooth and clean, as for example the peg of a peg-top, the lesions are more likely to be of a chronic kind, such as bronchiectasis and fibrosis of the lung; whereas if the foreign body have the opposite character, such acute morbid conditions as pneumonia, abscess and gangrene of the lung are much more likely to result. Indeed, apart from physical asphyxia, the last three are the most frequent causes of an early fatal termination. The time which is required to elapse before the bronchiectasis declares itself varies greatly; that is from a few weeks to several years.

Symptoms and Physical Signs. As a rule there are prominent symptoms immediately after the entrance of a foreign body into a bronchial tube, the most characteristic of which are severe dyspnoea, a sensation of suffocation, violent cough and cyanosis. In a certain proportion of cases, however, there is a complete absence of such symptoms, especially if the foreign body be small, smooth and rounded. After the initial prominent symptoms there is often a lull of symptoms for some days, and even some weeks or months. Then the cough begins to attract attention. Not infrequently it is very paroxysmal and accompanied by intense dyspnoea and lividity, no doubt due to the fact that the foreign body has become projected from its nidus in the relatively insensitive bronchus towards the larynx. These cases may be mistaken for whooping-cough. As the case goes on the expectoration becomes purulent, and later foetid, increasing in amount. Hæmoptysis may occur, especially in those cases in which hard, irregular bodies have been inhaled.

Feebleness of breath sounds over one lung below the seat of obstruction is the only constant early sign. If the obstruction be at all complete, diminished movement on the affected side will be observed. Next, an area of impaired resonance and fine râles may develop at about the point of obstruction, due to local hyperæmia. Later still, there may be symptoms and physical signs of bronchiectasis and fibrosis, pneumonia, abscess and gangrene of the lung, emphysema, fistula from the obstructed bronchus through the chest wall (causing a thoracic abscess or a purulent pneumo-thorax) or cerebral abscess.

At first the physical signs present in the chest are always one-sided. Later they become bilateral.

Diagnosis. It should be remembered that a

foreign body may have been introduced without the knowledge of the patient or his friends. It is of the utmost importance to get a full and accurate history of the case. A seizure such as that described, followed by the symptoms and physical signs of incomplete obstruction to the function of one lung or part of one lung, and later on by bronchiectasis and fibrosis, are sufficient to establish a correct diagnosis. The fact that the bronchiectasis is one-sided, and that it cannot be explained by a history of antecedent pneumonia or pleurisy, is of considerable diagnostic value. An examination by X-rays may be helpful.

Prognosis. It can readily be understood that the entrance of a foreign body into the air passages is a serious occurrence.

Treatment. Every case in which there is good reason to believe in the presence of a foreign body in the bronchus should be treated at once, even although at the time the body produces no active symptoms. After the first paroxysm has passed the services of an operator experienced in bronchoscopy should be taken advantage of whenever possible. In superior bronchoscopy the tube is introduced through the mouth and glottis, whereas in lower bronchoscopy it is introduced through a previously performed tracheotomy wound. When this is not possible, if the foreign body is of the smooth hard variety, inversion of the patient and slapping or shaking of the back, either after tracheotomy or with instruments ready at hand for tracheotomy should a paroxysm of dyspnoea come on, should be resorted to. If the foreign body has the opposite character tracheotomy should be performed, and then an attempt be made to remove the body by means of forceps or a loop of silver wire.

Obstruction of the Bronchi.—Localised narrowing of a bronchus may be caused by (1) occlusion—foreign bodies within the tubes, (2) stenosis either by a cicatricial contraction of an ulcerated surface within the bronchus (usually syphilitic), or by an invasion of the wall by malignant growths, and (3) compression—pressure upon the bronchus by mediastinal new growths, aneurysm, enlarged glands, hydatid cyst, etc.

When the obstruction is gradual it produces accumulation of secretion, with dilatation of the tubes behind the obstruction, and subsequently fibrosis of the surrounding lung. When the obstruction is sudden and complete it causes collapse of the area of lung to which the bronchus belongs.

Symptoms and Physical Signs. There is usually cough from the first, generally spasmodic in type; when the nerves of the larynx are concurrently involved the cough is of the laryngeal type. Cough and expectoration having the characters of those of bronchiectasis

may be present. Dyspnoea, varying in degree from slight shortness of breath on exertion to actual suffocation, may present itself; there may be sudden paroxysmal exacerbations. Where the dyspnoea is great there is usually cyanosis. Stridor is very common. At first it may be only slight and occasional, but it gradually increases and may become very marked. It is chiefly inspiratory.

Feebleness of breath sounds over one lung below the seat of obstruction is the most constant early sign. If the obstruction be at all complete, diminished movement on the affected side will be observed. Later there may be physical signs of bronchiectasis, fibrosis, collapse, pneumonia, pulmonary abscess, or gangrene.

Diagnosis. As a rule this is not difficult. The differential diagnosis in regard to the cause of the obstruction is, however, sometimes a matter of difficulty. An X-ray examination should always be taken advantage of.

Prognosis. In all cases this is necessarily grave.

Treatment. The cause of the obstruction must be treated. The spasmodic cough and paroxysmal dyspnoea may be relieved by inhalation of chloroform. A few drops at a time may be placed upon absorbent cotton-wool in a small bottle and inhaled. Hypodermic injection of morphia may be necessary. For the paroxysmal dyspnoea, chloral and paraldehyde, especially the former, are often useful.

Tumours of the Bronchi.—Primary tumours of the bronchi are exceedingly rare. They are either carcinoma or enchondroma. They soon involve the lung, and are dealt with in connection with tumours of the lung. F. W. P.

ASTHMA

By asthma is meant a paroxysmal dyspnoea, which often comes on quite suddenly, and may subside again as rapidly. Many writers divide the disease into (1) primary, idiopathic or true spasmodic asthma, and (2) asthma arising as a complication of pre-existing bronchitis and emphysema.

Etiology. Heredity is an important factor; either there is direct inheritance of asthma or merely a "neurotic family history": there appears to be an interchangeability in families of hysteria, insanity, epilepsy and asthma. The affection may occur at any age, but it especially appears in the first decade of life. It is more common in males than in females. The exciting causes are (a) reflex (the most important), such as teething in children, nasal abnormalities, adenoids, gastro-intestinal derangements, and uterine disturbances; (b) direct, such as atmospheric influences, organic and inorganic dust, vapours and bronchitis, and (c) central, such as emotion. When asthma

is due to the ingestion of some particular article of diet it is termed "peptic."

Symptoms and Physical Signs. In about half the cases there are premonitory signs, such as buoyancy or depression of spirits, drowsiness, dyspeptic symptoms, or the passage of a large quantity of pale limpid urine. Usually the onset is gradual, the patient having for hours or even days a dry cough, some shortness of breath, a feeling of tightness of the chest, a sense of nervousness and malaise. On the other hand, the paroxysm may come on suddenly, especially during the hours of sleep, particularly between 2 and 4 a.m. The dyspnoea is intense, the face is dusky pale, the expression anxious, the patient assumes various positions and may even have to get out of bed, the chest becomes enlarged, the breathing is slow and difficult, though occasionally rapid, the accessory muscles of respiration are actively brought into play, there is very little movement of the chest, which is nearly fixed in a condition of inspiration, the expiration is extremely long and accompanied by wheezing audible at a distance. The intercostal spaces, the suprasternal and supraclavicular fossæ and the epigastrium sink in during inspiration. The diaphragm is depressed and the abdominal muscles are tense. On percussion the chest is found to be hyper-resonant, the heart and liver areas of dullness are obscured or absent, and the lung resonance posteriorly is much lower than normal. On auscultation the inspiratory murmur is short and feeble, and the expiratory murmur is extremely prolonged and accompanied by loud, sonorous and sibilant rhonchi. The pulse becomes small, an abundant cold perspiration breaks out, the face becomes cyanosed and the conjunctivæ suffused, the extremities become cold, and the jugular veins distended. After a time—it may be from half an hour to six hours—the paroxysm begins to lessen. The patient commences to cough, and expectorates scanty, tenacious pellets of semi-transparent mucus which resembles tapioca, in which Curschmann's spirals and Charcot-Leyden crystals are generally present. The former are spiral threads of mucin, either in the form of twisted coils of concentrically arranged filaments, or the filaments may be coiled around a central longitudinal thread. Charcot-Leyden crystals are pointed octahedra. Then the breathing becomes easier, the cyanosis less, and the patient often falls asleep. When he wakes he may be able to breathe quite freely, but more often there is some dyspnoea for a day or two, and pellets of mucus are expectorated. In some cases the paroxysms recur for several nights in succession. Rarely each attack of asthma lasts for some days. Recurrence happens at longer or shorter intervals. Repeated attacks

generally produce emphysema, and are often associated with chronic bronchitis. Ultimately changes in the right heart secondary to emphysema occur. Eosinophiles in the blood are much increased in asthma.

Diagnosis. The striking clinical picture which is usually presented generally makes the diagnosis easy. It should be remembered, however, that in some cases of bronchitis there may be a spasmodic element in the dyspnoea, and also that a catarrhal factor may be present in asthma. Furthermore, some cases of cardiac and renal dyspnoea exhibit a spasmodic element, and when so the names "cardiac asthma" and "renal asthma" are used by many writers. Some even go so far as to hold that the clinical picture of both these is indistinguishable from that of the disease we are describing. Others believe that in cardiac and renal dyspnoea the respiration is much quicker, is of a sighing or panting character, and that the characteristic prolongation of the expiratory act is absent. In laryngeal or tracheal stenosis there is stridor and the dyspnoea is of the inspiratory type, whereas in asthma there is wheezing and the dyspnoea is of the expiratory type. In laryngeal obstruction there is increased respiratory movement of the larynx: this is absent in tracheal stenosis and in asthma. In asthma during a paroxysm there is extreme inspiratory distension of the lungs; in laryngeal stenosis the size of the chest is diminished and the diaphragm is elevated. It is sometimes necessary to exclude aneurysm of the arch of the aorta or a mediastinal tumour pressing on the trachea and left bronchus, since either may give rise to paroxysms of dyspnoea of the asthmatic type. The presence of brassy cough and physical examination are sufficient to distinguish these. In regard to diagnosis, it may be mentioned that Curschmann's spirals are found in the expectoration of cases of bronchitis and other conditions. Charcot-Leyden crystals also are found in the blood of leukaemia and in the semen.

Prognosis. When the disease appears in infancy or childhood, complete recovery in adult life is fairly common, especially if the intervals between the attacks are long. When the disease starts in middle age, recovery very rarely occurs. Cure is always more probable when the attacks are due to some definite remediable irritation. An attack itself is practically never fatal. Each attack of asthma adds to the degree of emphysema. When the condition persists, as a rule the patient's life is somewhat shortened.

Treatment. It is usually worth while to get the patient first to give a full account of his own observations of his case. It is of the greatest importance to try to discover the exciting cause of the attacks. Thus a particular locality may

excite the attack. In regard to a change of locality, each patient is a law to himself, and must therefore find out what particular locality suits him by residing there for some time. When catarrh is a marked feature, special climatic treatment is often useful. The teeth should be attended to. The nose and nasopharynx should invariably be carefully and competently examined and any pathological condition treated. Any gastro-intestinal or uterine derangements should be corrected. In cases of so-called "peptic" asthma, the experience of the patient himself will act as a guide. Untoward atmospheric influences, organic and inorganic dust and vapour should be avoided, and any bronchitis treated. The general health should be promoted and maintained at the highest possible level. Plenty of fresh air should be prescribed. Moderation in diet, coffee and alcohol should be enjoined. It is better that the principal meal should be taken in the middle of the day, only light diet being allowed afterwards, with the evening meal at least four hours before the usual bedtime. The amount of carbohydrates and fats should be restricted. Between the attacks the most generally useful drug is iodide of potassium, commencing in five-grain doses three times a day, which dose may be gradually increased to fifteen or twenty grains. It is well to combine it with the extract of stramonium. The writer has also seen good results follow the administration of arsenic in some cases. When gout is a factor it should be treated. In a certain number of cases good results have been stated to follow the administration of a vaccine containing 50 millions of Friedländer's bacillus at intervals of a week or so, but the writer is doubtful of this. The smoking of a cigarette containing stramonium, etc., or the inhalation of the fumes of burning nitre paper (blotting paper saturated in a solution of nitrate of potash, thirty grains to the ounce) before going to rest may ward off an attack.

When a paroxysm comes on, some simple remedy, such as the application of lin. terebinth. acet. to the chest, or the drinking of hot strong coffee, or a dose of ether and ammonia, may be tried. Failing these, the patient may smoke cigarettes of sedative and antispasmodic remedies, among which stramonium and nitrate of potash are the most efficacious. Espic's and Joy's cigarettes are well known, as also is Himrod's powder. The following formula is useful—

R	Lobeliæ	} āā partes æquales
	Stramonii Foliorum	
	Theæ Nigræ	
	Potassii Nitratis	
	Misce. Ft. Pulv.	
	When ignited, for inhalation.	

Burning nitre paper may be employed. The most efficient remedy is morphia used subcutaneously in doses of $\frac{1}{8}$ gr., with atropine sulphate $\frac{1}{100}$ gr. This may be repeated, if necessary, in two hours. The objections to its use are those which are common to the employment of morphia in other diseases, such as the presence of renal inadequacy or bronchitis. Apart from these there is the danger of setting up the morphia habit, so that this form of treatment should be resorted to only when imperative, and should never be in other hands than those of the physician. Chloral in full doses of ten to twenty grains every four or six hours may be used in the catarrhal forms; but there are the same risks in its use as in that of morphia. The next most efficacious remedy is chloroform. It should be administered by the medical attendant and only in amount sufficient to relieve the spasm. Amyl nitrite inhalations (five minims) may be tried.

F. W. P.

DISEASES OF THE LUNGS

Broncho-Pneumonia

The term "broncho-pneumonia" is commonly used to designate a variety of diseased conditions of the lung of infective origin in which the lesions have a lobular distribution, as distinguished from the general infective disease, lobar pneumonia, where massive consolidation is usually found and where the lesions have no definite relation to the lung structure.

Broncho-pneumonia may occur primarily in the lung or may be a process occurring secondarily to some infective catarrhal condition of the bronchial mucosa. The primary form is probably always of pneumococcal origin and is met with during the first year of life. The secondary is the more common disease, and is frequently found in association with one of the specific diseases, whooping-cough, measles, scarlet fever and diphtheria.

Bronchitis of the larger tubes, stomatitis, gastro-enteritis and any debilitating condition are common determining factors.

The organisms found in the secondary forms are many; more especially should be mentioned the pneumococcus, streptococcus pyogenes, staphylococcus aureus, Friedländer's bacillus and the influenza bacillus.

Age has an important bearing on the occurrence of broncho-pneumonia. The disease may occur at any age, but is much more prevalent up to five years. During the first year the primary pneumococcal form above referred to is usually found: during the next four years the incidence of the disease is largely influenced by that of the diseases to which it secondarily

occurs, and by the fact that children so easily contract a catarrhal bronchitis. This frequently spreads to the lung. During adult life inhalation of septic material in connection with operations on the mouth or fauces or the inhalation of irritating gases are prominent causes. The occurrence of influenza is a determining factor.

Broncho-pneumonia is a common cause of death in old age. The course of the disease is variable and much more so than that of lobar pneumonia. The onset is a gradual one, and in the large class of secondary cases there is no sharp line to be drawn between the primary disease and the onset of the pneumonia.

There is a gradual rise of temperature, a cough, some dyspnoea, and gradually increasing constitutional disturbance. In the primary pneumococcal cases the onset may be more sudden and may resemble lobar pneumonia, with cough, high temperature, vomiting and convulsions, severe constitutional disturbance and cyanosis. The degree of fever is variable, and is never sustained as in lobar pneumonia; as a rule the temperature is considerably raised, running up to 103° F. to 104° F., but in cases which are debilitated and exhausted from long illness it may be subnormal from the outset. As the inflammatory foci in the lung resolve, so the fever gradually subsides. In the preagonal stage a degree of hyperpyrexia is often seen, and indicates the onset of a rapidly fatal septicæmia.

Cough is frequent and distressing, and a vigorous cough is favourable and is to be taken as a sign that the medulla is reacting to stimulation by venous blood. Sputum is swallowed in children. The pulse is full and bounding at first and very frequent, and this out of proportion to the temperature. It often reaches 140, and may go so high as to be uncountable. Later, in severe cases, it becomes weak and irregular and dilation of the right heart may occur. The respirations are rapid, often fifty or more to the minute, and are accompanied by dyspnoea and working of the *alæ nasi*. There is often marked recession of the chest wall with inspiration in rickety subjects.

The inverted type of respiration is often seen in children, the pause being at the end of inspiration instead of expiration. The skin is moist and sweating and the face is flushed; the expression is anxious. Herpes is uncommon. Cyanosis is generally present and indicates a marked interference with the aeration of the blood. Its absence in severe cases is an indication of vasomotor failure and is a serious sign. Nervous symptoms are less common than in lobar pneumonia. There is usually a degree of restlessness, mental excitement and distress. In the primary pneumococcal form meningism is common. Thirst and anorexia are always

found, as in any disease accompanied by fever, and the condition is often aggravated by the occurrence of diarrhoea, vomiting and green stools. The urine is scanty and often albuminous. An actual nephritis is only found where the disease has occurred as a complication of one of the specific fevers.

The signs to be found in the chest are often unconvincing. The lesions may be very small and scattered, and at a depth from the surface, so that it is not always possible to determine that the lung has become solid unless, indeed, fairly large areas have become involved or the lesions have become confluent. At first the physical signs are usually those of a general bronchitis with feeble breath sounds and many râles to be heard over the chest. Later small areas may be detected, generally at the bases, where numerous fine râles are to be heard and where the voice sounds have a bronchophonic or an egophonic quality. Later still definite bronchial breathing is heard over these areas, though the true type of bronchial breathing with very few added sounds—the physical sign that is truly indicative of completely solid lung with patent tubes—is not often heard in an ordinary case of broncho-pneumonia.

Frequently the chest has to be examined in the greatest detail, inch by inch, to detect the presence of solid patches in the lung. The signs become the more obvious when the child cries. In the case of children, auscultation is by far the most useful method of examination at our command, and be it said that this method should always be the first to be employed in preference to percussion. The latter so often starts the child crying. A pleural rub may be heard over the affected area.

The heart is a little dilated, its action is rapid and the pulmonary second sound is much increased. It is not displaced, and should any displacement occur, it should at once suggest the presence of fluid at one or other base.

In the primary group of pneumococcal cases the signs of bronchitis are not so marked as in the larger and more important secondary group. Signs of bronchitis may remain for a very long time during convalescence. Occasionally the onset may be very sudden, the child becoming extremely ill, and may even die within a day or two. These cases are sometimes referred to as acute suffocative catarrh.

Complications. The ordinary case which does not end fatally usually recovers completely. Empyema may occur; this is usually pneumococcal, and may be accompanied by purulent pericarditis. Gangrene, abscess, fibrosis of the lung and bronchiectasis may occur. Tubercle is probably not so common a complication as is generally supposed, and when a case dies of tuberculosis it is more than probable that the

lesion has been tuberculous from the first. To establish a diagnosis a soft tube may be passed into the stomach and withdrawn. The mucus adhering to it may then be examined for tubercle bacilli.

Diagnosis. Generally speaking, a child who is ill with a temperature, signs of bronchitis, and constitutional disturbance lasting more than forty-eight hours may be taken to have broncho-pneumonia. The diagnosis from bronchitis is easy when the signs of solid lung appear, and a more or less localised bronchitis is always suggestive of broncho-pneumonia or tubercle.

Prognosis. The prognosis in the pneumococcal primary form is decidedly good, and such cases rarely die, unless they develop such complications as pericarditis or meningitis. In the secondary form the death-rate is very high, the disease so frequently coming on in a patient who is already much debilitated by the primary disease, such as measles or whooping-cough. The most favourable cases are those which develop subsequently to a bronchitis.

The absence of cyanosis in a child seriously ill is a bad prognostic sign, and so also is the absence of cough, this being an indication that the medulla is no longer responding to the stimulus of blood that is insufficiently aerated. Death may take place from heart failure, owing to the right heart giving out. It may be due to toxæmia or to a terminal septicæmia, along with some such complication as pericarditis or meningitis.

Treatment. The patient should be kept in bed, and in a warm well-ventilated room at or about a temperature of sixty degrees. There is no good to be gained by the use of a steam kettle. The atmosphere surrounding the child becomes overheated and oppressive, and the natural means of reducing the temperature by means of evaporation from the surface are interfered with. There is always the grave risk, too, of rendering the secretion within the tubes too fluid, and so further embarrassing the processes of aeration in the lungs. A cotton-wool or gamgee-tissue jacket should be placed on the chest. There is nothing to be gained by the application of poultices or mustard plasters. If any pleurisy is present a few leeches should be applied. The child must be fed, and if food is refused nasal feeding must be resorted to. The feeds should be small, should mainly consist of diluted boiled milk, which may with advantage be peptonized, and should be given at frequent intervals. Ample water may be allowed between the meals if thirst is excessive. Drugs should be chosen with the greatest caution; there are not many which do good, and a number which do harm. Where there is dry bronchitis expectorants may be given to loosen the secretion, but they should be at once

stopped when this result is attained. It is lamentable to see a child whose bronchioles are already overfilled with liquid secretion being actively plied, with the very best of intentions, with expectorants and steam, so that what little chance it ever had of recovery is taken from it, and it is literally drowned in its own secretion. The drugs of main use are belladonna, strychnine, alcohol, oxygen and adrenalin. Camphor in solution and used as a hypodermic injection is a useful stimulant.

Belladonna acts by stimulating the respiratory centre and decreasing the amount of secretion in the bronchial tubes.

Strychnine is the most powerful and most useful stimulant, and should be freely used in half-minim doses every four hours as required.

Oxygen is a respiratory stimulant and very appreciably diminishes the amount of circulating toxin. It should be given early and often and should be warmed by passing a few coils of the tube from the cylinder through a vessel containing hot water. It may, with advantage, be bubbled through a flask containing some form of alcohol.

Adrenalin used in minim doses of the 1 in 1000 solution and given hypodermically is a powerful drug in conditions of collapse or vaso-motor paralysis.

Alcohol is best given as brandy in ten-minim doses, diluted, every four hours or so. Convulsions and attacks of sudden collapse are best treated by the mustard bath.

Much can be done to prevent the onset of broncho-pneumonia by taking especial care of those suffering from the diseases of which it is a complication. This is strikingly shown by the difference in the incidence of the disease among the children of the poor as compared with those of the rich. There is as yet no reliable form of specific treatment for broncho-pneumonia to be recommended.

Emphysema

Emphysema is a disease in which the essential pathological lesion consists of over-distension of the alveoli, with thinning and rupture of their walls. Owing to these lesions the capillary area of the lungs available for aeration of the blood is considerably reduced. The capillaries are thus in part destroyed and new vessels appear which serve to short circuit the blood from the venous to the arterial side without it having been fully aerated. Lymphatic destruction also takes place, so that inflammatory products which may accumulate in the course of any disease of the lungs are removed with greater difficulty, and so the danger of any such disease is increased.

A degree of fibrosis also occurs, and this by its contraction tends to increase the lesion.

Clinically *five* varieties may be recognised—

1. Large-lunged (hypertrophic) emphysema, the common variety, found in conjunction with the "barrel-shaped" chest, more commonly in males at or about middle life.

2. Small-lunged (atrophic) emphysema, the name given to a senile atrophy of the lung tissue which is found in old people along with atrophy of other organs. It is not an important variety.

3. Compensatory emphysema, a condition found in one part of the lung when some other is diseased. It represents an effort of the lung tissue to compensate for the part which is thrown out of action.

4. Acute vesicular emphysema, not a true emphysema, in so far as there is not usually any actual destruction of tissue; the alveoli are merely over-distended and return to their normal state when the determining cause is removed. It is found in whooping-cough, acute bronchitis and in death from asphyxia.

5. Interstitial emphysema, again not a true emphysema, but a condition due to air finding its way, from any cause, into the interstices of the lung. It usually tracks along the facial planes and comes to the surface at the root of the neck as so-called "surgical" emphysema. It need not be further considered.

Emphysema may occur at any age. It is more common in men at or about middle life. It is found in those who follow any occupation involving muscular efforts with a closed glottis, such as blacksmiths, porters, etc. The players of wind instruments are liable to the same affection, as also are those who suffer from chronic bronchitis or chronic valvular disease. There is evidence to show that heredity plays some part in the production of emphysema.

Symptoms and Signs. Dyspnoea is practically the only symptom which is directly referable to emphysema. Many other symptoms may be described which are given rise to by conditions which commonly accompany emphysema, such as chronic valvular disease and chronic bronchitis.

The dyspnoea is found at first on exertion only, and almost imperceptibly increases as the disease advances, until in advanced cases it is constantly present to a greater or less degree.

Cough is commonly found, and is due to the chronic bronchitis which usually accompanies emphysema. Sputum may be present, usually scanty, and attacks of hæmoptysis may occur. The extent of the dyspnoea may be taken as a measure of the extent of the disease.

Cyanosis is usually present. In slight cases it may appear only on exertion, but in severe cases it is present in a marked degree, and more severe cyanosis is seen in this than in any other disease, except, perhaps, congenital morbus cordis. The cyanosis is accompanied by a

polycythæmia, the red cells reaching eight to ten millions per c.m. Clubbing of the fingers and toes usually occurs.

The veins at the root of the neck are distended and may show pulsation; they may fill from below, thus indicating that the valves at the openings of the jugular veins are incompetent.

The *chest*, in a well-marked case, is enlarged in all its diameters; it is as though in a state of permanent inspiration and is often described as "barrel-shaped." The neck thus appears short and thick, the accessory muscles of respiration being well developed.

The ribs are widely separated, being more horizontally placed than normal. The intercostal spaces are drawn in with inspiration, owing to the non-expansion of the emphysematous lung. They bulge on coughing.

The subcostal angle is wide and a row of dilated venules is to be seen along a line corresponding to that joining the attachments of the diaphragm. This may be found to a slight degree in perfectly healthy people, and so is of no diagnostic import unless well marked.

Vocal fremitus is diminished over the lung in emphysema. The cardiac impulse is feeble or absent, owing to the pericardium being covered by lung to a greater extent than normally. Epigastric pulsation is well marked.

The note to percussion is hyper-resonant and may have a distinctly "boxy" quality. The area of cardiac dullness is much diminished, and the hepatic dullness may not extend above the seventh or eighth rib, instead of reaching the sixth rib, as it does normally, in the mid-clavicular line. The diaphragm is depressed and the liver is displaced downwards; the abdomen thus becomes more prominent. A resonant note may often be obtained as low as the twelfth rib posteriorly.

The most noticeable change in the respiratory murmur is that the expiratory phase is much prolonged, owing to the diminution in the elasticity of the lung. The change from inspiration to expiration is more marked than normal, and often a few added sounds are to be heard scattered over the chest due to an accompanying bronchitis. In cases where the right ventricle is failing fine râles at the end of inspiration may be heard at the bases.

The cardiac sounds are usually very indistinct, their intensity depending upon the degree of emphysema and the amount of lung covering the heart. The pulmonary second sound is usually accentuated, owing to the obstruction to the pulmonary circulation.

Emphysema rarely presents much difficulty in diagnosis. The appearance of the patient, the character of the percussion note, the prolonged expiratory murmur, together with the disposition of the thoracic viscera, are generally

sufficient data on which to frame a diagnosis. It has to be distinguished from pneumothorax, cardiac dyspnoea, and aneurysm of the transverse arch pressing upon the trachea. In estimating a prognosis in a case of emphysema it should be remembered that the disease is invariably a progressive one, that the rate of progression depends upon the extent to which the primary cause of the disease can be removed, upon freedom from attacks of chronic bronchitis, and upon the integrity of the heart and blood-vessels.

The vast majority of such cases die from the secondary effects upon the circulatory system.

Treatment. There is no cure for such a disease. One is not as a rule called upon to treat emphysema, but the circulatory disturbances which follow in its train.

Avoidance of the primary determining cause is of the first importance. Attacks of bronchitis are to be particularly guarded against, and those who can arrange it should winter in warmer climes. Any form of exercise which induces dyspnoea should be forbidden. The patient's own sensations are the best guide to the amount of exercise he can stand with safety. No drug has the slightest effect on the lesion in the lung, though relief can often be obtained by treating the accompanying bronchitis. Iodide of potassium in doses of five to fifteen grains should be given and may be combined with carbonate of ammonium where the secretion is scanty. All the usual remedies prescribed in chronic bronchitis are applicable here. Morphia is contra-indicated in the presence of emphysema; it diminishes secretion, abolishes reflex action and depresses the respiratory centre, so that it is a highly dangerous drug to use. Cod-liver oil is an excellent remedy to prescribe as a routine in such cases. The diet should be light and the main meal should be taken at midday. Dyspepsia and flatulence should be carefully guarded against. Considerable ease can often be obtained by wearing a broad flannel belt round the lower part of the thorax, it thus being constricted and the diaphragm more arched. The range of respiratory movement is by this means increased and the secretion more readily expelled. A compressed air bath is an excellent adjunct to the treatment of emphysema. The patient lives in the bath for thirty minutes daily. Under such treatment the dyspnoea becomes less marked and capacity for work and exercise are much increased. H. P.

CHRONIC INTERSTITIAL PNEUMONIA

This disease is often known as pulmonary cirrhosis, fibroid lung or fibroid pneumonia. It is the name given to a clinical group of conditions, all of which have one pathological

feature in common, that of fibrosis of the lung. The symptoms found in this group are in the main due to contraction of the fibrous tissue and consequent distortion of the lung and displacement of the heart and great vessels. The conformation of the thoracic parietes is also altered.

Fibrosis of the lung may be induced by any inflammatory process taking place in the lung. The fibrosis may be localised or diffuse. Local fibrosis occurs around tuberculous deposits, gummata, abscesses, infarcts, parasitic cysts or any foreign body lodged in the lung. Diffuse fibrosis is more important and may follow lobar pneumonia, in which resolution is very slow, broncho-pneumonia, inflammatory conditions of the pleura, collapse of a lung or part of a lung from pressure on a bronchus, or any cause of a pneumoconiosis. The chronic congestion induced by disease of the mitral valve, especially stenosis, will in time induce a diffuse fibrosis.

The *symptoms* of this state are at first those of a general bronchitis, and later a gradually increasing dyspnoea with cyanosis. As the fibrosis increases the right heart undergoes hypertrophy and dilatation.

The *signs* have reference to the thoracic parietes and contents. The chest wall is altered in shape, being flattened from before backwards, and the shoulder on the affected side is lower than on the sound side. The diaphragm is displaced upwards, and consequently the abdominal viscera on the affected side are on a higher level. The heart is drawn towards the affected side, and when the left lung is the contracting one an increased area of cardiac pulsation is often to be seen. Vocal resonance and fremitus are usually increased over the affected area. The percussion note is impaired if the fibrosis is in relation to the pleura. It is increased over an area of compensatory emphysema and may be hyper-resonant over a bronchiectatic cavity. The deformity with regard to the chest wall is always greater when the pleura is involved and adhesions are present.

The *prognosis* is ultimately bad, since we are here dealing with a progressive disease, but the rate of progress varies in different cases. It is least rapid in those forms which have their origin in the pleura.

There is no treatment of any avail. Where the exciting conditions exist everything should be done to prevent the disease being established. Stone-masons, knife-grinders and all those whose occupation necessitates their breathing in dust particles should be cautioned against mouth breathing, and should, if possible, be induced to wear masks through which the inspired air can be filtered. There is no drug which has any effect upon fibrosis of the lung.

Treatment has usually to be directed towards the accompanying bronchitis or the heart. H. P.

GANGRENE OF THE LUNG

Gangrene of the Lung is a condition found when putrefactive organisms gain access to a necrotic area. Necrosis alone does not give rise to gangrene. The organisms found in association with gangrene are varied and are both saprophytic and pathogenic.

Gangrene of the lung may follow many conditions. The chief are lobar pneumonia, broncho-pneumonia (especially the aspiration form, such as that following diseased conditions of the mouth, perforation of the œsophagus, foreign body in the bronchus), embolism, bronchiectasis, tubercle and septic wounds associated with injury. It is a disease liable to come on in the aged and debilitated, and in those suffering from chronic alcoholism and diabetes mellitus.

The disease is a febrile one, and is accompanied by cough, with copious and extremely offensive sputum. The fœtor is peculiar and characteristic. The sputum contains many organisms, and usually yellow elastic tissue may be found.

The cough is severe, prostration is, as a rule, very marked, and the patient is very ill.

The process may be a localised one, or may be diffuse, and the physical signs will vary according to the extent and seat of the lesion. Fœtid sputum, with signs in the lung, may arise in bronchiectasis, or when a stinking empyema ruptures into the lung, but gangrene of the lung may be distinguished by the finding of elastic tissue in the sputum as evidence of lung destruction. This does not occur in the two former. Hæmorrhage may occur.

Little can be expected from treatment, and the patients usually die. Spontaneous evacuation and cure may occur. Quinine and iron should be given in large doses and inhalations of turpentine and creosote may prove beneficial in relieving symptoms, though they can have no effect upon the gangrenous process. The patient should be compelled to take as much nourishment as possible and alcohol should be allowed. Where the gangrenous area is circumscribed and near the surface a portion of a rib should be removed and the area drained. H. P.

ABSCESS OF THE LUNG

An Abscess of the Lung occurs when suppuration takes place within the lung tissue itself. It is to be distinguished from suppuration within a dilated bronchus, as in bronchiectasis, or suppuration within a cyst cavity, as in suppurating hydatid cyst.

An abscess of the lung may occur under the following conditions—

1. Following lobar or lobular pneumonia.
2. In the course of chronic pulmonary tuberculosis where secondary infection has occurred.
3. As a sequence of perforating wounds, or growths in connection with the œsophagus rupturing into the lung.
4. In connection with infective emboli from the peripheral veins via the right heart and pulmonary artery.

The *symptoms and signs* are extremely variable, but abscess of the lung is to be suspected when the sputum becomes offensive, (not the fœtor of gangrene), increased in quantity and contains fragments of lung tissue. The elastic tissue is very abundant.

Medical treatment can do little. When diagnosed and near the surface the abscess should be opened and drained. H. P.

HÆMOPTYSIS

In the term hæmoptysis are included all conditions where blood is brought up from the bronchial and pulmonary vessels and expectorated. It may be due to one or more of the following causes—

1. External injuries. A stab wound or a fractured rib may injure the lung and cause spitting of blood.
2. Pulmonary tuberculosis. This disease is the great cause of hæmoptysis, and is probably responsible for ninety per cent. of all cases.
3. Lobar pneumonia. A brisk attack of hæmoptysis may take place at the commencement of the disease, or the hæmoptysis may be confined to the "rusty" sputum.
3. Pulmonary abscess and gangrene.
4. In acute and chronic bronchitis slight hæmoptysis may occur.
5. In bronchiectasis.
6. In chronic interstitial pneumonia.
7. In new growth of the lung.
8. In chronic mitral disease. Hæmoptysis is here chiefly seen in the course of mitral stenosis, and is then often due to infarction. Congestion alone does not so often cause hæmoptysis.
9. Pressure of an aortic aneurysm, or leakage or rupture of it into a bronchus will give rise to hæmoptysis.

10. Pulmonary infarcts.

11. Certain blood diseases. Purpura hæmorrhagica, scurvy, hæmophilia, the leukæmias, certain of the acute specific fevers.

12. Ulceration of the larynx or bronchial passages.

13. Vicarious menstruation. With suppression of the menses in young women an attack of hæmoptysis may occur at the menstrual period in the absence of any sign of disease.

In arriving at a diagnosis as to the seat of the

bleeding being below the glottis, a chronic pharyngitis, with dilated and bleeding veins, or bleeding gums should always be carefully excluded.

In pulmonary tuberculosis, the disease in which hæmoptysis most frequently calls for treatment, the amount of bleeding varies very much in quantity. It may consist of a few streaks only, and then calls for no special treatment beyond that of the disease in which it occurs. It may be more marked, and the quantity may vary from an ounce to half a pint. This is about the extent of the hæmoptysis in the large majority of cases in which the hæmoptysis demands treatment or in which treatment can be of any avail. In still other cases the hæmoptysis may be so marked that a large quantity of blood is lost in a few seconds, and so the result of such extensive hæmorrhage is usually a fatal one. These cases are rare.

The indications for treatment are: (1) To reduce the force and frequency of the heart beats. (2) To lower the blood pressure. (3) To keep the patient mentally and physically as quiet as possible. Patients rarely die of hæmoptysis, and everything should be done to reassure them. The patient should lie on the affected side if the seat of the lesion is known.

Opium should be freely given to quieten the cough, to lessen the heart's action, to lower the blood pressure and to render the patient drowsy. It is best given as morphia hypodermically. Active purgation should also be used; salines are the best drugs for this purpose. Vaso-constrictors should not be used, such as ergot or adrenalin, since they cause a general rise of blood pressure, and it is doubtful if the lungs contain vasomotor nerves. Vaso-constrictors would thus induce a rise of blood pressure in the lungs and cause an increase of the hæmorrhage. If morphia and purgatives fail to arrest the hæmorrhage no other drugs will do so. The diet should be light, and everything should be done for the next ten days after the hæmoptysis has ceased to keep the blood pressure as low as possible.

In the severe type of hæmoptysis the patient's head should be drawn over the side of the bed, and the blood allowed to run out of his mouth to prevent him drowning. H. P.

DISEASES OF THE PLEURA

Pleurisy

Inflammation of the pleura occurs in the dry form or accompanied by serous or purulent effusion. It may be a primary disorder or secondary to other conditions. In reference to its clinical course it may be acute or chronic.

Fibrinous Pleurisy.—This form occurs as a

primary condition, and has been attributed to exposure to cold, but this is a doubtful cause. It is recognized by pain in the side, with some febrile disturbance, and a friction rub heard over a localised area of the chest. The condition lasts as a rule for a few days.

As a secondary affection, it is generally associated with acute pneumonia, cancer, abscess or gangrene of the lung, also with pulmonary tuberculosis and syphilis. It generally occurs in the neighbourhood of the primary lesion. It may be apical, basal or double. It may be rheumatic, and I have noted it in association with herpes zoster.

The symptoms are pain, cough and friction, and in addition there are the evidences of the primary disease.

Serous or Sero-fibrinous Pleurisy.—Exposure may be regarded as a predisposing factor in this condition. Its microbic origin is undoubted and the majority of cases have been shown to be due to tubercle by the post-mortem findings when unexpected death has taken place during an attack, and by the subsequent history of pulmonary tuberculosis which follows in so large a proportion of cases. It occurs in cases of Bright's disease, cirrhosis of the liver and cancer, all of which are frequently associated with tuberculosis. Other cases are of pneumococcal, streptococcal, staphylococcal, or gonococcal origin, or due to infection with Friedlander's bacillus, typhoid or diphtheria. The condition not uncommonly arises during the course of the infective exanthems, especially scarlet fever in children. Its tubercular origin is best shown by inoculation with the effused fluid, and the larger the quantity of the fluid used the more certain the result. In a considerable proportion of acute effusions I have found Moro's tuberculin test give a markedly positive reaction. The fluid effused is generally clear, of an amber, straw, lemon or pale sherry colour; the specific gravity ranges from 1005 to 1020. It coagulates on standing. It may be rendered slightly turbid from the presence of leucocytes. It contains endothelial cells, red blood corpuscles, and fibrin. In some cases cholesterin, uric acid and sugar have been found. The amount effused may range from half to many pints. The fluid may be quite free in the pleural sac, enclosed in a meshwork of fibrinous material or loculated and in other instances localised and shut off in a definite region.

Symptoms. The illness is not usually heralded by any prodromal symptoms. It may come on quite insidiously and without any acute symptoms, so that the patient may suffer little or no inconvenience beyond some dyspnoea on exertion, and when medical advice is first solicited a large effusion may be already present. Other cases suffer rather severe symptoms

according to the initial cause, and the condition be ushered in with a rigor. The onset again may resemble an acute pneumonia. Where the disease at its commencement is accompanied by definite symptoms they are generally those of an acute dry pleurisy at first, and comprise pain in the affected side, described as a "stitch," which is aggravated with each inspiration, and generally situated in the submammary region. The pain, however, may occur in the back at the spinal margin or lower angle of the scapula, and when the pleurisy commences low down it may be referred to the abdomen, and simulate an acute abdominal condition. There is a variable amount of dry cough which increases the pain. The respirations are frequent and shallow because of the pain, and often accompanied by a short "catch" at the end of inspiration. The pulse is increased in frequency, the temperature raised to 100° F. or it may reach 103° F. The temperature is higher on the affected side. With the pyrexia there are symptoms of general fever. This constitutes the first stage, and is accompanied by the physical signs of dry pleurisy, comprising diminished respiratory movement on the affected side, possibly friction fremitus on palpation, and a definite to and fro localised friction rub on auscultation.

With the development of the second stage or stage of effusion the symptoms and physical signs change in character. The pain disappears, the patient lies on the affected side, the dyspnoea may become more marked, due to pain if persistent, or fever and compression of the lung. The temperature falls somewhat and may remain lower, or become intermittent, the cough may be less troublesome, but accompanied by some mucus which may contain streaks of blood. The pulse generally increases in frequency as the fluid increases in quantity.

The physical signs comprise disappearance in whole or part of the friction rub, distension of the affected side, loss of movement, and visible dislocation of the heart's apex beat from the normal, and in a direction opposite to the affected side. Palpation corroborates these signs, and slight œdema of the thoracic wall may be detected. Vocal vibrations are diminished or obliterated, a physical sign which is of great importance. In children, however, the vocal fremitus is not always lessened or lost. Percussion reveals a diminished resonance of note and with much effusion a characteristic "wooden" dullness with a peculiar sense of resistance to the finger. Above the level of the fluid the note is a high-pitched tympany, known as Skodaic resonance, best elicited just below the clavicle, or even in the supraspinous fossa. Traube's resonant area on the left side may be encroached upon or quite obliterated by a large

effusion. When not complete the dullness in this area is generally movable on respiration. The diaphragm is depressed, and with right-sided effusion the liver may be felt and percussed below the costal margin. The area of dullness in effusion passes over the middle line in front, but rarely, if ever, above the level of the second rib; it becomes continuous with the cardiac dullness which is dislocated to one or other side. Behind, a triangular area of impaired resonance, Grocco's triangle, may be elicited on the side opposite to the effusion, the apex of the triangle indicating the upper level of the fluid, the outer side of the triangle passing downwards and outwards from the spine; it has been so evident in some cases that the exploratory needle has been used on that side. Direct or indirect percussion of the spine elicits impaired bone resonance from the upper limit of the fluid downwards. The upper level of the fluid describes an S-shaped curve from the spine to the front of the chest, the dome of the S being in the lateral and scapular regions. The upper level of the fluid may alter with change of posture, if the effusion be small, but it does so very slowly, and does not compare with the alteration which takes place in hydro-pneumothorax, or even in passive hydrothorax alone. As the heart is dislocated transversely and does not rotate, the right ventricle may be seen and felt pulsating to the right of the sternum in cases of considerable left-sided effusion; in right-sided effusion the apex beat may be felt and percussed in the left lateral region. When the effusion is double this alteration of position may be modified or absent.

On auscultation the breath sounds are modified. When the effusion is insufficient to compress the bronchi, one may hear distant tubular breathing with a *ch* whiff, especially noticeable with expiration. As the lung becomes more compressed the area of effusion becomes quite silent, but there often remains, especially in children, an area of harsh or bronchial breathing at the side of the spine, in the inter-scapular area, where the compressed lung is situated. The friction sound disappears as the fluid collects, but it may be found at times at the upper border. In children, however, the auscultatory phenomena may resemble those of solid lung. Above the level of the fluid the breath sounds are exaggerated. The vocal resonance is diminished or lost, as a rule, over the effusion, but in the region of the lower scapular angle the vocal vibrations are transmitted with a reed-like quality. This ægophonic resonance is also heard at the upper level of the fluid in some cases. In other instances when the bronchi are not fully compressed the vocal resonance is increased, especially in children. The whispered voice is

said to be transmitted through serous fluid but not through pus. This is known as Bacelli's sign; but my experience does not support this distinction. Effusions, according to their nature, seem to have a selective influence rather than a wholly inhibitive one on the transmission of vocal vibrations.

On auscultating the heart a systolic murmur may often be detected either at the aortic or pulmonary areas, seldom at the apex. This usually disappears when the fluid subsides or is drawn off. Pleuro-pericardial friction may also be present, especially when the effusion is left-sided, the friction sound having a dual time, synchronous with the heart beat and respiration; the former continuing, the latter ceasing when the breath is held.

On the absorption of the fluid the respiratory phenomena gradually return to normal, but this may take place slowly and incompletely for some time. Friction may return as the pleural surfaces come into apposition, but I do not think this occurs as frequently as is generally supposed. Crepitations and râles may be detected in scattered areas.

The course of the disease varies. In moderate cases the constitutional disturbance may cease in about a week or ten days and the fluid be absorbed. Even in large effusions absorption may take place, but there is left behind diminished respiratory phenomena, which may persist for months, with some impairment of percussion note. With absorption of the fluid the pulse drops in frequency; when aspirated, a recurrence of pulse frequency indicates a re-collection of fluid. Sudden and unexpected death may take place during the course of pleural effusion, especially on exertion or stooping. This danger must not be forgotten. If fluid has existed for a considerable period it may break through the lung or chest wall.

Prognosis. This, as a rule is good, but in view of the large number of cases which are tubercular in origin, a guarded prognosis should be given, as there is great probability of the subsequent development of pulmonary tuberculosis. As a rule, pneumococcal empyema ends favourably and even when aspirated only. In comparison to the probability of subsequent pulmonary tuberculosis following serous effusion, empyema is rarely followed by it. In chronic cases cerebral abscess may occur as a sequel.

Tuberculous Pleurisy.—Attention has already been drawn to the close association of pleurisy and tuberculosis. It may be a very early sign of developing tuberculosis. Pulmonary tuberculosis may infiltrate the apex while the pleura shows definite signs of infection at the base. The miliary form is usually dry, and

may cause protective adhesions. In a few instances one meets with double dry pleurisy, which is tubercular in origin. I have known it to attack practically the whole of both pleurae without any immediate lung affection. As before stated, it is a common cause of effusion. The physical signs when dry or with effusion are those which have been previously described.

Hæmorrhagic Pleurisy.—The effusion is hæmorrhagic in many cases of malignant disease of the lung, pleura or mediastinum; the initial effusion may be quite clear, but at one time or other it becomes blood-stained. It is found in certain cases of Bright's disease, malignant fevers, cirrhosis of the liver, and a certain percentage of tubercular cases. The character of the fluid is revealed by the aspirating needle. The presence of blood in the fluid is strong evidence of malignant disease.

Diaphragmatic Pleurisy.—Inflammation of the pleura in this region is commonly dry, in rare instances it may give rise to a circumscribed basal effusion. Pleurisy in this position gives rise to considerable pain, the diaphragm is fixed, and abdominal movement may be impeded on the affected side. The pain may be referred along the attachment of the diaphragm, or low down in the abdomen, and on the right side simulate appendicitis so closely as to lead to error in diagnosis. This peculiarity should be remembered particularly in children, but both in them and adults in all cases with abdominal pain the chest should be carefully examined. It may also simulate perforated gastric ulcer. On the left side particularly perforation of an ulcer at the cardiac end of the stomach may give rise to friction extending along the basal area of the pleura, but this is really peritoneal in origin, and has a different quality to pleural friction, being softer in character and more distant in position when the ear is accommodated for this purpose during auscultation. I have verified this in several cases where the condition closely resembled pleurisy but was really stomach perforation. On the other hand, I have known the abdomen to have been opened for the latter condition which proved negative, and some time afterwards, when the case came under my observation, it was found that a localised left-sided basal empyema was responsible for a condition which had so closely resembled gastric perforation as to have led to abdominal section.

There is much dyspnoea with diaphragmatic pleurisy, and it may give rise to attacks resembling angina pectoris. Hiccough is sometimes present. Friction may be absent, and as a rule the subjective symptoms in many cases are greater than the physical signs.

Encysted Pleuritic Effusion.—This takes place by the adhesions shutting off the fluid into one or more circumscribed pockets. In order to establish the diagnosis the exploratory needle must be freely used.

Interlobar Pleurisy.—In every case of diffuse pleurisy the interlobar surfaces are more or less affected, collections of serous fluid or pus may become imprisoned in these situations, and if left may perforate bronchi. The area of impaired resonance or dullness is located somewhere along the line of the sulcus, with probably a clear apex and base. In such cases the exploratory needle should be used in spaces along this line.

Diagnosis of Pleurisy. The diagnosis is usually easy from the physical signs: Pleurodynia may resemble pleurisy, but the pain of the former is not only associated with respiration but with general body movement, and there is an absence of physical signs. Herpes zoster gives rise to severe pain referred to definite areas with tender points, the pain is not definitely affected by respiration, there may be considerable intermissions, and the usual crop of vesicles sooner or later reveals the nature of the condition. In two cases, however, I have met with fine pleuritic inspiratory friction with herpes zoster, in one at the apex a diagnosis of apical phthisis had been made, but the eruption appeared in the subclavicular fossa, on the shoulder and down the arm. It may be that an eruption may take place on the parietal pleura. When there is slight effusion the condition may resemble acute pneumonia, but the onset of the latter is more severe, and there is the characteristic sputum containing pneumococci. One must remember, however, that pneumococcal pleurisy may be present from the outset, in which the constitutional disturbance is similar to pneumonia without affection of the lung, it may run a precisely identical clinical course and end with crisis, the sputum may be scanty and not rusty. The pain is usually more severe, the resolution is unaccompanied by redux crepitation, and physical signs remain, when in pneumonia they should have disappeared. In these cases purulent effusion is not uncommon and gives rise to a more wooden dullness than pneumonia, with absent vocal fremitus. Auscultation is often deceptive and the interpretation of the physical signs difficult, so that the use of the exploratory needle is demanded. With effusion the mediastinal contents and other organs are altered in position, and the dull area of fluid does not correspond to the shape of a lobe as it does in lobar pneumonia. Massive pneumonia may resemble fluid, but the area of dullness does not trespass beyond the pulmonary boundaries as fluid does, although the lung may be "silent."

Blocking of a bronchus may simulate pleuritic effusion closely, but in the latter the "silence" of the lung is never complete. In my experience a complete block of a bronchus causes absence of respiratory phenomena in the area supplied such as effusion never does. The use of the needle is necessary. In one case, however, the needle revealed pus, having passed through a thin layer of lung into a large pulmonary abscess; the latter discharged through a bronchus and caused fatal suffocation, and the autopsy revealed a bronchus blocked by a clove which had set up suppuration and excavation of the lung. In this case the lung was quite silent. With a syringe acting perfectly, the pus from an abscess of the lung may be found to be aerated, which is helpful in diagnosis between it and extra-pulmonary purulent effusion.

Pericardial effusion may be mistaken for pleural when large and extending, as it often does, well over to the left side. The clinical course and earlier physical signs will prevent confusion, but it must not be forgotten that effusion in both sacs may occur at the same time. A large pericardial effusion may give rise to basal dullness behind with tubular breathing and bronchophony at the lower angle of the scapula (*vide Pericardial Effusion*).

Unilateral hydrothorax is common in the late stages of heart disease, and may arise before there is any swelling of the lower extremities. It usually occurs on the left side; it may be double, but always more pronounced on the left side. New growths in the thorax may simulate effusion, but the area of dullness is more irregular. When the fluid is aspirated the amount obtained is often less than could have accounted for the physical signs, which may be but slightly altered by the procedure. The fluid is often blood-stained or markedly hæmorrhagic, and it may contain particles of growth; there is cachexia and enlarged axillary or cervical glands. Hydatid cyst of the lung or pleura may lead to difficulty in diagnosis. In the former the silent and dull area is surrounded by a zone of crepitation, in both the history may help, and the exploratory needle reveal the nature of the condition. Where hydatid is suspected the needle used should be long and fine, and it is a useful rule not to explore unless prepared to operate at the same time, for a hydatid of the lung when pierced may leak into the lung, rupture and cause suffocation when being expectorated. On the right side abscess of the liver may simulate pleural effusion. There is usually a history of previous dysentery or appendicitis, or other abdominal suppuration. The exploratory needle may be called for, but when the symptoms particularly denote liver abscess, one should be prepared to operate at the same or within a very limited period, for

if the needle has to penetrate both pleura and peritoneum to reach the pus, infection of both by its track is almost certain to follow. Malignant disease of the kidney may affect the diaphragm, and simulate pleurisy with or without effusion. There are the abdominal tumour and genito-urinary symptoms to help in diagnosis.

In tubercular peritonitis the distension of the abdomen may raise the spleen and left lobe of the liver to such an extent as to simulate fluid in the left pleura. I have met with two such cases in which exploratory puncture was deemed advisable, but with negative result. The liver may be pushed up on the right side also, in which case its dullness does not extend to the lower costal margin. It is seldom that aneurysm leads to any great difficulty in diagnosis, but rupture into a pleural sac will give rise to signs of effusion. Collapsed lung may simulate effusion, but the needle will clear up any difficulty. Subdiaphragmatic abscess always gives rise to difficulty in diagnosis, especially if effusion above the diaphragm be present at the same time. There is generally a history of previous abdominal trouble, and the dislocation of thoracic organs is not the same. The heart's apex may be raised on the left side. Peritoneal friction may be elicited, abdominal respirations impeded or reversed. Rigidity of one or other rectus muscle is usually present, and any area of dullness does not fall in with the usual march of a pleural effusion. On exploratory puncture the act of respiration on the flow of the fluid is said to be the reverse of that obtaining in pleural effusion.

In all cases which are not sufficiently acute to prevent it, X-ray examination should be made, when possible, and in every case before exploratory puncture if there be doubt as to such conditions as aneurysm, abscess below the diaphragm, or where exploratory puncture has any element of risk with it.

After the effusion has been absorbed the physical signs may remain obscure from thickening of the pleura, with an impaired percussion note and diminished respiratory phenomena, so that it may simulate fluid remaining, or primary thickening of the pleura may simulate fluid. The exploring needle will settle matters.

As to the nature of the effusion the clinical history and course may help. In empyema there is always constitutional disturbance indicative of suppuration. The series of symptoms resembling acute pneumonia points to pneumococcal origin, and the result is usually favourable. More serious symptoms are associated with streptococcal and staphylococcal infections. The fluid when examined will reveal the organism.

In purulent effusions there is often a mixed

infection. Attention has been drawn to the peculiarity of tubercular effusions, and if an effusion be found sterile it is most probably tubercular. When associated with pus in pyopneumothorax I have found the pus swarming with tubercle bacilli in a few cases.

Chronic Pleurisy.—There are three recognized forms of chronic pleurisy. One, which is associated with effusion, which may come on insidiously or follow an acute attack, which has the ordinary characters of pleurisy with effusion, and the other a chronic dry pleurisy which may be a sequel to an attack of pleurisy with effusion, or empyema, in which the condition is more marked.

The two layers of thickened pleura which form the sac of the empyema meet and adhere with organization. It is generally basal, giving rise to impaired percussion note, vocal fremitus, breath sounds and expansion, with varied creaking sounds in scattered areas. Calcification may occur, and a small amount of fluid may become encysted. The chest becomes retracted and the lung carnified. There is often chronic dragging pain in the side, and after empyema patients may suffer from distressing pain situated below the ribs in one or other hypochondriac region. Bronchiectasis may develop on the affected side, and occasionally on both.

The third form is a primitive dry pleurisy, which may follow an attack of acute dry pleurisy or come on insidiously. The patient may be conscious of the friction. Adhesions form, but may give rise to no physical signs, unless they are thick, when they cause diminished expansion, and Litten's shadow sign may be absent on respiration. The function of the lung may be unimpaired. It is not uncommon to find pleural adhesions at autopsies which have not been preceded by any history of acute pleurisy, and in elderly people soft thin adhesions may be found over the whole of both lungs.

In other cases primitive dry pleurisy may invade the lung with fibrous infiltration running into it in strands and producing cirrhosis. This generally attacks the lower lobe, producing the "sclerosed pleurogenous pneumonia" of Charcot, with dilatation of the bronchi.

In tubercular dry pleurisy the pericardium and peritoneum may be affected also. Associated with syphilis one meets with dry pleurisy producing adhesions at the bases, and interfering with the functions of the lung. This condition may come on quite insidiously. It is more common than it is generally thought to be.

Treatment of Pleurisy. In simple acute dry pleurisy, counter-irritation over the painful area by means of mustard or a blister is valuable, or by the application of a hot poultice. A hypodermic injection of morphia may be desirable.

The side may be fixed with plaster to diminish movement. Salicylate of soda, acetyl-salicylic acid, phenacetin or suchlike preparations may be given to relieve pain and reduce fever if necessary. Cough may call for expectorants or sedatives, preferably the latter, as there is little or no expectoration. Rest in bed is desirable, with a light, nourishing diet. The bowel should have attention. As a rule this line of treatment is sufficient and the condition subsides in a few days.

When effusion takes place, an effort should be made to restrict it, by saline purgation, with sodium or magnesium sulphate in concentrated solution every morning. Diuretics such as digitalis, squill, acetate of potash, etc., may be found useful, and to produce diaphoresis a hypodermic injection of pilocarpine. A salt-free diet with limited fluid should be advised. These measures may be sufficient in some cases, but the majority require aspiration. Although some effusions absorb naturally it is not advisable to wait too long for this as aspiration is an easy method of relieving the patient's distress. It is inadvisable to wait longer than ten days, and if the effusion is great and distressing it should be aspirated earlier. Even if the whole of the fluid cannot be withdrawn at once, the removal of part may be sufficient to start absorption of the remainder. Fever and other constitutional disturbance is no contra-indication to the procedure.

Paracentesis thoracis should be performed through the sixth or seventh intercostal space at the mid or post axillary line, or at the lower scapular angle in the eighth space, keeping near the upper edge of the rib. It is essential to use a needle with a trocar. A simple sharp-pointed needle is dangerous for fear of injuring the visceral pleura or lung.

The skin may be rendered anæsthetic by means of the chloride of ethyl spray, but it often interferes with the easy introduction of the needle. When there is any special difficulty in penetrating the space, the skin may be frozen and a small incision made in the skin prior to inserting the needle. One may use a bottle aspirator, but I prefer the simple cylinder and piston as it is more perfectly under the operator's control, although its action may be slower and take more time. A needle of fair calibre should always be used. Very fine needles are liable to become blocked at any time, and when there is pus they may not allow it to flow at all.

Withdraw the fluid slowly, and stop when the patient develops irritative cough, feels sick, faint, or complains of suffocation, dyspnoea, or pain. It is a valuable measure to inject into the pleural sac after aspiration a drachm of 1 in 1000 solution of adrenalin chloride. Some physicians inject sterile air or an indifferent gas

into the sac, with the view of keeping the pleuræ apart, but my personal experience does not lead me to advise it; it prolongs the course of the illness, and it is doubtful if it has any special value in the final result. Repeat the aspiration so long as the fluid remains serous, and whenever it re-collects to produce definite signs, or the pulse remains frequent.

After aspiration cough may prove troublesome and should be allayed. It may be accompanied by profuse expectoration from rapid cedema of the lung, this has proved fatal at times, but if the fluid be slowly drawn off there is little fear of this taking place; personally I have never met with it. Aspiration is not without danger, and cases have been recorded in which syncope, convulsions and even sudden death have occurred. Fortunately they are extremely rare. Sudden death has occurred more often in children. I have fortunately never seen any untoward result follow paracentesis, except in one case when an enormous amount of fluid had been present for a long time, and on being withdrawn was followed by surgical emphysema; this and pneumothorax may follow if the lung be injured. The possibility of this may be prevented if due care is taken, and the fluid not completely withdrawn at one operation. In very chronic effusions it may be advisable to incise the pleural sac and drain it.

Treatment of Empyema. Apart from the general sustaining and symptomatic measures called for in this condition, the treatment is essentially surgical. As soon as pus has been discovered in the pleural sac by means of the exploratory needle, nothing is to be gained and much may be lost in delaying surgical interference. It is true that a certain small number of empyemata may be cured by aspiration only; this is said to be so when the empyema is of pneumococcal origin. I have had experience of a few such cases, but it is not a satisfactory procedure to repeat aspiration in the hope of ultimate recovery when a more definite and certain result may be attained by incision and drainage. This may be done by simple incision between two ribs, but I think in all cases the operation should include resection of part of a rib, or of more than one if necessary. A large drainage tube should be inserted. Prior to operation, if there be a great effusion it is often an advantage to aspirate first and operate the following day. By this means the shock caused by a sudden evacuation of pus is lessened. The question of subsequent irrigation of the empyema sac is still undecided. Some cases do very well without it. In others I have had resource to it with advantage, especially when the pus is fetid and producing severe toxæmia. The kind of antiseptic lotion used should

be changed from time to time. Irrigation is not without danger and has caused fatal syncope. It should not be practised when there is a communication between the empyema and the lung. The danger from the administration of a general anæsthetic is lessened if aspiration be performed prior to operation. When the administration of a general anæsthetic is fraught with danger, the operation is best performed under local anæsthesia; by the injection of eucaine, or suchlike, with adrenalin chloride, at the seat of incision. I do not think the after-healing of the wound is so satisfactory when local anæsthesia has been produced. The surface of the wound always has a thin layer of sloughing tissue spread over it and there is a tendency to local hæmorrhage.

In tuberculous empyema it may be advisable to repeat aspiration several times before resorting to operation.

In cases where the resulting sinus refuses to close up and the lung does not expand satisfactorily, a further resection of portions of one or more ribs may be necessary in order to allow the chest wall to sink into the lung.

Efforts at expansion of the lung should be made and respiratory exercises advocated and pursued. Blowing through a series of bottles and forcing fluid from one to the other under pressure is very useful.

When thickened pleura and adhesions remain after pleuritic effusion, whether simple or purulent, I have found a course of injections of thiosinamine preparations, *e.g.* fibrolysin or iodolysin, of considerable value. They are contra-indicated in tuberculous cases.

When a sinus is slow in closing, a course of autogenous vaccine therapy has proved useful in many cases.

After recovery from the immediate serious condition, a change of air either on the sea-board or inland is of great value, and in order to help expansion of the lung a residence for a period at a high altitude may prove very beneficial.

Hydrothorax.—In contrast to acute pleurisy with effusion, hydrothorax consists of a passive transudation of fluid into one or both pleural sacs without inflammation. It is a secondary process, the fluid is clear and the pleura remains smooth. It is generally bilateral.

It occurs as a secondary condition in association with general dropsy, whether of renal, cardiac or hæmic origin; also with tumours of the lung or pleura. It may occur early in the course of scarlatinal nephritis. In renal cases it is usually bilateral; in cardiac conditions one side, generally the left, contains more fluid than the other.

Symptoms. The symptoms and physical signs are those of double pleuritic effusion.

Dyspncea occurring during the course of nephritis, acute or chronic, or of heart disease, indicates the probability of pleural effusion, and the chest should be carefully examined to this end, for effusion may come on quite rapidly and unexpectedly even without any signs of general dropsy. Pain, as a rule, is absent; cough is inconstant. There is no friction sound at the outset, and some impaired resonance at the bases with, at first, inspiratory crepitations, precede the effusion. The crepitations and breath sounds become more distant; this takes place on the side in which the fluid collects more rapidly. If, in the course of heart disease, such crepitations be found present at both bases, but on daily auscultation they are found to remain constant at one, while becoming fainter and more distant at the other with greater impairment of percussion note, it is almost certain that effusion has occurred at the latter, and an exploratory puncture should be made. When the effusion is bilateral there is no displacement of mediastinal contents, and when there is a greatly enlarged heart the same effect upon its position does not take place as would if the organ were normal, so that in such conditions too great reliance cannot be placed on the alteration of cardiac dullness. As a rule there is no fever from the effusion.

Treatment. In addition to the general treatment of the primary condition to which the effusion is due, aspiration in the ordinary way should be practised and repeated when necessary.

Hæmothorax.—Blood in the pleural cavity may be the result of trauma, puncture or laceration of the lung. An aneurysm may rupture into the pleura. Hæmothorax occurs with intrathoracic malignant growths, also in the course of pulmonary tuberculosis, cirrhosis of the liver, chronic renal disease, and in association with altered blood states such as purpura, scurvy, leukæmia, the hæmorrhagic diathesis, and during malignant infective fevers.

The *symptoms* depend upon the cause; the signs are those of fluid in the pleura which is found to be hæmorrhagic on exploration. There need be no friction or febrile disturbance.

Treatment. This will depend upon the condition with which the hæmothorax is associated. There are no definite lines of treatment, each case must be considered on its own merits.

Chylothorax.—This is a rare condition arising from injury with rupture, or from obstruction of the thoracic duct.

New Growths of the Pleura.—Non-malignant growths of the pleura are very rare; fibroma, lipoma and osteoma of the parietal pleura have been recorded. Malignant growths are rarely primary. Endothelioma arising in the lymphatics or, less frequently, from the endo-

thelium of the pleura are the most common. It may affect the whole of the serous membrane, often in a thin layer, trabeculated on the surface, or there may be quite a thick growth. It infiltrates the bronchial glands, the diaphragm, the capsule of the liver, and spreads to the peritoneum and omentum. It may resemble true carcinoma, with columns of cylindrical cells.

Sarcoma also is a rare primary growth, varying in type and structure.

Secondary growths occur as carcinoma or sarcoma; the former is usually secondary to growth in the mamma, lung, bronchus or the mediastinum. Secondary sarcoma is usually a late deposit, occurring at a remote period after removal of the original growth. Secondary growths may produce a general and uniform infiltration, or appear in masses, which may project into the pleural sac; they may be pedunculated. In other cases the deposits occur as scattered nodules. Both lung and interlobar pleura may be infiltrated.

Symptoms and Signs. These are very variable. The onset is insidious, there may be dyspnoea with dull pain and tenderness at the affected area or reflected elsewhere. Cough may be irritable, unaccompanied by fever, and with little or no sputum; the latter, when present, may be blood-stained. There will be irregular dullness and varied respiratory phenomena, generally tending to silence over the growth, and sooner or later characteristic signs of effusion present themselves. When symptoms of chest trouble arise which are greater than can be accounted for by the presence of fluid alone malignant growth should be suspected. Further, when on aspiration the amount of fluid withdrawn is not sufficient to account for the total physical signs, and these with symptoms are only partially relieved or altered, the probability of new growth is strengthened. In some cases there may be little effusion and the needle may be felt transfixing hard, resistant material often transmitting a grating feeling to the hand. This is a sign of some import.

Apyrexial cough over a prolonged period, with signs of pleural implication, is an important indication of malignant disease. The nature of the effusion is a valuable guide to diagnosis, it is often hæmorrhagic, in some cases the fluid may contain fat, and particles of the growth may be found.

Before, but especially after, inspiration, loud, coarse friction may be heard, and even friction fremitus felt. Enlarged glands may be felt in the axilla or above the clavicle of the affected side; signs of enlargement of mediastinal glands may appear, causing substernal or interscapular dullness and pressure symptoms. During the early stages of the disease there may be little

or no cachexia, but later there may be profound wasting and asthenia.

The *prognosis* is invariably hopeless and the treatment resolves itself into the practise of palliative measures.

Hydatid of the Pleura.—Primary hydatid cyst of the pleura is rare, it generally occurs secondary to deposits in the liver. There is no constitutional disturbance unless the cyst causes suppuration. If large it may cause local bulging to a variable degree, with impaired percussion resonance, loss of vocal fremitus and respiratory sounds over the cyst area. At the margins of the cyst there may be definite friction. X-ray examination will reveal the cyst. The history of the case is an aid to diagnosis. Exploration with a long, fine needle will reveal the nature of the fluid, which, on further examination after centrifugalizing, may be found to contain the characteristic hooklets. The blood may contain an excess of eosinophile cells. As a rule there is no ectocyst in pleural hydatid, the pleura taking its place.

Treatment. Medicinal treatment is of doubtful value, drachm doses of the tincture of kamala, large doses of iodide of potassium, and the internal exhibition of turpentine have been advocated in the hope of causing the death of the parasite.

Successful results have followed tapping the cyst with a fine trocar and cannula. Complete aspiration may be followed by hæmorrhage. The features of pleural hydatid are practically the same as when the cyst is in the lung. With this in mind and in view of the danger of tapping a pulmonary hydatid, by causing rupture into the lung and possible suffocation, it is desirable to be prepared to operate by free incision and drainage at the time the exploratory puncture is made. R. J. M. B.

PURULENT PLEURISY (EMPHYEMA)

Purulent Pleurisy may be a sequence to an acute serous pleurisy or it may arise, as it so often does in children, as a suppurative condition from the first. In children it may occur as a complication of infectious diseases, especially scarlet fever and typhoid, less often in measles and whooping-cough. It occurs also after punctured wounds of the thorax, fractures of the ribs, malignant disease of the lung or œsophagus, and from the rupture of tuberculous cavities.

Instances arise where empyema is secondary to subdiaphragmatic suppuration either directly below the diaphragm or at a distance as in appendicitis. It not infrequently arises during pyæmia and other septic processes and a variety of organisms are responsible for the con-

dition, principally pneumococcus, streptococcus, staphylococcus, bacillus coli and tubercle.

When in an attack of pneumonia the physical signs do not clear, are atypical, the temperature erratic, or after the critical fall of temperature there is a short afebrile stage with a subsequent rise again, empyema should be suspected and the chest explored. In children the condition may come on quite insidiously with wasting, cough and sleep sweats.

The general symptoms are those of toxæmia. The temperature is usually hectic in type, but it must be remembered that empyema may be present with but little or no pyrexia or even a subnormal temperature. There may be no pain, cough or dyspnoea, but in children the last two are practically always present. The face assumes a peculiar waxy anæmic colour, the tongue is furred, there are sleep sweats, the eyes become brilliant and there is emaciation. The fingers in many cases become markedly clubbed, mostly on the affected side. This I consider an important general sign, and when the pus is removed the clubbing will often be found to disappear almost as quickly as it came. There is a definite leucocytosis and iodophilous reaction of the polymorphonuclear cells.

The physical signs are those of fluid as described under serous effusion, with bulging of intercostal spaces. An important sign is œdema and redness of the chest wall on the affected side. Whispered pectoriloquy is said to be absent in purulent effusions. I have already doubted this. It is to be remembered that many cases of empyema give physical signs denoting solid lung, this especially in children; and in adults when the condition has resembled pneumonia from the outset, it has been regarded as an unresolved pneumonia and has become chronic or even fatal, or has burst through the lung, from the want of proper and, if necessary, repeated exploratory puncture. In some cases the empyema may point externally and pulsate, especially when in the left pleural sac; this may be seen and felt, and may resemble aneurysm. It may pulsate without pointing. When pulsation and pointing take place the condition is termed "empyema necessitatis."

Clinical Course. Empyema if left becomes chronic and may end in death. In some cases absorption or partial absorption may take place with shrinking of the affected side. The pus may, by local necrosis of the lung, perforate the latter and discharge through it, or it may discharge through a bronchus more rapidly, in which case there is a great probability of pneumothorax following. The escape of the pus through the lung may be so profuse as to cause suffocation and death, but fortunately in the large majority of instances the process is

gradual and intermittent and may end in recovery. The empyema may find an escape externally close to the sternum, usually in the third or fifth intercostal spaces, more commonly in the latter. The pus may break through the pericardium, a dangerous complication.

Perforation may take place into the œsophagus, peritoneum or the stomach.

It may burrow in other directions and pass down to the abdomen, and has been known to track in rare instances to remote positions. When absorption takes place, and if the collection be small and local, calcification may follow.

Empyema may be localised and enclosed in a thick pleural sac. Although the pus collects most commonly at the base and posteriorly, it is not uncommon to find it in the lateral region, and I have seen it localised at the apex, giving rise to great difficulty in diagnosis. It may be enclosed between the lobes of the lung, and when exploratory puncture fails to detect pus in the more common situations, it should be carried out in the line of the interlobar sulcus, if necessary in two or more interspaces. Empyema may be present in both pleural sacs at the same time, fortunately an uncommon occurrence.

R. J. M. B.

PNEUMOTHORAX (HYDRO- AND PYO-PNEUMOTHORAX)

Pneumothorax is the presence of air (or gas) in the pleural sac. It is often associated with serous or purulent exudation, and these will be considered together.

Etiology. Pneumothorax pure and simple is not a common disease, combined with fluid or pus it occurs more frequently. The majority of cases occur in pulmonary tuberculosis, more especially in acute forms and where adhesions have not formed. Others arise from rupture of an empyema into the lung, of pulmonary abscess, bronchiectatic cavity, gangrene or breaking down infarct into the pleura. Perforations of the œsophagus, stomach or intestine communicating with the pleura have caused it. It has occurred occasionally in association with caries of the ribs or sternum.

A few cases have followed infection with gas-forming organisms, *B. coli* and *B. aerogenes capsulatus*. Rupture of emphysematous bullæ may cause it, and in some of these the pneumothorax may be recurrent.

Pneumothorax also follows external injury by penetrating wounds of the thorax. Simple fracture of the ribs does not often cause it, although the lung may be torn. It has followed paracentesis thoracis, and for this purpose pointed needles should never be used. In apparently healthy persons it has been caused by strain. In one such case it occurred while

the person, a medical man, was assisting in lifting a heavy piano. Tracheotomy and operations about the lower part of the neck have given rise to it, generally associated with surgical emphysema, and when artificial respiration has been practised.

Pneumothorax occurs more often on the left than the right side. The rent in the lung generally occurs in the lower part of the upper lobe or upper part of the lower; I have known it to be at the extreme anterior edge of the upper lobe high up. The opening may be direct or valvular, the latter being the more serious, as great positive pressure of air in the pleura takes place, while in the former it remains the same as that of the atmosphere. Adhesions are protective and tend to minimize the danger. A simple tear closes up as a rule, the air is gradually absorbed and recovery follows. When the rupture is associated with any septic process, such as tubercle, effusion of serous fluid or pus follows and the condition becomes more complicated and serious.

Symptoms. The onset is accompanied by pain in the side, which may be severe, dyspnoea follows immediately, the pulse becomes rapid and small, there is cyanosis, feeble voice, subnormal temperature and sweating, all denoting general collapse. When the opening is valvular the dyspnoea is extreme and there is orthopnoea. There is irritating and ineffectual cough, and unless there be disease of the lung the expectoration is scanty.

Physical Signs. With complete pneumothorax the shoulder is raised, the intercostal spaces are obliterated, the affected side distended and movement diminished or lost. On the sound side movement is increased. The heart's impulse may be seen displaced to the sound side. Palpation corroborates these signs, the vocal fremitus is abolished and the liver and spleen displaced downwards. Percussion reveals a hyper-resonant or tympanitic note as a rule, but where the air is under great tension the note may be higher in pitch, and in extreme cases may be dull and resemble effusion. If effusion be present the tympany will change to dullness over it and its upper level alters with change of position. The heart dullness is obliterated or displaced and the tympany encroaches upon or crosses the mediastinum. The "bruit d'airain," "anvil," "bell" or "coin sound" can be elicited.

On auscultation the breath sounds are absent in the valvular form, but if there be more direct communication with a bronchus the sounds are amphoric. In the region of the spine breath sounds may be heard over the collapsed lung; in some cases they are "distant" all over. When bubbles of air explode into the pleural space they cause metallic tinkles. The voice

sounds are often echoed, and this occurs when breathing is inaudible; I consider this an important diagnostic sign, especially so when the whispered voice is echoed, and this latter should always be sought for, as it will occur when the ordinary vocal vibrations do not resound. The echo has a peculiar metallic quality. The metallic tinkling sometimes occurs with it. The tinkle is more that of glass than metal and resembles the sound of ice shaken in a tumbler containing fluid. On placing the ear upon a towel spread close over the back and shaking the patient, Hippocratic succussion is heard if fluid be present, and this has the ring of glass. In some cases this splashing may be heard without auscultation and is recognized also by the patient. X-ray examination will reveal the clear air space and the dislocation of the heart; if fluid be present, shaking the patient produces a visible ripple on its surface, and alteration of posture changes its level.

The respiratory phenomena on the sound side are all exaggerated.

Diagnosis. As a rule this is easy. When the tension is great it may be mistaken for fluid. Emphysema when extreme may resemble it, but it is on both sides with a long history, while double pneumothorax would cause rapid death. A large vomica may offer difficulties, but the displacement of the heart, when present, is to the affected side. In one case, apart from the position of the mediastinal contents all the signs were those of pneumothorax; the case was one of tubercular excavation of the whole of the left lung, which was corroborated post-mortem. A sub-diaphragmatic collection of pus and gas may be very difficult to diagnose, especially from local pneumothorax; the heart's apex on the left side would be raised, and X-ray examination would reveal the true condition. Hernia of the stomach through the diaphragm, due to severe injury, is rare, auscultation would reveal peristaltic bubbling, and X-ray examination would show the condition. There would also be other symptoms and signs associated with disturbance of abdominal contents. When pus is expectorated it should be examined for organisms, etc., tubercle in particular.

Prognosis. Simple pneumothorax occurring in the healthy usually gets well. In tuberculous cases a limited pneumothorax has a tendency to arrest the disease, as it closes up the affected lung and itself causes but slight inconvenience. In the large majority of tuberculous cases when there is advanced disease, and if the opposite lung be affected, tubercular pyopneumothorax is established, constitutional disturbance is aggravated, and death may occur in a few weeks. I have seen cases, however, lasting several years even with pus in the pleural sac. One of these

had pyopneumothorax, the pus loaded with tubercle bacilli, for over three years, travelled far and climbed Mount Hecla twice, and later undertook business duties. In the early stage death usually takes place from shock and collapse, while in those who are already ill, as in chronic phthisis, there seems to be less shock.

Treatment. In cases occurring in the apparently healthy the condition is as a rule recovered from, and the treatment required is to combat the shock, so that stimulants in the form of ether, ammonia or alcohol are called for; morphia should be given hypodermically to relieve pain, anxiety and cough, or for the latter heroin may be given. If there be no great distress or dyspnoea, cyanosis and laboured heart, it is well to await developments, as the rent in the visceral pleura may heal and the air be absorbed. If, however, the distress be great it is desirable to withdraw some of the air through a fine cannula, either by very gentle aspiration, or through a rubber tube attached to the cannula by one end, the other submerged in a vessel of water or antiseptic lotion. This procedure may delay the closure of the rent, but the lesser of two dangers must be chosen. I have found great relief follow the escape of air. The procedure may require repetition. The occurrence of subcutaneous emphysema is very rare, and has to be guarded against by firm closure and sealing of the needle track. When there is severe cardiac distress and a burdened right heart venesection will give relief. Dry cupping and leeching have been recommended to relieve pain. If fixation of the affected side gives relief, it may be helpful to strap it with plaster. Rest in bed is essential. If fluid collect in the pleural sac it may be examined by exploratory trocar and cannula and, if found clear, aspirated; this will require repetition. The exudate is almost certain to become purulent and accompanied by much constitutional disturbance. It then becomes necessary to open the chest and afford free drainage, especially if the pus be offensive. In one of my cases with pulmonary gangrene the portion of the gangrenous lung sloughed off and was delivered through the operation wound with subsequent recovery.

There are a certain number of cases in which the hydropneumothorax becomes chronic and without any constitutional disturbance. If the other lung be good, no interference may be necessary, and in some cases of phthisis it is advisable to let matters take this course and await events. Aspiration, when the pus contains tubercle bacilli or other organisms, may end in infection of the chest wall and abscess formation, with a direct communication with the pleural sac and pneumocele. Such a condition demands surgical interference and free

drainage. It is thought by some that tubercular pyopneumothorax should not be opened; each case requires consideration on its own merits. When there is hectic fever, sweating and rapidly failing health, operation is necessary and desirable.

R. J. M. B.

DISEASES OF THE MEDIASTINUM

Mediastinitis.—This occurs as a simple acute, suppurative and gangrenous, or chronic affection.

Simple Acute Mediastinitis.—The cellular tissues of the mediastinum may become acutely inflamed in association with inflammatory affections of one or other of the mediastinal or thoracic contents, *e. g.* pericarditis and pleurisy, disease of the sternum or spine, or cedema as part of general dropsy. Organization of the exudate may take place resulting in adhesions.

Acute Suppurative and Gangrenous Mediastinitis.—These conditions are very rare, especially the latter. They are due to septic invasion.

Causes. Suppurating tuberculous glands; direct trauma; indirect trauma through the oesophagus, by impaction of foreign bodies and injuries with ulceration; breaking down of oesophageal malignant growths; caries, acute necrosis, or syphilitic disease of spine or sternum; extension of suppuration from elsewhere, *e. g.* neck, pharynx, pleura, pericardium, thyroid, thymus; general infections, *e. g.* erysipelas, exanthems, pyæmia. Gangrene may follow oesophageal sloughing, gangrene of the lung or larynx, or sloughing glands.

Symptoms. The simple form may be difficult to detect. When the anterior mediastinum is affected there may be substernal pain and superficial tenderness, friction synchronous with the heart-beat or respiration on auscultation, and fine creaking at the edges of the sternum. With suppuration there is a more definite train of symptoms. The pain may be severe, either substernal or spinal, with tenderness over sternum or spine; it is throbbing and increases in severity; referred pains are sometimes present. When the abscess finds an exit the pain subsides. Pressure symptoms comprise dyspnoea, dysphagia, paroxysmal ineffectual cough, alteration in radial pulses, irregular pulse, vomiting. Hæmoptysis with gangrenous odour of the breath may occur.

Physical signs may be wanting or definite; they comprise superficial redness, cedema, pulsatile fluctuating swelling in the suprasternal notch or an intercostal space near the sternum, percussion dullness over the sternum. If in front, the heart sounds may be distant. Fever is present, possibly rigors and sweats with weakness and anæmia.

Course and Termination. The abscess may

burst into the trachea, œsophagus, aorta, pericardium, pleura, or track to a distance, *e. g.* the abdomen.

Prognosis. This is very grave. Unless the pus gains an exit or is evacuated the affection proves rapidly fatal. It may become chronic, and if the abscess be small, it may dry up and calcify. Gangrene is always fatal.

Diagnosis. This is based on the symptoms and signs with fever, which differentiate it from tumours. When the abscess points and pulsates it may simulate aneurysm, but there is no bruit or diastolic shock and it is not expansile. When gangrenous and communicating with a bronchus it cannot be distinguished from pulmonary gangrene.

Treatment. Rest, local sedative applications, poultices or fomentations, morphia for the pain, general tonic and supporting measures and nourishing diet are necessary. Surgical interference is demanded when practicable, but abscess in the posterior mediastinum hardly admits of this. When the abscess bursts into an air-passage antiseptic inhalations or intratracheal injections may be useful.

Chronic Mediastinitis (Indurative Mediastino-Pericarditis).—There are three forms of this recognized, one in which the condition is external to the pericardium, another in which the pericardium is adherent to surrounding structures, and the third in which there is pronounced fibrous mediastinitis with adherent pericardium. It may follow acute mediastinitis, pericarditis or pleurisy, be the result of injury or due to tubercle, syphilis, local bone disease or old-standing bronchitis and emphysema. Proliferative peritonitis is not seldom associated with it. It is more common in adults than children, in males than females, but it generally commences in early life.

Symptoms and Physical Signs. These generally are those of cardiac embarrassment. The condition may be latent, or in a definite case dyspnoea, substernal pain and distress, cardiac disturbance, venous obstruction, cyanosis and swelling of the face, and troublesome cough are present. Percussion may reveal substernal dullness; creaking at the sides of the sternum on moving the arms, heard on auscultation, is an important sign. Inspiratory swelling of the cervical veins, and the pulsus paradoxus are present in some cases. If the pericardium be adherent there are the signs indicative of this condition. Ascites with enlarged liver is not uncommon and there may be albuminuria.

Treatment. This should be directed to the alleviation of cardiac disturbance. Injections of fibrolysin or iodolysin may prove useful. The operation of "cardiolysis" may be desirable in certain cases. The general health should be

maintained. Dropsical effusions require attention. In children any attack of rheumatic pericarditis calls for prolonged rest in the recumbent posture.
R. J. M. B.

AFFECTIONS OF THE MEDIASTINAL LYMPH GLANDS

Simple Lymphadenitis.—This occurs in practically all inflammatory affections of the lungs and bronchi, especially in measles, pertussis and influenza. In pertussis the enlarged glands have been considered responsible for the paroxysmal cough.

Suppurative Lymphadenitis.—This may follow the simple form, or be associated with infective processes, especially tubercle. The abscess may burst into the trachea or a bronchus, the œsophagus or aorta.

Tuberculous Lymphadenitis.—The glands may be secondarily infected from the lungs or pleura, rarely from bone, by extension from cervical glands, or from the abdomen by the thoracic duct. Primary infection is rare. The glands may caseate, calcify or suppurate. The thoracic duct may be affected.

Symptoms. When the enlargement is slight there may be no special symptoms. When considerable enlargement is present there may be cough, paroxysmal, stridulous or croupy in character, dyspnoea or orthopnoea. There may be slight expectoration, but if suppuration has taken place, with discharge through a bronchus, there will be purulent sputum with or without tubercle bacilli.

Physical examination may reveal impeded air entry into one or both lungs. There may be a dull area over the sternum or in the inter-scapular space; in children a venous hum may be heard at the root of the neck when this is extended. The enlarged glands are revealed by X-ray examination.

Treatment. This must be carried out with a view to the original cause. There is no specific treatment for the adenitis. When suppuration takes place surgical treatment may be necessary. General tonics, cod-liver oil, iron, fresh air and good food are necessary in ordinary cases.

Mediastinal Emphysema.—As a rule this is traumatic in origin or occurs after tracheotomy. It may occur after rupture of the lung or pleura or perforation of the trachea or a bronchus. It may occur during violent paroxysms of whooping-cough, also from perforation of the œsophagus, and from infection with gas-forming organisms.

Symptoms and Signs. Progressive admission of air to the mediastinum fills the chest and compresses the lungs, a condition which is rapidly fatal. The normal relations of the intra-thoracic contents are disturbed, the chest

distends and a hyper-resonant percussion note may be present all over. A dry crackling may be heard on respiration or on moving the arms. The air or gas may extend to the cellular tissues of the neck or chest, producing characteristic subcutaneous emphysema.

Treatment. There is no special treatment; in some cases surgical measures may be indicated.

R. J. M. B.

MEDIASTINAL NEW GROWTHS

These may be malignant or benign. They comprise carcinoma, sarcoma, lympho-sarcoma, endothelioma, lymphoma, lymphadenoma, fibroma, dermoid cysts, teratoma, lipoma, enchondroma, osteochondroma, thymoma, myeloma, hæmatoma, hydatid cyst, gumma, tubercular glands.

The majority of the primary growths belong to the sarcomata, lymphomata, or a mixture of both—lympho-sarcoma. Carcinoma occurs much less frequently even when secondary. Males are more commonly affected than females, the age of onset generally being between thirty and forty, but they do occur in early childhood. They may originate in any structure in the mediastinum, but the most common are the thymus, lymph glands, pleura and lung. They may also invade the mediastinum from elsewhere, as from the thyroid gland.

Symptoms. These are due to pressure, and comprise dyspnoea, which may be due to direct pressure on the trachea or bronchi, the recurrent laryngeal nerves, the heart or vessels, or from pleural effusion; paroxysmal cough of a "brassy" or "goose-gobble" quality; aphonia; pressure on veins, resulting in oedema of the head, neck and arms, and distension of superficial veins. The inferior vena cava may be compressed, and the growth may penetrate the veins. The arteries are not commonly affected. Dysphagia, pupillary changes, dilatation or contraction from involvement of the sympathetic may be present.

Pain is a variable symptom, it may be absent or slight, severe and radiating to the arms, it may resemble angina pectoris, or pass round the chest and be associated with herpes zoster.

There may be hæmoptysis or prune-juice expectoration when the growth invades the lung. Cyanosis may be extreme. Other general symptoms are weakness, emaciation and anæmia. Fever is not common in the early stages, but it may be present in the later and is hectic in type; in Hodgkin's disease and tubercular masses it is often a marked feature. anorexia and insomnia are sometimes troublesome.

Physical Examination. On inspection cyanosis and dilatation of superficial veins may be

observed, there may be clubbing of the fingers and swelling of hands, arms or head. The sternum may be prominent, subcutaneous deposits or enlarged cervical and axillary glands may be seen or felt. There may be local unilateral or bilateral loss of movement on respiration, the spaces may bulge or be retracted, asymmetry of the two sides may be present. The heart may be dislocated with altered cardiac dullness and impulse. Palpation reveals impaired fremitus over the growth, or over the lung if a bronchus be blocked, but deposits around patent bronchi in the lung increase the fremitus. The tumour may pulsate. Percussion reveals dullness over the growth, with usually an irregular outline. When a bronchus is blocked the corresponding lung area gives an impaired note.

On auscultation the area of the tumour is silent on respiration, and the heart sounds dulled or absent. In some cases they are loudly transmitted. Over areas of infiltrated lung the breath sounds may be bronchial if the tubes are patent, silent if blocked. Crepitations and creakings are heard in scattered areas, and pleuritic friction is often present. Vocal resonance is absent over the growth, but varies in the surrounding lung with the patency or blocking of bronchi.

Signs of pleural effusion are not uncommon, in some cases there is a considerable amount of fluid, especially when the growth originates in the lung.

The radial pulses may be asymmetrical. Inequality of the pupils and paralytic position of vocal cords are other signs. Tumours of the thymus may erode the sternum. When in the middle or posterior mediastinum the symptoms are more pronounced than the physical signs and there is great dyspnoea. Tumours in the anterior mediastinum cause much venous obstruction.

The tumour can be readily seen by means of skiagraphy; a lateral view should always be taken.

Diagnosis. The principal condition which may give all the signs and many symptoms of mediastinal tumour is aneurysm of the thoracic aorta. In aneurysm the pain is generally worse, the swelling at the surface is pulsatile, expansile, and presents a diastolic shock. There is generally a history of syphilis and strain. Aneurysm generally has a longer history than tumour. Tumour rarely causes tracheal tugging. Glandular enlargement and cutaneous deposits denote new growth. Pleural effusion may mask the diagnosis until it has been aspirated; in new growth the fluid is often sanguineous. Irregularity of dullness extending over the middle line, especially when above the second rib, point to tumour. Pericardial effusion may have to be

excluded. It gives a characteristic area of dullness and has its own clinical history. Skiagraphy is of the greatest value.

Prognosis. In malignant growth this is very grave, as the condition is progressive; a fatal issue results as a rule within twelve months after the disease is recognized. It is not always possible to diagnose the true nature of the growth, so that one must be guarded in prognosis, for tubercular, gummatous and even lymphadenomatous masses may disappear under treatment. Age must be considered in diagnosis and prognosis.

Treatment. Only general lines of treatment can be indicated here. Tubercular masses are to be treated as for tubercular disease generally, and by the use of tuberculin in desirable cases. Gumma demands full doses of potassium iodide and mercury, or intravenous injection of salvarsan. Malignant growths do not respond to treatment; exposure to X-rays has proved beneficial in sarcomatous growths, and this with injections of Coley's fluid deserves further trial.

As a rule the treatment must be palliative; atropine and morphia will relieve dyspnoea and

pain. Referred neuralgic pains call for remedies such as phenazone, phenacetin, ammonol or other nerve sedatives. Heroin hydrochloride is useful to relieve cough, syrup of codeina taken at night will relieve cough and induce sleep. Insomnia may be relieved with hypnotics, of which chloralamide is very useful, and the changes may be rung on trional, veronal, chloral and bromide of potassium.

Counter-irritation may be considered for relief of pain, and nothing proves so effectual as small mustard blisters over tender areas; active and prolonged counter-irritation is undesirable. Pleural effusion should be aspirated when there is much dyspnoea.

Growths arising in accessible places may afford a chance of surgical treatment. Urgent dyspnoea may call for tracheotomy, but it will only prove useful when there is no local pressure on the trachea. Inhalations of chloroform relieve dyspnoea. Venesection will relieve venous obstruction and cyanosis. The general comfort and nourishment must be attended to, and in some cases with dysphagia artificial methods of feeding may be required.

R. J. M. B.

DISEASES OF THE CIRCULATORY SYSTEM

BLOOD PRESSURE

It will save repetition if, before entering into the question of high and low blood pressure, a superficial survey of the physiology of the subject is attempted. It is a commonplace to say that all the physiological processes are under the control of the nervous system. In the matter of normal blood pressure the nervous system is the key to the whole situation. By means of the vasomotor centres it presides over the contraction and dilatation of the peripheral vessels, which is the principal factor in promoting variations in arterial tension. Vasomotor control exists of course both in the medulla and in the cord, each of which exercises the control in a different manner. The centres in the cord are responsible for local variations in blood pressure. These local centres balance one another in such a way that when one of them orders a local dilatation, it is the duty of its correspondent to decree a local constriction, and vice versa, to the end that the general blood pressure be not affected by the exigencies of functioning organs. Thus it is that when the gastric vessels dilate to supply blood for the digestion of a meal, those in the skin contract and give rise to a feeling of chilliness. This see-saw is constantly taking place during the active hours, and it is the satisfactory adjustment of the balance between the various spinal

centres which makes the changes imperceptible to the individual.

In these activities the medulla normally takes no part. The power of this vital portion of the nervous system is apparently limited to ordering a general vaso-constriction, or, if it is forced thereto, a general vaso-dilatation. It has no power of interfering with the see-saw of the local centres. As a matter of fact, the medulla never voluntarily interferes except to produce a general vaso-constriction, and this it does only as a measure of self-preservation. For instance, if the contraction of the cutaneous vessels does not adequately balance the dilation of the gastric vessels during digestion the general blood pressure will fall. If it is in danger of falling to the point where the medulla will be face to face with starvation, then a general order for vaso-constriction and a consequent general rise of blood pressure is at once issued by the bulb, with results with which, in the subjective sensations of dyspepsia, all are familiar. The circumstances under which, apart from self-preservation, the medulla orders a general vaso-constriction are not many, but they are important. In the first place the bulb may be provoked or irritated into issuing this order by the action of toxins circulating in the blood. The exact nature of these toxins is not accurately known, but experience teaches us that they are very closely associated with

defective metabolism, especially of meat foods; that gout produces them, and that they are present in great quantities in the conditions known as uræmia and eclampsia.

Secondly, mental excitement, from whatever cause arising, immediately reflects itself in the medulla in such a way as to cause the latter to issue a general order for vaso-constriction. When the excitement has subsided the vessels relax and the pressure falls. Sir Clifford Allbutt tells the story of a patient who showed an abnormally high blood pressure because he thought he recognized in the instrument the medium through which he was to receive an electric shock, a previous experience of which had caused him much pain. As soon as he had been reassured the pressure fell to the normal. With nervous patients it is a great mistake to discuss the height of their blood pressure. The mere fact of the armulet being applied excites their interest and the pressure immediately rises, not infrequently to a figure which to the inexperienced may seem to indicate something serious. This is a practical point of very great importance.

A third, and only other cause to which reference need be made is the stimulation of a sensory nerve. This immediately causes a rise in blood pressure commensurate with the degree of pain produced. It is to be supposed that the medulla is thus reflexly irritated into issuing a general order for vaso-constriction. Of these three causes, the first, namely toxins, probably of gastro-intestinal origin, circulating in the blood is the most important. It is, however, very necessary to bear in mind the other two, in order to avoid the mistake of ascribing to a continuous and possibly serious cause phenomena which are in reality transient and harmless.

A widespread vaso-dilation may be occasioned by the action of the spinal centres, but a vaso-dilation which is general and sustained is always the result of medullary exhaustion.

Instruments and Procedure. Until comparatively recently, blood pressure was measured clinically by the finger. Now-a-days we use instruments of precision, and Sir Clifford Allbutt very properly insists that in an individual case it is as futile to talk about blood pressure without one of these, as it is absurd to discuss temperature in the absence of a thermometer. It is doubtless a pity that our unaided senses are not able to give us positive information in this matter; but, such being the fact, it is as well that it should be recognized, so that we may learn to discard unreliable methods and to avail ourselves of more trustworthy informants. It seems that the finger can only appreciate total force; it cannot appreciate such refinements as amount of force in relation to unit of surface; so that having regard to variations

in the size, not only of the same artery in different persons, but also of the same artery in the same person under different conditions, it would seem impossible for any one, however well educated his touch, to be quite sure of any but the most pronounced degree of abnormality. The moral is, then, that in view of the importance which the subject has now assumed, no one can afford to be without a reliable instrument for measuring blood pressure.

Of such instruments there are a great many on the market. Perhaps the most popular is that known as C. J. Martin's modification of Riva Rocci, a mercurial instrument which is

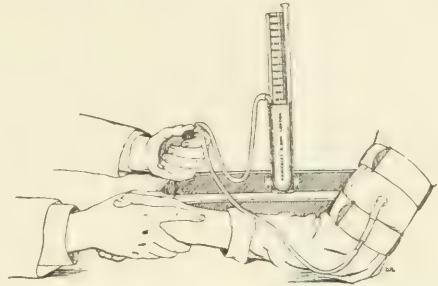


FIG. 1.—C. J. Martin's Modification of Riva Rocci.

very useful for the consulting room, especially since, by some further modifications of the maker, Mr. Hawksley, the spilling of the mercury, which was originally a source of constant annoyance, has been entirely obviated. Another mercurial instrument, which has the merit of being much more portable than the above, is one introduced by Dr. George Oliver (Fig. 2). This authority is responsible for the invention of three or four manometers, all of which have their several merits combined in the little instrument here figured.

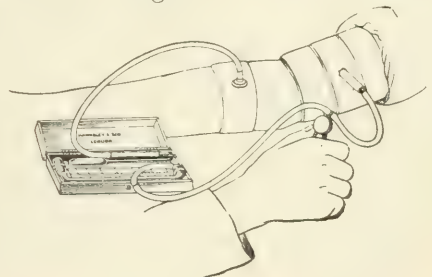


FIG. 2.

A very portable instrument on the aneroid principle was suggested by Sir Lauder Brunton, and is made by Mr. Hawksley. Aneroid instruments have, however, the grave demerit of unreliability. They require to be controlled from time to time by a mercurial manometer.

An exceptionally neat instrument of recent introduction into this country comes from

America, and is known as Dr. Roger's Tyco's Sphygmomanometer (Hawksley) (Fig. 3). It has the dial suggestive of an aneroid instrument, to which however it bears no real relationship, the operation of the instrument depending not



FIG. 3

upon a spring, but upon the expansion of diaphragm chambers, which is unaffected by altitude or atmospheric change.

All the above instruments are connected to an armulet twelve centimetres broad which encircles the upper arm immediately above the elbow. The armulets supplied with most of the instruments are armed with straps and buckles and are very cumbersome. That supplied with the Tyco's instrument (see Fig. 3) is a very great improvement on anything yet introduced. With the armulet applied, all screws tightened and the observer's finger on the radial artery, air is gradually pumped into the armulet until the pulsations at the wrist disappear. The point which the indicator has reached is now read off and noted. This gives the systolic pressure in millimetres of mercury (mm. Hg). So far, attempts at estimating the diastolic pressure have been unsuccessful.

The normal systolic pressure in a young and healthy male adult may be taken as 120 mm. Hg. In women it is rather lower, say, 100–110 mm. Hg; in children lower still, say, 90–100 mm. Hg. The blood pressure tends to rise with advancing years. At fifty years of age a pressure of 150 is not abnormal; at sixty years of age it may be 160 without exciting alarm, and from seventy years onwards it may reach 200 mm. Hg with apparent impunity.

In estimating the significance of a particular reading the age of the patient and some other factors presently to be noted must always be taken into consideration. A blood pressure which remains persistently below 80 mm. Hg is of serious augury, and one which approaches 70 mm. Hg must always be regarded as a danger signal.

High Blood Pressure.—Inasmuch as high blood pressure was originally found to be associated with renal cirrhosis and arteriosclerosis, it was assumed that these organic diseases were the cause of the rise in pressure. This is now known not to be the case. It is of the utmost clinical importance to realize that high arterial tension, as it used to be called, is generally the first event, and that structural

disease in the arteries is the second. By irritating the medulla or otherwise, certain toxins circulating in the blood cause a contraction of the finer branches of the arterial tree. The heart, in order to overcome the resistance

so created, is moved to stronger contractions, and the general blood pressure necessarily rises. This is what was called by Huchard the stage of pre-sclerosis, and by von Basch the stage of latent sclerosis. In this country it is called functional high blood pressure, and it is im-

portant that it should be recognized, for it is in this stage, and in this stage only, that the malady can be checked and the otherwise inexorable fatalities averted. If the conditions which have brought about the high blood pressure are allowed to persist, certain changes occur in the walls of the vessels which convert this functional contraction into a structural narrowing of the lumen of the tube, and the patient enters into the stage of definite arterial degeneration. This degeneration is not equally diffused through the system; the process seems, indeed, to have a selective affinity for the vessels in certain areas. Thus we find that the renal arteries, the cerebral arteries, the hepatic arteries, and the coronary arteries are among those most commonly affected. The explanation of this would seem to be that it is these organs that have to bear the brunt of the poisoning. The liver and kidneys are busily engaged in endeavouring to eliminate the poison, while the heart is obliged to redouble the force of its contractions to overcome the peripheral resistance which the poison has occasioned. This increase of activity, however, soon tells its tale. The liver and kidneys tire, with the result that the poison, being inadequately excreted, accumulates in the blood. Now, whatever effects in other directions this state of matters may produce—and they are very variable—the one system which always suffers is the cardio-vascular system. The portion of this system which has to bear the brunt of increased blood pressure is that portion of the aorta immediately above the aortic valve. It is not therefore surprising to find that a very common effect of persistent high blood pressure is aortitis of a chronic degenerative type. This condition is not always easy to distinguish during life, but it is a common finding in the post-mortem room, and its importance resides not so much in any disabilities which it may of itself entail, as in the consequences to which it is liable to give rise. The first and most important of these is aortic aneurysm. The never-ceasing impact of the impure blood, delivered with ever-increas-

ing force against the damaged wall, eventually produces its effect, and the aneurysmal sac is established. This may not be the mechanism of aneurysm formation in all cases, but it is certainly one, and by no means the least important, of the methods by which these tumours arise. It is therefore necessary to ascertain the state of the blood pressure in all cases. High tension in association with an aneurysm, however caused, is one of the most serious conditions in which a patient can find himself.

The aortitis in the neighbourhood of the arch may produce effects elsewhere than at the arch itself. It may spread downwards and involve the aortic ring and the aortic valves. The result in the first case is the production of aortic stenosis; in the second, aortic regurgitation. It is not difficult to imagine that a sclerotic or atheromatous or an allied degenerative process, once started in the vicinity, should attack these structures, or that, when so attacked, they should suffer in the way indicated. One point of interest in this connection relates to the question of treatment. We are often told that we should not give digitalis in disease of the aortic valves, especially in aortic regurgitation, because digitalis prolongs the diastole of the ventricle; and the same authorities assert that iodide of potassium is as useful in affections of the aortic area as digitalis is in affections of the mitral area. Now, there is no doubt that digitalis does prolong the diastole of the ventricle, but it also increases the ventricular force and constricts the peripheral vessels, and it is probably owing to these two actions, both of which contribute materially to the raising of the blood pressure, rather than to its diastolic effect, that it has justly fallen into disrepute in aortic disease. And the usefulness with which iodide of potassium is very properly credited is to be explained in the same way. This drug cannot possibly have any effect either upon the constricted ring or upon the damaged and deformed valves, but it can and does have a very considerable effect in reducing blood pressure, so that when the iodides improve matters in aortic disease they do so in virtue of their hypotensive powers. These considerations serve to emphasize the fact that in all cases of heart disease, whether the trouble be aortic or mitral, it is of the utmost importance to determine whether the primary condition has been cardiac or arterial, for upon the settlement of this point necessarily depends the treatment proper to the condition; what is beneficial in the one case being harmful in the other.

But the above-mentioned chronic degenerative aortitis may give rise to yet another serious condition, the most serious, perhaps, of any. The sclerotic process may pass into the coronary

vessels and obstruct the nutrition of the heart itself, and this we know to be the commonest cause of true angina pectoris—the angina of muscular effort.

The consequences, then, of high arterial tension which has passed through the functional stage to the point of involving the arteries in important viscera are most manifest in and about the heart itself. Aneurysm, aortic valvular disease, and angina pectoris, as sequels of an aortitis set up by high blood pressure, are all common; and inasmuch as these are generally attributed to other causes, it seems desirable to emphasize this aspect of their pathogeny. They may, of course, appear as consequences of high blood pressure without the occurrence of aortitis, but we are less likely to forget important facts if we arrange them in the above sequence. Granular nephritis, hepatic cirrhosis, and disturbances referable to the nervous system are also common; there is, indeed, no organ or system which may not on occasion be affected, but it is obviously impossible to enter into details. The all-important point to bear in mind is that a functional high blood pressure, if allowed to continue unchecked, will assuredly give rise to serious organic disease somewhere, and that the detection of the functional stage is therefore a matter of supremest moment. The detection of this stage is only possible by the use of a manometer. Fingering the radial pulse may give rise to reasonable suspicion; more than this it cannot do. The routine use of a manometer is the more necessary, inasmuch as the symptoms of the functional stage are unfortunately very indefinite. Of physical signs there is only one which is unequivocal, and that is the accentuated second sound at the aortic cartilage, the significance of which is so generally overlooked. A general complaint of being "out of sorts," especially when associated with breathlessness on slight effort and some degree of polyuria, is, however, so suspicious that it should always lead to the use of the sphygmomanometer, if this has not previously suggested itself.

A patient suffering from high blood pressure, whether it be functional only or associated with some organic disease, is always liable to hæmorrhage, and the occurrence of hæmorrhage in a person of over forty years of age, even when it takes the form of a slight epistaxis, should always lead to a very careful examination of the cardio-vascular system. If there is any weak spot in the arterial tree, it is easy to understand that the increased pressure will find it out and give rise to hæmorrhage. Hæmaturia, hæmatemesis, hæmoptysis, menorrhagia, ocular and other hæmorrhages, are all quite common, and it is of course by no means infrequent for high blood pressure which has

been long in existence to show itself for the first time by a crippling and even fatal hæmorrhage into the internal capsule.

The prognosis of high blood pressure which is still definitely in the functional stage is on the whole favourable, but there is frequently not a little difficulty in inducing the patient to take his condition seriously. He does not feel really ill; he regards himself as out of sorts and in need of a tonic. He is therefore inclined to rebel against the dietetic and other restrictions to which he ought to be subjected. Moreover, a certain degree of high blood pressure is distinctly stimulating, and the patient experiences a certain degree of mental well-being, which is liable to leave him when the pressure is reduced. If the pressure is associated with organic disease, the prognosis necessarily resolves itself into an estimate of the degree of danger imposed by the organic lesion. While the malady is still in the functional stages a good deal may be effected by treatment. The first care is to revise the general hygienic habits of the patient: meat foods should be severely restricted, and alcohol, if taken at all, should be taken in severest moderation. Excess of chlorides being now recognized as a very potent cause in the raising of the pressure, the addition of common salt to the ordinary diet should be forbidden. Muscular exercise is very essential, the amount and degree of which must necessarily vary with the age and general condition of the patient. Hot baths, Turkish baths, and radiant-heat baths, especially when combined with massage—any measure indeed which promotes free access of blood to the cutaneous vessels—is of very considerable use. Remedially, nothing can compare with venesection. This should be performed once in every three months if necessary, and from twenty to thirty ounces should be extracted at a time.

Of drugs, calomel and iodide of potassium are exceedingly useful. The calomel should be given once a week, and the iodide of potassium in doses of two and a half to five grains three times a day for three weeks at a time. It is as a rule very suitably combined with small doses (one-eighth grain) of thyroid extract in an infusion of buchu. A course of treatment at Evian-les-Bains or Vittel should be urged upon those whose circumstances permit of a visit to a foreign health resort. The vaso-dilative drugs, amyl nitrite, sodium nitrite, erythrol-tetranitrite, nitro-glycerine and trinitrin are all excellent measures to be used in an emergency, but inasmuch as their effect is very transient, no reliance should be placed upon their producing any permanent effect.

Low Blood Pressure.—From the brief physiological preamble it will be understood that practically the only condition in which a

dangerously low blood pressure can occur is that of exhaustion of the medulla. Where the powers of the medulla remain intact it can, and does, order up a general vaso-constriction which, assuming the powers of the heart to remain constant, will always provide against an undue fall. Medullary exhaustion occurs in an acute form in surgical shock and collapse, and is very generally fatal. It is best combated by placing the patient on his back with his heels at a higher level than his heart, so that the splanchnic vessels empty themselves readily. It is the dilatation of the splanchnic vessels which constitutes the chief danger, for so capacious are these vessels that they can contain the whole of the blood of the body within their walls.

It is not uncommon to find surgical shock and collapse treated by the subcutaneous injection of strychnine, a practice which it is impossible too strongly to condemn. Strychnine acts by stimulating the medulla; the medulla being already in an exhausted state, any stimulation brought about by the strychnine is bound to be followed by a reaction in which the exhaustion is so pronounced as to cause death. Eserin has been recommended by some, but the most useful measure is the subcutaneous injection of pituitary extract (Burroughs & Wellcome's ampoules).

Minor degrees of low blood pressure are seen in any condition where the tonus both of the myocardium and middle coats of the arteries is from any cause deficient. Such a cause is supplied by tubercle, cancer and other wasting diseases, the most conspicuous example being Addison's disease.

The hæmomanometer, if used when the patient is recumbent, is not always a good guide to the discovery of unduly low blood pressure. The normal difference between the pulse-rate in the recumbent as compared with the upright posture is from eight to ten beats per minute, the recumbent rate being that number fewer than the rate when standing. Leonard Hill, who has carefully studied the effect of change of posture on the blood pressure, says: "A useful clinical guide to the condition of the compensatory mechanism in man is afforded by the rate of pulse on change of posture. If the heart becomes greatly accelerated on rising from the horizontal to the vertical position, the vasomotor tone is deficient."

Apart from disease, deficiency of vasomotor tone is very frequently seen in adolescents: in girls it gives rise to menstrual difficulties; in both boys and girls, and more especially in boys of athletic habits, it is very liable to give rise to what is called cyclical, or physiological, or postural albuminuria. Deficiency of vasomotor tone and vasomotor control are conspicuous in hysteria and neurasthenia from

whatever cause arising; it accounts for a great many of the subjective miseries from which idle people are liable to suffer.

Contrary to what is usually believed, gout in some of its protean aspects is very often accompanied by a deficiency in vasomotor tone.

It would seem that some of the partially metabolized proteids are distinctly vasodilator in their effects. People with unmistakable gouty manifestations associated with low blood pressure are far more common than is usually considered to be the case. L. W.

DISEASES OF THE PERICARDIUM

PERICARDITIS

Causes. (1) Pericarditis occurs as a complication of the same series of infective processes as lead to endocarditis: *acute rheumatism, chorea, scarlet fever* and "*septic processes*" generally. It is, however, not so constant a feature in rheumatic fever as is endocarditis. (2) It is more often a terminal condition than is endocarditis, and is especially prone to affect patients suffering from *acute and chronic nephritis* in this way. (3) It is sometimes due to *tuberculosis*, which is a very uncommon cause of endocarditis. (4) And owing to anatomical differences it may arise in two ways which are scarcely possible in endocarditis: *by extension* from neighbouring organs—especially the lungs, as in pneumonia—and *by trauma*.

Forms. Pericarditis may be *acute* or *chronic*. Acute pericarditis presents two stages, according as there is not, or there is, liquid effusion present. In some cases these two stages both occur; in others the disease terminates without the second stage developing; in a third group the second stage has arrived by the time the disease is recognized.

I.—Acute Fibrinous Pericarditis

(*Synonym:* Pericarditis without liquid effusion.)

Symptoms. (1) *Pain:* Not constant, but more frequent than in endocarditis; it may be referred to the shoulder or to the epigastrium; it is rarely intense. (2) *Dyspnœa,* (3) *Palpitation:* Unusual, and not features of the disease as in pericardial effusion. (4) *Fever:* More constant, though by no means invariable. An exacerbation of the fever due to the underlying cause may indicate (as in endocarditis) the onset of this complication.

Signs. The cardinal physical sign of pericarditis, like that of pleurisy, is a *friction sound*. As many cases of pericarditis are latent, and the early recognition of the disease is of great importance, this sign must be listened for in a routine manner in every case in which the disease is a possible complication. It is usually heard first at the base of the heart, probably on account of the reflection of the membrane around the great vessels being often first in-

volved; later it becomes more general. Sometimes, however, it is heard first, and most clearly at the apex. When occurring early it may be a single sound, systolic in time, but soon it attains the characteristic "to-and-fro" rhythm. The friction sound is not altogether synchronous with the heart sounds, indeed, when cardiac bruits are also present—and they often are—it may be very difficult to associate the exocardial sounds with any events of the cardiac cycle. And if the heart's impulse is not palpable it may be quite impossible. Pericardial friction is to be distinguished from the to-and-fro murmur of "double" aortic disease, and this is done by observing (1) the character of the exocardial sound—rougher and nearer to the stethoscope than aortic bruits, (2) that pressure of the instrument intensifies the pericardial but not the endocardial sound, (3) that there is much less "conduction" of the former sound than of the latter, (4) that the pericardial sound is much less constant in position and intensity than the valvular sound, and (5) that the vascular signs of aortic regurgitation (pulsating arteries and jerking pulse) are absent in pericarditis, unless, of course, the two conditions concur.

In some cases the friction can be clearly felt by the hand. When the friction sound passes away, either by resolution or by the advent of liquid effusion, it is usually heard last at the point at which it first appeared.

Diagnosis. In addition to the murmurs of aortic disease, *pleuro-pericardial friction* has often to be distinguished from pericardial friction. The most careful differentium is that the latter sound almost, or quite, disappears when the breath is held. *Cardiac bruits*, other than those of aortic disease, occasionally cause confusion, and the writer has known an exceptionally harsh hæmic murmur (present only in the recumbent position) mistaken in this way for pericardial friction. It should be remembered that pericardial friction is generally to-and-fro in character.

Course. (1) It is probable that a few cases, in which the exudate is slight, undergo complete resolution. (2) A much larger number, however, proceed to organization of the exudate, and terminate with local or general pericardial

adhesion, not necessarily handicapping the heart in any appreciable degree. (3) A smaller number go on to the stage of liquid effusion (*vide infra*). (4) A few become chronic, leading to progressive adhesive pericarditis (*vide infra*). The tuberculous cases, if not fatal during the acute stage, do this.

Treatment. (1) Absolute rest in bed. (2) Diet and general management of skin and bowels as for all acute inflammatory processes. (3) The local application of an ice-bag, or of iodox, or of leeches, or of small blisters. (4) The internal administration of salicylates (in rheumatic cases) with iodides, or of iodides alone in non-rheumatic cases. (5) A consideration of any specific measures towards combating the underlying infection or disease.

II.—Pericarditis with Liquid Effusion

This may follow I., or it may arise without the patient being suspected of any prior condition of inflammation of the pericardium. In other words, pericardial effusion is not seldom a latent disease, manifesting itself only after it has fully developed.

Symptoms. (1) *Pain* is often present and is not relieved with increase of the effusion. (2) *Dyspnœa* is very common and, in adults, progresses to *orthopnœa*, a striking symptom in some cases. (3) *Cyanosis* may attract attention. (4) *Fever* is usual, except in cases of hydro-pericardium, or when the underlying disease is of a very debilitating kind, such as chronic Bright's disease. (5) *Delirium, sleeplessness and restlessness* may be present, and these symptoms should suggest pericardial involvement in patients suffering from likely causes of this condition.

Inspection. In children with large effusions there may be "bulging" of the precordial region, but the sign is not common. In adults it is hardly ever seen, though it was apparently common formerly to see considerable enlargement of the left side of the chest due to large pericardial effusions. The most that is usually seen now-a-days is fullness of the costal interspaces.

The heart's apex-beat is often seen to be high, in the third or fourth interspace; it is not seldom invisible.

Palpation. The above position of the apex-beat is confirmed. The impulse becomes less and less as the fluid collects. *Fremitus* may be felt (just as the friction sound may be heard) some time after fluid collects; but eventually it, too, disappears. *Edema* of the chest wall is not uncommon.

Percussion. The normal area of cardiac dullness becomes much enlarged, and the shape of the enlarged area is triangular, with base below. Dullness to percussion in the fifth

right intercostal space is an important point to establish, because it very rarely occurs as a result of dilated heart. Whether the area of modified percussion tone described at the angle of the left scapula be due to the pericardial exudate or to collapsed left lung as the result of pressure is uncertain.

Auscultation. As mentioned above, the friction sound may still be heard if the amount of liquid exudate is not large. The heart sounds are weak ("distant"), and may be inaudible.

Pressure Signs. In addition to the cyanosis, local pressure signs may be seen: fullness of the veins of the neck and face, *œdema* of the left arm, cough and difficult swallowing.

The Pulse. Increased frequency, diminished volume and irregularity are the usual features. *Pulsus paradoxus*, the pulse wave diminishing in size or disappearing entirely during inspiration, is common, but by no means pathognomonic.

Diagnosis. This is especially from *dilated heart*. Cases occur in which the difficulty is extremely great. Of course the two diseases may concur, and not infrequently do. In a doubtful case the nature of the disease is probably dilated heart. The following are the most useful differential points:—(1) Shape of the dull area on percussion; in cardiac dilatation this is more square than triangular, owing to the distension of the right auricle and ventricle at the upper level of the dull area. As already remarked, dilated heart rarely gives dullness to percussion in the fifth right interspace. (2) Any trace of the friction sound makes, of course, for pericardial effusion. (3) In dilated heart the heart sounds are usually audible and are sharp and short in quality; in pericardial effusion, if the sounds are not absent they are muffled, without being short. (4) The apex-beat is rarely quite absent in dilatation of the heart, and the impulse, if palpable, is "wavy."

A large left-sided *pleural effusion* may cause difficulty, but only if the possibility of the alternative condition be lost sight of.

Course of the Disease. A large number of effusions clear up under treatment, leaving, no doubt, universal adhesion. In others the effusion goes on collecting, necessitating drainage (*vide infra*). In some cases, as stated, the condition is a terminal event in some chronic disease, especially nephritis.

Treatment. At first the measures undertaken are exactly the same as for a case of "dry" pericarditis. If, however, the effusion increases, giving rise to cyanosis, orthopnœa and pressure symptoms, the fluid must be removed either by paracentesis or by incision. *Paracentesis pericardii should never be performed unless the diagnosis from dilated heart has been clearly established.* If there is any doubt at all, or

if it be thought that both conditions concur, it is wiser to open the pericardium by means of a small incision. The point chosen for paracentesis is usually, for greatest safety, the left side, at the angle between the xiphoid cartilage and the costal cartilage, directing the needle backwards and upwards. The same spot is chosen for incision. If the exudate be pus, an incision is essential for drainage. T. J. H.

MYOCARDITIS

(Including myocardial degeneration and dilatation of the heart.)

General. Consideration will be here given to those important conditions of defect in the musculature of the heart arising apart from valvular disease. When valvular defects are present in a heart these are for a time compensated for by increase in size of the heart chambers and increase in thickness of the heart wall—a state of things designated by the term “compensation.” When compensation “fails” the correlative of this event, so far as the heart muscle goes, is a series of nutritional defects leading to dilatation of the chambers in excess of hypertrophy of the wall. These important defects are excluded from the present account and are dealt with under the section on valvular disease, in the course of which they occur as a natural sequence. We are here concerned with the more primary defects starting in the muscle itself, the endocardial structures remaining intact, or suffering, if at all, to a minor degree. The same remarks apply to the pericardium.

Types of Myocardial Disease. There are two main forms of primary myocardial disease, the acute and the chronic form. The histological changes underlying the acute form are parenchymatous degeneration, especially fatty degeneration, with or without cellular infiltration of the interstitial tissue. The histological changes underlying the chronic form are fatty degeneration and fatty overgrowth, with fibrosis of the interstitial tissue. In both forms dilatation of the chambers, with thinning of the wall of the heart, are consequent changes if death does not occur before such changes can take place.

Nomenclature. Acute myocardial degeneration is sometimes spoken of as “acute myocarditis,” and again as “acute dilatation of the heart”; similar names are sometimes given to chronic myocardial degeneration. Seeing that the term “myocarditis” does not necessarily connote changes of a strictly inflammatory kind, it may be used as a convenient word for the purposes of this account.

Acute Myocarditis (Acute Myocardial Degeneration; Acute Dilatation of the Heart)—

Causes. The poisons of the acute specific

fevers produce most of the cases of acute myocarditis, and the fevers specially prone to this effect are *acute rheumatism, diphtheria, septicæmia, typhoid fever, pneumonia and influenza*. Although the brunt of the rheumatic poison falls usually upon the endocardium, leading to acute endocarditis, especially of the mitral cusps, the myocardium is probably always affected to a minor degree, and in some cases to a major degree. It may be positively asserted that in the very severe cases of acute rheumatic heart trouble the myocardium suffers considerably; certainly the prognosis turns very largely upon the degree of myocardial intoxication. In those rheumatic cases in which the whole of the heart structures—endo-, myo- and peri-cardium—suffer from acute inflammation, the term “acute carditis” is not inappropriately given. In the other fevers above named it is particularly the heart muscle which suffers.

Symptoms. These vary somewhat with the cause, but a general account may cover all of them; any conspicuous points of difference will be incidentally referred to. Briefly, the cases fall into four groups.

1. The patient is extremely ill with his disease, and is so generally “poisoned” that it is impossible to apportion the degree of poisoning of his various tissues. The myocardial change is quite *latent*, and is only discovered at the autopsy.

2. The myocarditis is unsuspected until the patient *dies suddenly*. This event may transpire in the course of any of the above fevers, but is rather more characteristic of *diphtheria*, in which disease it may occur at a time when the patient is thought to be convalescing (see section on *Treatment*).

3. In the third group of cases *symptoms are present at the height of the causal disease as well as physical signs* which enable the physician to diagnose the disease and to treat it.

The clinical picture is familiar to all experienced observers. The patient lies low in bed, is restless, often quietly delirious and his face wears a dusky hue upon the malar prominences. Even if not delirious the mind is not clear, so that micturition and defæcation may be involuntary and a stuporous condition prevail. The hands are tremulous and the finger-nails are cyanosed. Vomiting may occur, and in some of the diphtheria cases this symptom, a grave omen, is one of the chief features of the serious complication. The pulse is usually frequent, soft and tends to be irregular in force as well as rhythm. The respirations are more frequent than the temperature warrants and are shallow; they may be rhythmical, or have a true Cheyne-Stokes periodicity. The patient is usually sleepless. It should be

observed that in typhoid fever acute myocarditis does not raise the pulse frequency as in other diseases. On examining the heart in a case of this kind, although sometimes the signs are quite inadequate to account for the severity of the condition, the following points may be made out. On inspection the heart's impulse is seen to be "wavy" and diffuse, occupying a larger area of the chest wall than in health, though little or not at all displaced. Palpation discovers the impulse to be lacking in force and confirms its diffuse character. Percussion detects little or no change, especially as the patient is too ill to admit of "deep" percussion. On auscultation the sounds of the heart are lacking in "tone," are apt to lose their proper spacing, approximating to the fetal type, and are sharper than normal, a fact more noticeable, of course, in the second sound. Reduplication of either sound is quite common. A soft systolic apex bruit is also frequently heard, and a murmur of similar time over the base of the heart is commoner still.

This complete picture may not, of course, be present, and yet it is by no means uncommon. It is often seen in patients suffering from septicaemia, of puerperal or other origin, or in highly "toxic" cases of typhoid fever. It is quite impossible at times to differentiate the effects of intoxication of the central nervous system from those of poisoning of the myocardium, but the fact is that, in autopsies upon patients dead of diseases in which such a picture as that just described has been observed, the chief pathological findings are often in the myocardium, and this fact warns us to attribute great importance to the state of the heart in such cases. The somewhat crude notion, therefore, that death in these patients is due to "heart failure," is probably in essence quite correct.

4. In the fourth group of cases there are symptoms, but these appear after apparent recovery from the causal disease. This is notoriously the case in *influenza*; partly accounted for, no doubt, by a special affinity of the influenzal toxin for the heart muscle, but partly by the fact that it is often extremely difficult to persuade many patients of the necessity for a continuation of the rest and treatment for a week, at least, after the fever is over. These patients resume their active life too soon, to find the secondary heart symptoms appearing in disappointing fashion. The picture is not, of course, either as acute or as grave as that already described. Shortness of breath, an unwonted lack of vigour, rapid tiring with effort and certain abnormal sensations referable to the precordium constitute the subjective side of the picture. On the objective side are frequent pulse-rate, low

pulse tension, loss of tone in the heart sounds and a sharp, slightly displaced impulse—the symptoms and signs, in fact, of slight acute dilatation of the heart.

Course and Prognosis. These are largely determined by the nature and course of the disease of which the heart condition is a complication. But all diseases thus complicated are unduly prolonged on account of the very complication itself, and it may be confidently asserted that the convalescence will, if established at all, be a tedious affair. Unfortunately the mortality is high in acute myocarditis, and sudden death can never be excluded as a possible event in the bad cases. More often death is preceded by oedema of the lungs and by coma. The significance of vomiting has been referred to already. Some of the cases only recover partially, being left with a "weak heart" for the rest of their lives, the condition being in all probability one of diffuse fibrosis with dilatation.

Treatment. This is of the utmost importance, for upon prompt supervision of the patient's treatment and upon expert nursing recovery depends in many cases. The recumbent position is, of course, a necessity, and every effort should be spared the patient. In the very grave cases the bed should be raised at the foot, not a few inches merely, but one and a half or two feet. Plenty of fresh air must be admitted to the sick room, and this may be supplemented by the occasional inhalation of oxygen, unless the effect of this is found to be restlessness or excitement. The diet is generally determined by the causal disease; but if it is not it must consist of highly nutritious articles in small bulk, omitting all easily fermenting foods. It is desirable to limit the amount of fluid put into the stomach, but to supplement this by saline infusions per rectum, thus keeping the total fluids of the body at a bulk likely to preserve a good blood pressure. If the case be very acute and severe, the intravenous route should be chosen for the saline infusions. It goes without saying that all that can be is being done to assist elimination of the causal toxic agent. Stimulants are definitely indicated and there is nothing capable of replacing alcohol in its power of controlling this form of myocardial failure. In some cases champagne, in others liqueur brandy, answers best; it is always advisable to vary the form of alcohol chosen after a few days. As regards amount, the individual case must decide this point, but in the writer's opinion acute heart cases are too often under-stimulated, and chronic heart cases are too often over-stimulated. An adult suffering from a very severe form of acute myocarditis will often improve upon six to eight ounces of brandy in the twenty-four hours when a smaller

quantity seems ineffectual. Common-sense will dictate the wisdom of "saving" some of the stimulant as soon as the patient seems to have gained a small margin of heart strength. Other volatile stimulants that are useful, though much less so than brandy, are ether, tincture of musk and camphor. French and Italian physicians use the last-named very freely in these and allied cases. Strychnine is definitely indicated in nearly all cases, and is probably the best adjuvant of brandy. It should always be given hypodermically, say $\frac{1}{60}$ gr. every two, four, or six hours, according to the severity of the case. If the pulse tension be very low (it is always low) the strychnine may be given with small doses of suprarenal extract, five minims of a 1 in 1000 solution. As an alternative pituitary (infundibular) extract may be used hypodermically, in doses recommended by the manufacturers of the particular specimen selected. The effect of this preparation is sometimes quite remarkable, but tolerance seems rather quickly established.

Mention has been purposely made of several different types of cardiac tonics, because it is of importance that the practitioner should not attempt to rely too much upon any one of these. The drugs of the digitalis group do not give nearly such good results in these cases as in those of chronic dilatation of the heart, though many practitioners use them. There is, however, no contra-indication to their trial; the best form of administration is probably a preparation of the total alkaloids given hypodermically. Local applications to the precordium may be tried, of the counter-irritant form, such as a small mustard leaf for fifteen to twenty minutes. Venesection is contra-indicated.

As already said, convalescence, if the patient recovers, is tedious and prolonged. But no good comes of trying to hurry it. Sooner or later, however, much benefit follows gentle vibratory massage of the precordial area, and, later, carefully graduated passive movements. The masseur, in his haste to get results, usually requires to be cautioned against too vigorous or too prolonged treatment in the early days.

In cases of the fourth group, chiefly seen in *influenza*, where the patient has thought himself well when his heart has not actually returned to its normal state, no half measures are of much avail. Certainly all such cases should be put back to bed to begin with, whilst careful observations are made and the effect of passive and active effort carefully noted.

Reference has been made to the occurrence of sudden death during the first days of convalescence from *diphtheria*. Any defect observed in the heart or pulse during, or after,

this disease, should make the physician insist upon absolute recumbence for a fortnight. And even if no such defect be present the recumbent posture should, as a safeguard, be encouraged for a week following defervescence.

Chronic Myocarditis (Chronic Myocardial Degeneration ; Chronic Dilatation of the Heart)—

Causes. These are much more variable than in the acute form of the disease, since several other factors besides infective processes enter into the production of the cases that come under observation. *Infective processes* are, indeed, not a very common cause of chronic myocarditis, and, apart from *influenza*, are not of great practical importance. Group 4 of the cases discussed under "acute myocarditis" forms a connecting link between the acute and the chronic disease, many cases of "influenzal heart" developing into chronic dilatation. *Strain*, both physical and mental, constitutes a potent causal factor. *Syphilis* is a proved cause, and *alcohol*, assisted doubtless by "luxus consumption," must also be included. Two associated pathological conditions must be referred to as frequent causes of chronic myocardial degeneration: *arterio-sclerosis* and *granular kidney*. Finally, there is the condition of myocardial malnutrition, eventually resulting in degeneration of muscles and dilatation of the heart chambers, seen in the "failure of compensation" consequent upon valvular disease.

Symptoms and Signs. These are best dealt with by reference to certain types of cases. The following types recur with sufficient frequency to deserve mention—

1. *The Anginal Type.* Sclerosis of the coronary arteries appears to be the most constant underlying lesion in angina pectoris, with localised nutritional defects, and ultimate fibrosis of parts of the cardiac muscle. The patient suffers from anginal attacks (see *Angina Pectoris*).

2. *The Renal Type.* Symptoms referable to granular kidney are present (polyuria, slight albuminuria, chronic uræmic symptoms), and the hypertrophied heart sooner or later shows signs of dilatation.

3. *The Arterio-Sclerotic Type* resembles the last very closely, but the evidences of renal inadequacy may be absent, the notable features being a high blood pressure, thickened arteries, pareses of various kinds, hæmorrhages from one or more sets of degenerate vessels, and signs of hypertrophy and dilatation of the heart.

4. *The Senile Type.* The heart may be small, there may be a low rather than a high blood pressure, and the condition is often asthenic rather than sthenic. Pseudo-anginal symptoms may occur and sudden death is

not uncommon. Bradycardia is a not uncommon feature.

5. *The Type of Failing Compensation in Valvular Disease.* This is dealt with fully in the article on valvular disease.

6. Excluding the above types, there remains a set of cases in which the condition of myocardial degeneration seems to have arisen as a primary condition. The two pathological lesions are *fibrosis* and *fatty degeneration and infiltration*, and the general examination of the patient gives a fair clue to the lesion likely to be present; both lesions may be present together. The following remarks will have reference to these cases.

Signs and Symptoms. The signs of chronic dilatation of the heart are exactly those described under the second stage of valvular disease (*q.v.*). But the evidence that the condition follows mechanical valvular defects is absent. Quite often the symptoms are out of proportion to the signs, and it may require considerable experience to decide whether the practitioner is dealing with a degenerative state of the cardiac muscle or with a mere defect in cardiac innervation. Briefly summarized the *symptoms* are as follows—

Dyspnoea on exertion; precordial distress; inability to rest in completely recumbent position; palpitation; pain referable to precordium and radiating as in angina; syncopal attacks; slight cyanosis, with feeble peripheral circulation. If the condition proceeds to venous stasis the picture of "failing compensation" is seen, with oedema of feet and legs, orthopnoea, scanty urine and general congestion of viscera.

Treatment. The treatment of myocardial degeneration in its chronic form follows in the main the principles laid down under the second stage of valvular disease (*q.v.*). But certain points are of special importance. The response to passive movements, and to properly arranged baths of the Nauheim type, is often extremely good. A general revision of the patient's routine of life is essential, and if this be done he need by no means always be condemned to invalidism. Treatment by drugs is not so definitely indicated as in the cases of dilatation due to valvular defects; great differences, however, occur in individual cases. T. J. H.

ACUTE ENDOCARDITIS

Acute inflammation of the endocardium occurs in two forms—as a *simple* inflammation, resulting in the production of one or more rows of minute "vegetations," with swelling and congestion of the underlying membrane, and as an *ulcerating* process, associated with the presence of infecting micro-organisms. Al-

though it is true that no rigid line of demarcation exists between these two forms of the disease, the distinction is amply justified by the differences in symptoms, course and prognosis in the two sets of cases. In both forms the inflammation affects chiefly, though by no means entirely, the endocardium of the valves of the heart.

I.—Acute Simple Endocarditis

Causes. This is in the great majority of cases a part of some more general disease, of which *acute rheumatism* is the commonest. As the proof of endocarditis is often uncertain, it is impossible to do more than estimate the proportion of cases of rheumatic fever in which endocarditis occurs. According to some authorities it occurs in every case; it probably occurs in at least half of the cases. Its onset is usually about the end of the first week, or rather, its first detection is about this time. It occurs quite commonly in *scarlet fever*. Less often it is seen with, or after, *acute sore throat* (*e.g.* tonsillitis), *pneumonia*, and perhaps all other *acute specific fevers*. From the greater incidence of these causes in children and in adolescents, acute endocarditis is mainly a disease of these periods of life. In the rheumatic cases it tends to recur.

Symptoms and Signs. The condition is insidious in its origin, and is often quite latent. As already mentioned, its recognition is difficult, and quite often a matter of assumption from a combination of certain events. (1) A rise in the temperature, after this has fallen entirely or in part as the result of salicylate treatment in rheumatic fever and there is no exacerbation of the arthritis. (2) Palpitation, with irregular and frequent pulse. (3) Dyspnoea. (4) The presence of a cardiac bruit, not previously heard. This bruit is systolic and most often heard in the "mitral area" (*i.e.* at or near the apex-beat), because the commonest site of acute endocarditis is the mitral valve. It cannot be distinguished from the systolic bruit of acute myocarditis, and on this account it must be admitted that there are no pathognomic signs of acute endocarditis. Indeed, acute myocarditis and acute endocarditis often coexist and yield, not only the same physical signs, but also the same symptoms. Pain is not a feature of acute endocarditis. *In actual practice it is safest to assume that acute endocarditis exists in every case of rheumatic fever in which the fever persists after subsidence of the arthritis, unless there be some other definite cause for the elevated temperature.* If the bruit be diastolic in time the diagnosis is placed beyond doubt, inasmuch as this means an affection of the aortic cusps.

Course. It is probable that in a few cases

the acute inflammation completely resolves, leaving a natural endocardium. (But if complete restoration of the heart sounds occurs, it may be that the lesion has really been a myo- and not an endo-carditis.) More often the resolution is incomplete, leading to a sclerosis of the endocardium and the establishment of one or other of the forms of valvular disease. In a very few cases the inflammation proceeds to ulceration, with the changes occurring in "malignant endocarditis"; these cases have been termed "malignant rheumatism."

Treatment. Although no treatment of a very specific kind is at present available, it is a matter of such great importance to endeavour to control the process and to avoid or minimize future valvular defects, that every effort should be employed to this end.

The patient is kept in the recumbent position for at least a month after the fever has subsided. This time should be made much longer (even up to three or four months) if fever, irregular heart's action or undue pulse-frequency indicate it. And when the patient is allowed out of bed his movements must be carefully graduated.

Blisters may be employed over the precordium.

Salicylates are used by some authorities, and in large doses, together with alkalis by others. But the action of these drugs is by most found to be very disappointing. Iodides are perhaps more useful, and may be given in full doses over a lengthy period.

Antistreptococcus serum sometimes has an excellent effect, especially in the prolonged or in the recurring cases. It is best given in 10 c.c. doses subcutaneously, once a day for a week.

II.—Ulcerating, Infective or Malignant Endocarditis

The relations between this form of endocarditis and rheumatic affections are still close, though by no means as close as in simple endocarditis. In the majority of cases there has been previous acute rheumatism, it may have been many years previously, leading to valvular disease. In a much smaller number there is a direct transition from simple to ulcerating endocarditis. In some cases, forming a larger group than the last, there has been no true rheumatism at any time; here the diseases concerned are (in order of frequency) scarlet fever, pneumonia, gonorrhœa, influenza, Graves' disease and malaria. The disease may complicate congenital heart disease and "athlete's heart."

For convenience of description all the recognized forms of malignant or ulcerating endocarditis will be dealt with in this account, although one form, and by no means an un-

common one, runs a chronic rather than an acute course, and may last many months.

Of the valves affected, the mitral and aortic together come first in frequency, the mitral alone next, then the aortic alone, then the tricuspid, and lastly the pulmonary. Affection of the endocardium of the chambers of the heart (neural endocarditis) is by no means uncommon, and it may occur without any involvement of the valve area at all. Such a condition adds difficulty to the diagnosis, the physical signs of valvular disease being absent.

Micro-Organisms Concerned in the Disease.

Contrary to the experience of most observers in rheumatic fever, in which disease micro-organisms have not yet been isolated from the blood or inflammatory exudates, carefully planned blood-cultures in infective endocarditis usually yield a growth of some organism of definite pathogenicity. Positive blood-cultures are obtained sooner or later in the course of the disease in about ninety per cent. of the cases. In the technique of the culture the following points must be observed:—(1) Sufficient blood must be taken, not less than 5 c.c.; (2) the blood must be taken direct from a vein, to avoid air or skin contamination; (3) the blood must be at once transferred to a series of broth tubes, mixing the blood and broth in different proportions; (4) as soon as possible the tubes should be incubated at a temperature of 37.5° C; (5) the absence of visible growth in forty-eight hours must not be taken as final; tubes which now appear sterile should be well rolled and re-incubated, thus giving a minute and slowly growing colony encouragement to show itself.

Positive blood-cultures in the disease demonstrate that infective endocarditis is pre-eminently a form of *streptococcal* disease. If the *pneumococcus* be regarded as belonging to the genus *streptococcus*, the percentage of cases due to this microbe rises to seventy-seven. Pfeiffer's bacillus (*B. influenza*) comes next in frequency, then the *gonococcus*, then *staphylococcus aureus* and occasionally such organisms as *B. coli*, *B. typhosus*, etc.

The characters of the streptococci found in malignant endocarditis deserve special mention. These streptococci are not identical with the highly pathogenic streptococcus of suppurative processes (*S. pyogenes*), but one or other of two types of streptococci closely allied to the "saprophytic" cocci of the alimentary canal (*S. salivarius* and *S. faecalis*). This fact harmonizes with certain broad clinical pathological principles connected with the disease, and serves to explain them—the chronicity and latency of some of the cases; the scanty leucocytosis often seen; the afebrile periods that may occur; the absence of suppuration in the embolic

infarcts; the absence of any visible source of infection; and the enormous number of living micro-organisms that may be present in the blood stream without causing grave symptoms.

Forms of the Disease. There are three main forms of the disease, according as its course is *acute*, *subacute* and *chronic*. In addition, the disease may be fulminating or completely latent; both these forms are of less importance, inasmuch as their existence is only to be determined post-mortem.

1. *Acute.* The onset is abrupt, often with a rigor, and the symptoms are those of an acute specific fever. Arthritis, as in rheumatic fever, is common. The pneumococcal cases are nearly always acute, no crisis coming, however, but the patient remaining very ill after the tenth day. The gonococcus may be the causal agent. The duration of the cases varies from one to four weeks, and no doubt a very few recover.

2. *Subacute.* The commonest form. The onset is often insidious and takes one or other of these forms:—Cardiac symptoms (dyspnoea, palpitation, precordial distress, oedema, etc.); general weakness and loss of flesh with pains in extremities; the symptoms of subacute rheumatism; fever, unexplained by physical signs. The duration is from two to six months. The causal microbes are streptococci (salivary and fecal types), the influenza bacillus and occasionally the pneumococcus.

3. *Chronic.* Though less common, this form of the disease is of great importance. Its recognition is a matter of recent study. The onset is very insidious; indeed, it is often quite impossible to say when the disease began in any case. Often an extraordinary sanguineness of temper, a striking feature in the patients, prevents them from drawing the attention of their medical man to what they regard as quite trivial symptoms. The pre-existing heart lesion may be quite slight, though its presence is usually known in patients of the private class. A slowly progressive loss of flesh, anaemia, some irregular fever and sweating, vague pains in the limbs or joints or fingers or toes—one or more of these may be the initial symptoms. The first event to draw attention to the real state of affairs is often embolism.

Signs. The signs of infective endocarditis are three:—(1) The signs of valvular disease, (2) the occurrence of embolism and (3) the discovery of micro-organisms in the blood stream. If these three signs concur in any case, the diagnosis of ulcerating endocarditis may confidently be made.

1. *The Presence of Valvular Disease.* In most cases well-marked signs are present at the onset, and have been present for some time previously. In some cases these signs appear

during the progress of the disease. In a very few they may not appear at all.

2. *The Occurrence of Emboli.* It is doubtful if any case runs its whole course without embolism appearing somewhere. The effects of embolism are—infarction, aneurysm, hæmorrhage and inflammation, with or without suppuration. The situations of the emboli vary much; the most important, and their effects, are as follows:—*The spleen*, causing enlargement, tenderness, pain. *The kidney*, causing hæmaturia and albuminuria. Minute quantities of blood must be searched for microscopically. Intermittent albuminuria in a case of valvular disease should always suggest renal infarction. *The skin*, causing *petechiæ*. Purpura is sometimes an early sign of the disease. The significance of even a few pimple spots, say about the neck, is very grave in valvular disease. *The brain*, causing hemiplegia and, less often, monoplegia. Cerebral hæmorrhage may also occur, and not infrequently as a terminal event. *The retina*, causing hæmorrhage. *The limbs*, causing aneurysm, or arterial obstruction. *The heart*, causing sudden death.

Symptoms. In addition to the initial symptoms already mentioned, and those due to embolism, there are, during the course of the disease, certain others calling for consideration—

The Fever. The commonest type is an irregular remitting form. Less often seen is the quotidian intermittent type. Less often still is the high-continued or typhoid form. A few cases are afebrile; here the patient is usually suffering from some debilitating condition, such as cirrhosis of the liver or chronic nephritis.

The Leucocytosis. This usually varies between 10,000 and 15,000.

Loss of flesh is a constant symptom, as also is more or less *anaemia*.

Modes of Termination. (1) *Recovery.* A rare event, yet one occasionally seen. (2) *Death.* This is, in order of frequency, by circulatory failure, by coma, by sudden death, by uræmia and by hyperpyrexia.

Diagnosis. The *acute* cases have sometimes to be distinguished from the following diseases—

1. *Pneumonia.* The resemblance may be very close indeed, for when pneumococcus endocarditis occurs it often accompanies or follows pneumonia. A positive blood-culture does not prove endocarditis, but petechiæ and the plugging of arteries in a case giving the signs of valvular disease would justify the diagnosis being made.

2. *Typhoid Fever.* The agglutination test, especially in conjunction with a leucocyte count, will usually decide the difficulty; a positive Widal test with a leucopœnia may be regarded as decisive in favour of typhoid fever.

3. *Rheumatic Fever.* Recurring attacks of

acute or subacute rheumatism in patients who have valvular disease often give rise to considerable anxiety on account of the similarity which they bear to the symptoms of endocardial infections. The absence of a positive blood-culture on repeated trials gives a high presumption in favour of the simple as against the ulcerating form of endocarditis.

4. *Malaria*. Many of the cases showing high intermitting fever with sweats, are erroneously regarded as of this nature. The absence of the malarial parasite in blood films and the absence of a leucopenia are valuable differential observations.

5. *General Tuberculosis*. Here there is usually a low leucocyte count, valvular disease is not present, nor are emboli, and the blood stream is sterile to ordinary media.

The *chronic* cases have to be distinguished from—

1. *Prolonged attacks of Subacute Rheumatism* (*vide supra*).

2. *Tuberculosis*. This is seen to be a difficulty from the fact that some of the cases of chronic infective endocarditis find their way into consumption sanatoria. Absence of tubercle bacilli in the sputum, if this be present, and a combination of two or more of the cardinal signs of an infected endocardium should settle the difficulty.

Prognosis. This is always extremely grave. The chronic cases probably never recover; the acute and subacute cases only rarely. Periods of real improvement may follow certain events in the course of the disease, or certain lines of treatment, but the fatal issue is thereby only delayed. Not only the natural course of the disease has to be feared, there are the accidents resulting from embolism and hæmorrhage to consider. And disaster from these last-named events not seldom comes when all seems going well.

Treatment. Certain *preventive* measures follow from the above consideration of the infecting organisms usually present in the disease. The teeth and gums should be carefully attended to in all patients with valvular disease, and the state of the bowels must not be overlooked. The general resistance against streptococcal infection should be kept at as high a level as possible by various non-specific measures—fresh air, good food, absence of fatigue, etc.

The *curative* measures include a more rigid attention to these non-specific points, and an attempt at *specific therapy*. Chemical antidotes have been so thoroughly tried in these cases, and with such signal lack of success, that it seems almost waste of time to try them again—quinine, mercury, arsenic, carbolic acid, formalin and the sulphocarbolates. Silver salts in com-

bination with nuclein are not, in the experience of the writer, of any greater service than the older "remedies." These remarks include subcutaneous and intravenous routes for the drugs as well as the oral route.

Of the true *specific measures*, *anti-sera* may be given a thorough trial, and *vaccines* must certainly be used, as yielding the most hopeful results up to date. The writer combines these two methods, and considers that the employment of a "sensitized vaccine" is the most hopeful measure of all. The dosage of vaccine is still a matter of empirical observation in these cases. Probably the best method is to use small doses of vaccine (two to five millions) at intervals of three or four days, observing the effects very carefully. The opsonic index does not, in the writer's experience, assist in the choice of size or frequency of the dose. Often the index rises to a high level when the patient's condition is getting worse, and vice versa.

Certain palliative measures are indicated as complications arise, and the tone of the heart must be maintained by the customary means (see appropriate articles) during the time that efforts are being made to check the septicæmic process.

T. J. H.

HYPERTROPHY OF THE HEART

Cardiac Hypertrophy is an increase in the weight of the musculature of the heart, and occurs as the result of extra work, if and when the extra work is accompanied by an adequate blood supply to the myocardium.

Hypertrophy is a conservative change which increases the reserve power of the heart.

The most important change which takes place in the heart muscle is the increase in the size of the individual fibres of the myocardium; it is questionable whether there is any actual increase in their number.

Marked hypertrophy is sooner or later accompanied by degenerative changes in the muscle fibres, and also by a varying degree of proliferation of the connective tissue lying between the hypertrophied muscle cells. The actual power of a hypertrophied heart depends on the relative amounts of genuine musculature and fibrous connective tissue. The more extensive the connective tissue in proportion to the amount of hypertrophied muscle fibre, the weaker is the heart. When any increased work is put upon the heart, the first effect is distension or dilatation of the cavities, which accordingly accommodate a larger amount of blood to be dealt with by the heart. The load of the heart is increased and hypertrophy results. Hypertrophy is therefore never primary. It is always preceded by distension and occurs first in that

chamber of the heart upon which the stress falls.

The causes of hypertrophy may be classified under the following three headings (Adami)—

1. Obstruction to the egress of the blood.
2. Increase in the volume of blood to be propelled.
3. Increase in the rate of blood flow.

Arterio-sclerosis, chronic interstitial nephritis, stenosis of the valves and pericardial adhesions are the more common pathological conditions obstructing the outflow of blood. An increase in the volume of blood may result when there is regurgitation through the mitral or aortic orifices, and also in those patients who make a habit of consuming a large amount of fluid. Hypertrophy of the right ventricle follows on stenosis of the mitral orifice, and also on any disease of the lungs causing obstruction to the pulmonary circulation, such as emphysema or pulmonary cirrhosis. Adherent pericardium is also a cause of marked hypertrophy of the right ventricle.

Prolonged tachycardia from any cause, excessive muscular exertion and pregnancy are associated with hypertrophy.

Symptoms in most instances are due rather to the associated and causal conditions than to the hypertrophy itself.

It is the exception to find a patient conscious of the beating of his hypertrophied heart unless there is associated dilatation. There is sometimes a feeling of discomfort about the precordium, and these patients frequently complain that they cannot lie on the left side without distress. Headaches are occasionally troublesome.

Physical Signs. In hypertrophy of the left ventricle the deep cardiac dullness is chiefly increased downwards. A large, forcible, heaving apex-beat is one of the most valuable signs of such hypertrophy, and may be visible and palpable in the sixth, seventh, and even eighth intercostal space well outside the mid-clavicular line. In children there is often bulging of the precordium, mainly to the left of the middle line. The first sound is usually dull, low-toned and prolonged. It is not infrequently reduplicated, and is generally followed by an accentuated second sound. At the aortic area the second sound is accentuated. Hypertrophy of the right ventricle is characterized by a diffuse apex-beat well inside the outer limit of the deep cardiac dullness, and there is often definite systolic retraction of the intercostal spaces situated between the left margin of the sternum and the apex-beat. Substernal heaving and bulging is also corroborative evidence. The deep cardiac dullness in patients with marked hypertrophy of the right side of the heart is more circular in shape and extends farther to

the right than that found in hypertrophy of the left ventricle.

Diagnosis. As a rule diagnosis presents no difficulties. Careful percussion of the deep cardiac dullness reveals the size and shape of the heart, and the information thus obtained, considered in relation to the other physical signs, allows of a precise opinion.

Chronic contracting disease of the pleura or lungs may displace and uncover the heart, and give rise to an apparent increase in the force and area of the cardiac impulse, or the area of precordial dullness may be enlarged owing to pericarditis, mediastinal tumours and aneurysm.

It is much more difficult to speak with certainty in cases of marked emphysema, when the apex-beat is impalpable and invisible, the sounds are muffled, and the area of cardiac dullness difficult to demonstrate. Even here the quality of the second sound at the aortic area, the presence or absence of arterial hypertension, and the extent of the cardiac dullness will probably enable a correct opinion to be formed.

Treatment. Hypertrophy is to be welcomed as a satisfactory response on the part of the heart, and does not require direct treatment; but it must be remembered that it is followed sooner or later by degeneration. When possible, therefore, the causal factor should be modified in order to diminish the need for further hypertrophy.

There should be two objects in the treatment of hypertrophy. First, to maintain the nutrition of the heart by means of a healthy blood supply. Secondly, to prevent any excessive frequency by which the diastole is shortened and the resting time of the heart diminished.

Anæmia and dyspepsia require careful attention. It is important to remove all strain upon the circulation when it is possible to do so. If there is any undue tension, careful dieting and the use of salines, the iodides and the vasodilators may prove of considerable service. With the first signs of pathological dilatation, rest must be insisted on and adequate treatment prescribed (see *Cardiac Insufficiency*).

The hypertrophied heart is liable to be seriously damaged by any excessive strain, physical, mental or emotional, and these should be avoided, otherwise compensation may fail and it may be impossible to restore the equilibrium of the heart.

Prognosis. It is not possible to speak positively concerning the prognosis in patients with hypertrophied hearts. There is obviously a limit to the degree of hypertrophy possible in any heart, and this limit depends upon the amount of nutrition which can be supplied to the myocardium through the coronaries. If these are diseased, or partially obliterated, the

nutrition of the myocardium, and consequently the extent to which it can be hypertrophied, is limited.

If a moderate degree of hypertrophy is sufficient to meet the stress and supply a reasonable reserve power, and if the causal factor is not progressive, the prognosis is good. On the other hand, when the hypertrophy results from a serious irremediable and progressive lesion, the prognosis is correspondingly bad.

The outlook depends on the heart being able to maintain a moderate reserve power, and for this, good nourishing food is essential in order that the general nutrition should not be impaired. When the limit of the nutritive possibilities of the coronaries is reached, dilatation complicates the hypertrophy, compensation fails, and the condition of the patient becomes precarious. Any febrile complaint is liable to weaken the myocardium. Influenza, rheumatism and diphtheria are especially to be dreaded, and adequate rest must be insisted on during the convalescence from these infections.

J. H.

CARDIAC INSUFFICIENCY AND DILATATION

The heart stands out as an organ endowed with an exceptionally large reserve power capable of working far in excess of its ordinary duties without discomfort to its owner or damage to its musculature.

When from any cause this reserve power is diminished the deficiency is first noticed only during severe exercise. As the reserve becomes more and more limited less effort is required to bring about symptoms of distress, until finally a stage is reached when turning in bed may be more than enough to cause acute dyspnoea.

It is important to recognize clinically two varieties of cardiac failure: (1) where the contracting power of the myocardium—the function of contractility—is primarily at fault; (2) where the tone of the myocardium is defective.

Impaired contractility gives rise to cardiac failure without dilatation, while in failure of tonicity dilatation is the characteristic feature. One must always attempt to form an estimate as to the degree and extent to which these two functions are depressed in any given case.

The following are the more common conditions giving rise to exhaustion of contractility, and thus to cardiac insufficiency—

Diminution of the resting time of the heart as the result of increased frequency of the heart's action, increased work due to high blood pressure, arterio-sclerosis, valvular defects, defective nutrition of the myocardium as the result of disease of the coronary arteries or impoverished blood, myocardial degeneration,

and the onset of an auricular fibrillation or disorderly rhythm.

Each of these causes acts either by increasing the difficulties of the heart or by diminishing its nutrition. In such a case, on examination the heart is not necessarily found to be dilated; it may be enlarged as the result of high arterial tension or valvular defect, or from some other cause, but there are none of the ordinary signs and associated conditions of dilatation.

Although there is no evidence of dilatation, the distress of the patient is marked, and the signs of cardiac insufficiency are patent, viz. shortness of breath, sense of oppression over the precordium, pain precordial in site or extending into both neck and arms, extreme restlessness and starting from sleep, and pallor is sometimes marked.

The heart's action is frequent, and it may be perceptible to the patient; the blood pressure is usually well maintained, and it is sometimes found that the pulse takes on an alternating character. This form of pulse is frequently observed in the earlier stages of failure of contractility, and is an ominous characteristic.

If the onset of auricular fibrillation is the actual cause of the cardiac insufficiency, the patient will be aware of the increased frequency and the fluttering and irregular action of the heart. Cheyne Stokes's respiration or paroxysmal attacks of dyspnoea are frequently observed in these patients. Death may ensue without any indication of dilatation; on the other hand, dilatation may supervene and modify the whole clinical picture—the distress may then be lessened, but the patient tends to become waterlogged.

As a clinical contrast to the above group we have cardiac insufficiency due to depression of tonicity. In such cases the fibres of the cardiac muscle elongate and the heart dilates. Of especial importance is the stretching and weakening of the muscle fibres around the auricular-ventricular orifices, with the consequent valvular incompetency.

The heart becomes larger and more globular; the apex beat is more diffuse; it is weak and well within the left limit of the cardiac dullness. The heart sounds are either very faint or short and sharp. Murmurs become audible. The pulmonary circulation is embarrassed, there is congestion of the lungs giving rise to hæmoptysis, and hydrothorax may develop. A troublesome cough is generally present, and in many cases there is bronchitis.

With dilatation of the right heart and free tricuspid regurgitation, the systemic circulation is seriously involved. We then find venous engorgement, defective oxygenation of the blood, cyanosis, distension of the liver with accompanying tenderness of the overlying

abdominal wall, stasis in the kidneys and deficiency of urine, and œdema first of the legs and later more widely spread.

As in other forms of cardiac failure, there is dyspnoea and referred pains, tenderness on pressure over the precordium and of the sterno-mastoid and trapezius in severe cases. The defective oxygenation of the blood may cause a rise in blood pressure.

Among the numerous causes of cardiac failure, one of the most frequent and important is the presence of completely irregular action of the heart, the disorderly rhythm due to auricular fibrillation. This may occur in hearts either handicapped by valvular disease, or in those whose musculature is degenerated and fibroid.

The power of the heart is at once seriously diminished by this abnormal rhythm, and the patient is generally conscious of a very marked increase in his difficulties. If the myocardium is fairly healthy the distress will be moderate, but if the degenerative changes in the heart muscle are advanced before the onset of the auricular fibrillation, the added handicap of its presence may prove more than the heart can stand; its development is often in fact the first pronounced step towards a fatal termination.

Treatment. It is of considerable importance to begin treatment whenever indications of lessening of the reserve power of the heart manifest themselves. Shortness of breath, a sense of oppression, and palpitation on performing some action which up till then had never caused discomfort, such as walking upstairs, are probably the most common. Pain about the heart or in the left arm, during or subsequent to exertion, also a sense of exhaustion either general, or chiefly in the legs, are all valuable warnings that the heart is beginning to lose ground, and is in need of immediate treatment.

The work of the heart must be diminished, and this can best be attained by rest in bed. Rest and warmth are two essentials. If the cardiac insufficiency is slight, continuous rest in bed is hardly necessary, though it is valuable at the beginning of a course of treatment to have your patient in bed for a few days and under observation. The heart has then an opportunity to settle down, and it is possible to form a much better opinion as to the correct line of treatment to pursue.

Careful and detailed instructions must always be given as to the nature and the amount of exercise. Exercise is of value in moderation, but no sudden undue strain is to be put on the heart. The patient must recognize that the slightest shortness of breath, palpitation or pain, indicate cardiac stress and the necessity for rest, or at least diminution in the amount of work done.

In patients with arterio-cardio-sclerosis and raised blood pressure the work of the heart can be diminished by any treatment which lowers the arterial tension, such as careful dieting, diminution of the total quantity of the food, and cutting out of extractives of all kinds. In addition flesh meat should be indulged in sparingly and should be boiled rather than roasted.

Dieting and mercurial purges followed by a morning saline are more satisfactory in the regulation of the blood pressure than the use of the more evanescent nitrites.

The preparations of iodine are certainly of service, and if there is any reason to suspect syphilis treatment with the iodides and mercury should be given a fair trial.

In all patients where the heart is failing, diet is of considerable importance. The digestion is at fault and must not be overtaxed. As a rule, the food should be as dry as possible and easily digested. This is especially important if there is much œdema. Sometimes these patients do well with a milk diet or a modified Salisbury diet. As compensation improves, the digestive powers increase. The teeth should be carefully attended to, as it is most important that the food should be well masticated. Whatever food is presented to the patient should be as appetising as possible.

More active interference is required when the circulation is greatly embarrassed. If the turgescence of the veins is noticeable, the right heart labouring, and other signs of cardiac distress present, venesection is valuable; ten to thirty ounces, or even more, should be drawn off from one of the veins in the arm. At the same time a dry diet and free purgation are advisable. The value of venesection is much lessened if the patient continues to receive large quantities of milk, water and other fluids. Depletion through the bowels is of primary importance in supplementing the effect of the venesection.

Mercury is a most valuable drug in the treatment of cardiac failure, administered either as calomel or blue pill. The most remarkable results from the use of digitalis occur in those cases of chronic valvular disease where auricular fibrillation is present. Digitalis should then be given in large doses and independently of the presence or absence of dropsy; and it should be pushed until the physiological limit is reached.

When dropsy of the cardiac type is present in any form of heart mischief digitalis is obviously indicated. Dilatation of the heart is an indication for the exhibition of digitalis. Vomiting occurring while the patient is taking digitalis is due to two causes: (1) local irritation, the stomach resenting the nauseous drug; (2) genuine toxic vomiting.

In the first case the drug should be stopped for twenty-four hours and then resumed—this is often enough to allay the sickness, or give the dose of digitalis well diluted in half a tumblerful of water, or combined with large doses of bismuth. Another method is to inject digitalin or Cloetta's digalen (a soluble digitoxin) hypodermically.

When the vomiting is toxic the digitalis must be stopped, free purgation started, and any severe œdema relieved by tapping and incisions.

Digitalis should be given in doses of ten to fifteen minims every four or six hours to begin with, and this can be increased if necessary. For a more rapid effect the hypodermic injection of digalen or digitalin may be used.

The combination of digitalis, squills and blue pill is most valuable, but should not be used continuously in patients suffering from cardiac failure supervening on chronic nephritis.

In the cardio-arterio-sclerotic patient with hypertension when digitalis is prescribed it should be combined with the iodides, or a vasodilator such as erythrol tetranitrate should be given in quarter or half-grain doses. When for any reason digitalis is contra-indicated, strophanthus is a good substitute; it is less irritating to the stomach, and does not contract the coronary or the peripheral vessels to the same degree as digitalis.

Insomnia is a serious feature in any case of heart failure, and every effort must be made to remedy it. Loss of sleep is inevitably followed by nervous irritability and general exhaustion.

The bedroom should be quiet and freely ventilated and pain or cough alleviated. If these means fail, some direct sedative must be employed; these are numerous. Ammonium bromide in ten to twenty grains thrice daily may prove sufficient; when it fails, then ten to fifteen grains of chloral, or the liquor bromo-chloral compositus of the *British Pharmacopœia* can be used.

Chloral is especially helpful in the distressing nocturnal dyspnoea of patients with hypertension, whose hearts are failing but not dilating.

Paraldehyde in one or two drachm doses is best prescribed either as an emulsion or in capsules. Twenty grains of trional or five grains of veronal may be tried. If in spite of these hypnotics the insomnia persists, morphia must be employed.

There are certain symptoms which require to be mentioned. Pain if severe, especially when anginal in character, is satisfactorily relieved only by opiates; at first, nepenthe or the official tincture in doses of five or ten drops should be given, and the amount increased as is found necessary. When the blood pressure is high a vasodilator such as erythrol tetranitrate in

one-quarter to one-grain doses or sodium nitrite in one to five grains every four hours may diminish the intensity of the pain.

When dyspnoea is severe it is important to exclude hydrothorax, for fluid in the chest seriously increases the difficulty of breathing, and relief is often obtained by paracentesis.

Dyspnoea generally diminishes as the heart responds to rest and digitalis.

For the sudden startings from sleep followed by distressing gasping for breath, strychnine is a valuable drug, given late in the evening in full doses. It stimulates the respiratory centre and the breathing is deeper and quickened under its influence, there is then much less liability to the slight asphyxia which causes the starting dreams of these patients. As previously mentioned, chloral and opium readily diminish the sensations of dyspnoea.

When the œdema is excessive and resists treatment by purgatives, diuretics and a diet dry and salt free, it is necessary to puncture the dependent limbs and scrotum, and wrap them in sterilized dressings to drain. The skin should be carefully cleaned and the punctures made with a sharp bistoury or a large Hagedorn or bayonet-shaped needle. Instead of puncturing Southey's tubes may be inserted.

When the œdema has diminished as the outcome of this line of treatment, digitalis appears to recover its powers and free diuresis occasionally sets in with rapid disappearance of the dropsy. If digitalis fails and the œdema persists it is wise to prescribe in addition one of the theobromine preparations such as agurin in ten-grain or theocin sodium acetate in four- or five-grain doses thrice daily.

Many patients with cardiac failure are much worried at night by a distressing cough; a large mustard and linseed poultice over the base of the lungs generally affords some relief. Warm drinks are also helpful, and a linctus containing heroin one-twelfth grain in one drachm of syrup of Virginian prune will diminish the severity of the cough.

It is the exception for hæmoptysis to prove serious, though it may unduly alarm the patient. A dose of calomel and an extra dose of heroin or morphia is all that is required.

Palpitation is often a troublesome symptom (see *Functional Disorders of the Heart*, p. 180). When due to auricular fibrillation it disappears as the heart steadies under the influence of digitalis. Flatulence is sometimes the exciting cause, and then the diet may require regulating, and any constipation correcting. A useful carminative in such cases is the following—

R	Menthol gr. iv	} āā ā ss.
	Spiritus Chloroformi	
	Spiritus Ammonia Aromatici	

Of this mixture half to one teaspoonful is to be taken in water when flatulence is present.

Convalescence. Recovery from a condition of serious cardiac failure is facilitated by properly regulated exercises. As soon as the patient is able to sit up in bed with comfort passive movements should be instituted; these are followed by contraction of antagonistic muscles, and finally, each movement as it is carried out by the patient is gently resisted by the doctor or an attendant. Before advising passive movement, a course of gentle massage is often useful.

No patient should be allowed up until he has undergone a short course of such exercises. In carrying out such a course it is important that the movements and exercises should never be persisted in when they are followed by the slightest fatigue or cause the patient either to hold his breath or breathe more frequently.

The severity of the exercises should be gradually increased, and they should always be followed by a short period of absolute rest.

Constitutional treatment is important. When anæmia is present the administration of iron is essential.

A useful combination is—

R Ferri et Ammonii Citratis gr. x
Tincturæ Nucis Vomicae ℥ vii
Liquoris Arsenicalis ℥ ii
Aquæ Chloroformi ad 3 ss.

In some cases the arsenic can be increased with advantage. The bipalatinoid form of Blaud's pill is a good alternative. In children a course of cod-liver oil and malt extract, or the syrup of phosphate of iron form an excellent tonic.

J. H.

DISEASES OF THE VALVES OF THE HEART

Valvular disease of the heart is either acute or chronic. Acute endocarditis is in every case the result of an infection by some micro-organism. It is always secondary, though in some cases it is not possible to demonstrate the primary cause.

All grades are met with, between the simple or acute endocarditis and the malignant or ulcerative type. The former is most commonly secondary to acute rheumatism, less frequently it is associated with chorea, tonsillitis, or the specific fevers.

In some cases the acute process subsides and is followed by progressive fibrosis, with consequent shrinking and deformity of the valves. Thus we have initiated the common variety of chronic valvular disease—the other form is the degenerative or fibroid, associated with arteriosclerosis and atheroma.

Malignant or Ulcerative Endocarditis is a local

manifestation of disease, complicating a general infection—streptococci, staphylococci and pneumococci are the bacilli most commonly associated with this condition—more rarely gonococci and other organisms.

The *symptoms* in some patients are so slight that the condition may be considered “latent.”

Usually they are those of a generalized blood infection, irregular pyrexia, sweats, anæmia with indications of cardiac involvement, mitral or aortic bruits, and signs of embolism involving the skin, kidneys, brain, extremities, lungs, etc. The signs in the heart may be very slight.

Four clinical types are described.

1. The typhoid—the most common—characterized by a typhoid state: abdominal symptoms; distension, diarrhœa, melæna, enlargement of the spleen; rashes—papular, petechial and erythematous; and emboli which may suppurate.

2. Septicæmic—usually associated with some external wound, or acute necrosis, characterized by rigors, sweats, intermittent fever, large spleen, and numerous emboli. The right side of the heart is often involved.

3. Cerebral—simulating basilar or cerebro-spinal meningitis.

4. Cardiac type—usually supervenes on chronic sclerosing endocarditis. These patients sometimes recover.

Simple, or acute endocarditis usually arises during the course of rheumatic fever or other infection; often there are no general symptoms accompanying the onset. There may be a rise of temperature, increased frequency of pulse and dyspnœa, with palpitation.

Murmurs locate the disease, but, in the course of a fever, do not necessarily mean endocarditis, but may result from relaxation of the auriculo-ventricular orifices. An obstructive mitral or aortic regurgitant murmur appearing during pyrexial attacks indicates endocarditis. The earlier a mitral systolic murmur appears during acute rheumatism, the more likely is it to be due to endocarditis. The earliest evidence of endocarditis is prolongation or muffling of the first sound.

The *diagnosis* of malignant endocarditis rests on the presence of definite signs of involvement of the heart, embolism, septic or otherwise, pyrexia, leucocytosis and, finally, the demonstration of the infecting organism in the blood.

It must be differentiated from (1) typhoid fever, (2) septic conditions, (3) acute tuberculosis, (4) cerebro-spinal meningitis, (5) simple endocarditis, also typhus, smallpox and malaria.

The *treatment* for simple acute endocarditis is that of the associated condition, as, for example, a vaccine of the diplococcus of rheumatism, or the salicylates in the rheumatic

cases, combined with prolonged rest for the heart, small blisters applied repeatedly to the precordium, and, later, the internal administration of sodium iodide.

The *treatment* of malignant endocarditis is that of septicæmia, absolute rest, ice to the precordium, and such drugs as opium and quinine, etc. In some cases vaccine treatment is said to have proved beneficial.

Chronic Valvular Disease—Chronic Sclerosing Endocarditis affects both mitral and aortic valves, and frequently both orifices are involved in the same patient. This type of lesion is met with in young subjects. The *degenerative type* chiefly attacks the aortic valves, and is usually associated with degenerative changes in the first part of the aorta.

A degenerative sclerosis of the mitral cusps is also met with, but less frequently. It is met with in patients who suffer from arteriosclerosis and those who are subject to gout, syphilis or atheroma.

Mitral Regurgitation is most frequently combined with mitral stenosis, and is then almost invariably rheumatic in origin. The physical signs indicating mitral stenosis may precede those of mitral regurgitation by years.

Mitral regurgitation is indicated by signs of enlargement of the left ventricle, a murmur, systolic in time, loudest over the apex beat, conducted into the axilla and audible at the angle of the scapula.

The murmur may modify or replace the first sound; rarely an apical thrill is present.

Precordial bulging indicates great enlargement of the heart, a severe lesion, or an attack of endocarditis in early life.

In **Mitral Stenosis** the right ventricle is definitely enlarged, giving rise to substernal heaving and a diffuse apex beat. A presystolic thrill can be felt just over and within the apex beat, and this often precedes the appearance of the presystolic murmur. The thrill runs up to a forcible slapping apical impulse, and the typical rumbling or rough crescendo presystolic bruit ends in a sharp loud slapping first sound. The second sound at the apex is commonly reduplicated, and a soft blowing diastolic murmur may fill up the diastolic pause.

The pulmonary second sound is usually accentuated, and frequently reduplicated. In disease of the mitral orifice the pulse may be little altered; in severe stenosis the volume is often diminished, there are occasionally attacks of great frequency, and fibrillation of the auricles, with complete irregularity in the action of the heart, is not uncommon; this may arise at any stage of the disease, and is a common cause of failure of compensation in these patients.

The stress of a mitral lesion falls on the lungs

and right ventricle, and accordingly dyspnoea and palpitation on exertion are early symptoms, bronchitis is common, and hæmoptysis may occur. The flushed ruddy cheeks give a fictitious appearance of health.

Aortic Incompetence.—There is considerable enlargement of the left ventricle, and it is both hypertrophied and dilated. The apex beat is forcible and diffuse; sometimes a diastolic thrill can be felt over the sternum.

The murmur, diastolic in time, is best heard at the right edge of the sternum about the level of the third space, and is conducted towards the xiphisternum or apex beat, soft and gushing, loud, blowing or musical.

In a few cases a gurgling presystolic murmur can be distinguished—Flint's bruit.

In the *rheumatic type* the patient is young and the mitral orifice has been probably involved alone—the aorta remaining sound. Dyspnoea, pallor and epistaxis are characteristic. Pain is frequent but not so severe as in the degenerative type. The pulse is typically collapsing, the artery is healthy, and capillary pulsation can be demonstrated.

Cardiac hypertrophy may be excessive.

The *degenerative type* is found in the old or middle-aged, and any associated mitral regurgitation is usually secondary. The aorta is diseased and dilated, and the peripheral vessels are generally tortuous and thickened.

The first *symptoms* come on insidiously, and are giddiness, dyspnoea on exertion, insomnia and pain; this may be very severe and anginal in character.

The pulse is less characteristic, especially if there is some stenosis of the aortic orifice in addition to the incompetency. Occasionally there is only slight hypertrophy and the bruit is faint—these are sometimes very serious cases.

Marked pallor is the rule and syncopal attacks are common. The degenerative cases are liable to mental symptoms, secondary to sclerosis of the cerebral arteries.

Angina pectoris and syncope are two common modes of death.

Aortic Stenosis, from the very nature of the lesion, is often complicated by slight leakage through the valve. When due to rheumatism, the cusps are puckered and deformed; when of the degenerative type, the aorta is simultaneously diseased.

The *symptoms*, which may be long delayed, are vertigo, some shortness of breath, and vague precordial pain; the heart is hypertrophied, mainly the left ventricle. Emphysema sometimes masks this enlargement. A systolic thrill may be felt over the base of the heart and in the neck; a harsh vibrant systolic murmur is audible over the aortic area and

conducted into the large vessels. This murmur may, however, be soft and blowing.

The aortic second sound is usually much less intense than normal, and may even be absent, but in some cases with degeneration of the aorta the sound is markedly accentuated; later, secondary mitral regurgitation supervenes.

The pulse is infrequent, small and slow, and the artery can be felt between the beats.

Tricuspid Regurgitation is one of the commonest of all valvular affections.

It results from (1) endocarditis or degeneration of the cusps—this form is rare—or (2) from muscular weakness associated with dilatation of the right ventricle.

Emphysema, fibroid changes in the lungs, and mitral incompetence and stenosis are usually responsible for this dilatation of the auriculo-ventricular ring.

The right ventricle is dilated, there is epigastric pulsation and the cardiac dullness is increased to the right; the apex beat is diffuse; a soft systolic murmur is frequently heard at the left border of the lower end of the sternum, which is conducted to the right or in all directions.

The veins in the neck fill with each systole, and the liver may pulsate.

Tricuspid Stenosis is a rare condition—it is usually acquired, and is nearly always secondary to mitral stenosis. Its existence is often masked by the mitral lesion. There is great increase in cardiac dullness to the right, the veins in the neck are turgid, it is exceptional to find a presystolic thrill and murmur over the tricuspid area, and a graphic record of the pulsating liver shows that the systole of the right auricle distends that organ.

Lesions of the pulmonary valves are noticed in the section dealing with congenital heart disease.

Treatment. In the management of a patient suffering from chronic valvular disease—

1. Consider the individual rather than the lesion;

2. Do not interfere with the heart when the lesion is well compensated;

3. Interfere at once at the first indication of failure of compensation.

The condition of the heart muscle is dependent on the quality of its blood supply, and in all cases of chronic valvular disease special attention should be paid to remedying any tendency to anæmia, and improving the hæmoglobin content of the blood.

Exercise is essential if the reserve power of the heart is to be adequately maintained. The amount and nature of the exercise must be carefully indicated.

No sudden stress should be thrown on the heart.

Exercise must be moderate, regulated and well within the powers of the patient, it should be obtained in the open air when possible.

High altitudes are to be avoided, especially by those with the degenerative type of lesion.

In young patients with valvular disease it is necessary to guard against all exacerbations of rheumatism.

Tonsillitis, growing-pains, erythematous rashes, and choreic movements should all be carefully treated without delay and the condition of the heart watched.

These children should be warmly clothed and their bowels kept regularly open.

In older patients the blood pressure must be noted and modified when necessary; this end is best attained by diminishing the diet, cutting out the extractives, and by mercury and salines, with iodides, and rarely vasodilators.

A history of syphilitic infection justifies a course of antisyphilitic treatment.

Those who suffer from mitral disease are liable to bronchitis; they must not expose themselves to keen wind or fog, and the first indication of this complication should be vigorously treated. Digitalis and squills are specially useful in this form of bronchitis.

Hæmoptysis in these patients requires only rest and a saline purge; if the infarction cause pain, opium is indicated. In aortic regurgitation of the rheumatic type rest is of more importance than in any other form of valvular affection, even when the heart is compensated periods of complete rest should be insisted on.

J. H.

FUNCTIONAL DISORDERS OF THE HEART

Palpitation is a condition in which the patient is conscious of the beating of the heart; it is primarily a sensory phenomenon. Usually the rate of the heart is increased during an attack; the action is in most instances forcible, and may be irregular.

There are all grades of severity, from a mere sensation of fluttering under the precordium, to a violent and tumultuous throbbing and hammering of the heart against the chest wall, during which the patient is in acute distress and in fear of impending death. Severe palpitation is usually followed by a sense of exhaustion and weariness. It is not uncommon for the patient to pass large quantities of pale urine after an attack.

Patients suffering from valvular disease are more liable to palpitation than healthy individuals, but even the latter, if they take tea, coffee or alcohol to excess, or smoke immoderately, are liable to be affected. Dyspepsia is another common exciting cause.

Palpitation is more frequent in women than

in men, especially at the age of puberty and at the climacteric. It is a common symptom in hysteria and neurasthenia; probably these patients are over-sensitive to the ordinary stimuli passing up from the heart.

Treatment depends upon the etiology in each case. Where palpitation is due to toxins they must be eliminated; dyspepsia must be treated; and hysterical, neurasthenic and anæmic conditions should receive appropriate measures. Iron, arsenic, bromides, and occasionally small doses of digitalis are useful.

Arrhythmia.—The most common form of cardiac irregularity is the extra systole. The normal rhythm is interrupted by a premature beat which is the response of the heart to a stimulus arising in some portion of the cardiac musculature other than the normal site.

On feeling the pulse one notices either that a beat is missed (intermittent action) or that a small pulse wave is appreciated by the finger before the normal pulse is due. These premature beats may be regular or irregular in their appearance. They occur in the young and healthy, or in those who suffer from valvular disease, and they may be one of the first indications of cardio-sclerosis.

Dyspepsia, worries, nervous debility, toxins such as tobacco, may all in turn induce this form of arrhythmia. In many instances the patients are quite unaware of their existence. Sometimes, though conscious of them, they regard them with indifference. Occasionally, however, they cause great mental distress and perturbation. When occurring in a patient over middle age, a careful examination should be carried out to determine the presence or absence of arterio-cardio-sclerosis.

Treatment must be based on the etiology and on the general condition of the patient. Reflex causes such as dyspepsia, flatulence, constipation, should meet with appropriate treatment. It may be necessary to prohibit tea, coffee and tobacco. The fears of the patient should be allayed and a cheerful prognosis given.

There are two forms of irregular action which must be carefully differentiated from the extra systole: an intermittent pulse due to incomplete heart block and the alternating pulse. When the conducting power of the bundle of His is depressed, the ventricle fails to receive its normal stimulus regularly from the auricle, and accordingly a ventricular beat occasionally drops out. On listening over the heart when this occurs, there is a silence at the time of the irregularity in the place of the odd tumbling sounds audible with an extra systole. Digitalis, by depressing the conducting power of the bundle of His, may cause an intermittent pulse of this kind.

The alternating pulse, or "pulsus alternans," is one in which the rhythm is regular in time,

but where the beats alternate in size; at times the smaller beat is imperceptible to the finger. This is due to a failure of the contracting power of the ventricle and generally indicates a grave condition of the heart. It is most often met with in advanced cardio-sclerosis.

Paroxysmal Tachycardia.—Mackenzie restricts this term to an "increased frequency of the heart's action due to the temporary inception of an abnormal rhythm." The paroxysms of idiopathic paroxysmal tachycardia must be differentiated from attacks of frequent heart action in which the rhythm of the heart is normal.

The paroxysms come on suddenly, generally without warning, and the cardiac frequency may reach 250 or even more beats per minute. Their duration varies from a few minutes or less to several days. At first there may be little discomfort—nothing more than slight palpitation—and sooner or later in an attack of some duration the heart dilates, the veins in the neck are filled and pulsate violently, the liver is engorged, and there is pain in the abdominal wall overlying the liver, with other indications of cardiac failure. The paroxysm frequently terminates suddenly, or the heart may slow down gradually and pass through a stage of irregularity. The abnormal stimuli may originate either in the ventricle or in the auricle.

There is no adequate *treatment* for paroxysmal tachycardia, but when there is distress, and if the attacks are known to be of some duration, the patient should remain in bed. Friction of the chest wall and pressure on the vagus are said to have done good; but the paroxysms appear to begin and to end independently of outside interference, either mechanical or medicinal. When cardiac failure and dilatation manifest themselves, they must receive appropriate treatment (see *Cardiac Insufficiency*).

Transient attacks of frequent heart action are sometimes due to periods of auricular fibrillation—the frequency in these attacks is generally from 120 to 160 per minute, rarely more. When such is the nature of the tachycardia, digitalis should be given in full doses.

Bradycardia.—Abnormally slow action of the heart. The most marked cases of this kind are those in which the bradycardia is due to complete heart-block (see *Stokes Adams' Disease*). When a pulse remains persistently at or below thirty per minute, this syndrome should be suspected.

In some patients an infrequent pulse of fifty or thereabouts is normal. It is an idiosyncrasy of which there is no explanation. In convalescence from acute disease it is not infrequent to find a remarkably slow pulse, fortunately it has no untoward significance.

Arterial hypertension is a cause of diminution in pulse-rate, and a slow pulse is not uncommon

in patients with advanced arterio-sclerosis. Tobacco and the toxins of influenza, uræmia, jaundice and diphtheria slow the heart. With the exception of heart-block, the bradycardia has been, in each of the conditions already mentioned, that of a slowing of the whole heart, auricles and ventricles. Two other conditions must be referred to where the slowing is of a different character. For example, in a patient suffering from auricular fibrillation, a very slow pulse-rate may result from the administration of digitalis. This bradycardia is frequently characterized by coupled beats, the smaller of the two being ineffectual. The presence of numerous extra systoles which fail to send a pulse wave to the wrist also causes an apparent bradycardia.

Treatment. Bradycardia due to arterio-sclerosis, hypertension and gout, must be treated on the general lines suggested for those conditions. Alcohol, tea and tobacco must be prohibited if there is reasonable ground for suspecting them. Eliminative treatment is indicated in uræmia, and strychnine hypodermically in the serious bradycardia of diphtheria.

The bradycardia of convalescence need cause no anxiety. A coupled rhythm and a pulse-rate at or below fifty per minute in a case of auricular fibrillation is an indication that digitalis should either be stopped or the dose diminished.

J. H.

CONGENITAL HEART DISEASE

A child suffering from congenital heart disease is usually underdeveloped and cyanosed, its fingers and toes are clubbed, and it is liable to bronchitis. The cardiac dullness is frequently increased in extent, especially to the right. Murmurs are not uncommonly present. These are, as a rule, systolic in time and heard with greatest intensity over the base of the heart; in some instances they are accompanied by palpable thrills. Such signs occurring in a child under five years of age point definitely to a congenital lesion.

It must be remembered that a small number of patients with congenital heart mischief do not present the above group of symptoms.

It is rare for patients suffering from patent ductus arteriosus to manifest any cyanosis or clubbing of the fingers. There is, however, a typical bruit and thrill over the base of the heart, most marked in the second left intercostal space. The murmur is humming, almost continuous, most intense during systole, and passing on into diastole. The pulmonary second sound is sharp and intensified and apparently independent of the bruit. In contrast the pulmonary second sound in pulmonary stenosis is muffled or inaudible, and is preceded by a coarse rough systolic bruit and an easily perceptible thrill.

This bruit is superficial in character, rough and vibrant, and most audible towards the sternal end of the second intercostal space.

The following points may prove of service in the *diagnosis* of congenital heart disease in children under five.

(1) Loud harsh bruits with little increase in the size of the heart, or (2) cardiac murmurs associated with signs of an enlarged right heart, such as increased cardiac dullness and feeble apex beat, indicate congenital mischief.

(2) The existence of murmurs over the auricles or pulmonary orifice, with absence of any murmurs at the apex of the heart, suggests septal defects or pulmonary stenosis.

(3) Absence of thrill when loud murmurs can be heard all over the precordium points to a congenital septal defect.

The *prognosis* in congenital heart disease depends little on the intensity of the murmurs, but rather on the presence of cyanosis, the extent of the hypertrophy, the tardiness in general development of the child, and most particularly upon the degree of limitation of the reserve power of the heart.

Treatment. The child should be kept warm and well fed, special attention being paid to early indications of bronchitis, and if there is dilatation or failing compensation, then digitalis and other cardiac tonics must be employed.

J. H.

DISEASES OF THE ARTERIES

Acute Arteritis.—Primary acute arteritis is seen as a complication of the acute infections, especially typhoid fever, also in smallpox, scarlet fever, influenza, pneumonia, rheumatic fever, gonorrhœa, diphtheria, yellow fever, typhus and measles. Secondary arteritis occurs when a vessel is implicated in a neighbouring abscess or septic focus, or from an infected embolus in malignant endocarditis or pyæmia.

A local mesaortitis or mesarteritis as the result of syphilis, pneumonia, rheumatic fever and septicæmia is the most frequent; it causes a weakening of the wall of the artery, and according to the extent of the disease a local aneurysmal dilatation or a general dilatation of the vessel may ensue.

Symptoms. These are pain in the course of the vessel; over the site there is swelling and redness; below, the pulse is obliterated or lessened, and the limb, pale and cold at first, gradually becomes livid. Gangrene may quickly set in or a collateral circulation be established in a few days. The process may extend to the other limb.

Chronic Arteritis—

Etiology. 1. The wear and tear of life.

2. The acute infections. Syphilis is by far the most important. The other acute infections that offer danger to the arterial system are scarlet fever, measles, diphtheria, smallpox, influenza, typhoid fever and tuberculosis.

3. Intoxications. Of exogenous poisons alcohol, lead and tobacco are the chief. Of endogenous poisons those in gout, diabetes, Bright's disease and obesity promote arterio-sclerosis.

4. *Raised Blood Pressure.* Clinically there is no doubt that hypertension precedes the onset of arterio-sclerosis in many cases. The normal maximum blood pressure when at rest is about 125 mm. of mercury for persons below thirty-five; from this age onwards the blood pressure usually rises. A blood pressure of 160 mm. or more, except in the aged, should be regarded as abnormal. The causes of high blood pressure are—

(a) The persistent use of the muscles over prolonged periods to an extent sufficient to cause hypertrophy of the heart. (b) Excess of food and drink. (c) Endogenous poisons. (d) Renal disease.

Symptoms. Though there may be an extreme grade of arterio-sclerosis in certain areas no symptoms may be manifest to the patient, who may be able to perform his ordinary duties until suddenly some vascular accident, such as bursting of a cerebral vessel, thrombosis of a coronary artery, rupture of an aneurism or acute dilatation of the heart, causes death.

Arterio-sclerosis disturbs function in three chief ways—

1. There is a lessening in the amount of blood supplied to an organ unless the blood pressure rises concurrently with the narrowing of the vascular path. Slow progressive atrophy with gradual loss of function affects all areas supplied by a sclerotic vessel.

2. When the artery is finally obliterated, especially if this occur suddenly, necrosis and gangrene of the part occurs; hence the gangrene of the foot seen especially in the arterio-sclerosis of diabetes.

3. The muscle of an artery attacked by the sclerotic process is irritable and liable to spasm; there is a sudden loss of blood to the part, with pain, loss of arterial pulse and loss of function. The attacks are exactly comparable to those in Raynaud's disease, in which there is no structural change in the vessel. Seen in one of the superficial vessels, such as a digital artery, the finger becomes pale or, if the blood supply is not absolutely cut off, blue; there is pain, numbness and loss of movement. The part may return gradually to its normal state or gangrene of the peripheral portion may come on. These vascular crises, as they are termed, are the cause of the transient mono- or hemi-

plegias, aphasia, transient blindness, anginal attacks, and probably also lead colic and the crises of tabes.

General Arterio-Sclerosis.—Three types of cases are met with: (a) middle-aged men of forty or thereabouts who have led a life of great energy and have perhaps eaten much and drunk hard. Such a person does not complain of any symptoms, in fact he may pride himself on his fitness. But in an examination, as for life assurance, the apex beat may be a little out, the impulse forcible, the second sound accentuated, the palpable arteries thickened, the blood pressure 150 or over, and the urine shows traces of albumin and tube casts may be present. (b) In some persons the previous stage is absent and the disease is manifest by general local anæmia, the face and hands become pale, the bodily and mental vigour suffer gradual progressive impairment, the peripheral arteries harden and the appearance of age is marked; there is "a general flavour of mild decay, but nothing local." (c) The onset of arterio-sclerosis in younger persons is made evident by symptoms of neurasthenia, irritability, sleeplessness and emotion.

Local Symptoms. Cerebral. These are headache, continuous or paroxysmal, like migraine; vertigo, seldom as severe as in Ménière's disease, often brought on by stooping or sudden movement; transient monoplegia, hemiplegia, paraplegia or aphasia, the attacks often spread over a considerable number of years, and recovery after each may be complete or with slight impairment of function; epileptiform convulsions, either alone or ushering in a transient attack of hemiplegia, and progressive dementia may be seen.

Cardiac symptoms include: valvular insufficiency, from the sclerotic process affecting the valves; myocardial weakness, as shown by progressive dilatation, shortness of breath, palpitation, paroxysms of dyspnoea and slight swelling of the feet. Coronary sclerosis produces the picture of angina pectoris.

Renal. The urine is increased and has a low specific gravity, a small amount of albumin that sometimes disappears, hyaline casts and occasionally red cells. One form of arterio-sclerosis of the kidney shows little difference in the urine. With cardiac changes the state of the urine is masked.

Abdominal. To spasm of the mesenteric vessels are attributed the attacks of pain or meteorismus sometimes seen in arterio-sclerosis.

Peripheral Arteries. Local cramp of the muscles may follow some sudden effort. It is chiefly found in old persons with palpable arterio-sclerosis of the arteries of the legs. The attacks may be extremely severe. In intermittent

claudication the patient finds that pain in the legs and feet comes on after walking a short distance, rest relieves after a time, but on resuming walking the pain again comes on; the dorsal arteries of the feet are thickened and usually show absent or deficient pulsation. Numbness, tingling, burning and shooting pains are common complaints in endarteritis obliterans of the leg-vessels. These neuritic symptoms may precede the onset of local gangrene.

Diagnosis. Neither grey hair nor the presence of the arcus senilis can be taken as evidence of arterio-sclerosis. The most important signs are: thickening of the vessels, hypertrophy of the left ventricle, increase of blood pressure and a slight amount of albumin in the urine. The arteries later become tortuous. Early thickening can best be detected in the retinal arteries.

Treatment. The process cannot be cured, but its progress can be delayed. A peaceful life unattended by mental worry or physical strain is the best. Moderate exercise is advantageous, but all strain should be avoided. Warm baths or Turkish baths are helpful. The food should be reduced and meaty foods almost banished; the diet should consist chiefly of milk and milk products with fruit and vegetables. Spirits, wine and beer are harmful. Potassium iodide in syphilitic cases should be pushed, but in senile arterio-sclerosis it is best given in three-grain doses before bedtime, as the excretion is then slowest. It must be taken continuously. Against a high blood pressure the nitrates may be used, though the high pressure, being a compensatory phenomenon, should not be lowered unless there is a risk of arterial rupture. These and amyl-nitrite may be used for the vascular crises.

W. O.
A. G. G.

ANEURYSM

An **aneurysm** is a tumour containing fluid or solid blood in direct communication with the cavity of the heart or a blood-vessel. A *true aneurysm* is one in which the walls are formed by one or more coats of the vessel, a *false aneurysm* is a direct communication with the perivascular tissues. An *arterio-venous aneurysm* is a communication between an artery and a vein. True aneurysm may be localized, diffuse or affecting a whole arterial tree (cirroid aneurysm). In *dissecting aneurysm* the media splits and allows blood to penetrate between the coats.

Etiology. (1) Weakening of the coats of the artery by infections, pre-eminently syphilis; (2) arterial degeneration; (3) embolism; (4) external injury, and (5) strain, hence its frequency in men doing arduous labour.

Dissecting Aneurysm—

1. **Rupture of the Aorta** may be traumatic or spontaneous. Death may be immediate, but two stages may often be distinguished: first the agonizing thoracic pain and collapse of the initial rupture through the intima and part of the media, and secondly the complete rupture with death, which may take place some days later. Complete healing of a fracture of the inner coats may occur.

2. **Dissecting Aneurysm.**—The blood, entering through a breach in the intima, tracks along the course of the vessel between the layers of its walls, finally rupturing either into the vessel or through the adventitia. The symptoms are the same as in rupture of the aorta. This form of aneurysm may heal completely.

Saccular Aneurysm of the Aorta.

1. **Aneurysm of the Arch.**—The symptoms are often latent, and patients may die suddenly with rupture into a neighbouring cavity such as the pericardium. Clinically it is well to remember Broadbent's subdivision into the aneurysm of symptoms and that of physical signs. The onset of the disease is often marked by a severe bout of pain of any type, often following a strain, the pain subsiding later. The nausea and vomiting sometimes seen are caused by irritation of the vagus. Pressure on the sympathetic at the root of the neck may cause irritative or depressive symptoms, *e.g.* if irritated the pupil is larger, the palpebral fissure wider, the skin of the face paler and moister than on the opposite side; if compression blocks the impulses there is a small pupil, a narrow palpebral fissure, and flushing on a dry skin. In addition the pupil on the side of the aneurysm may be larger by reason of the lower blood pressure in the carotid artery of that side. Pressure on the recurrent laryngeal nerve is nearly always on the left side, and the abductor fibres are first affected; there may be no dyspnoea or aphonia; later the inner margin of the cord, previously straight, becomes excavated, and the voice becomes husky.

Compression of the trachea and bronchi produces cough, which is dry and irritative or "brassy" if the tubes are narrowed. There may be great stridor and dyspnoea. Compression of the bronchus on one side diminishes the respiratory murmur on that side, and the lung gradually becomes airless and fibrotic, recurrent hæmorrhages being seen sometimes in the process. Bronchiectasis, with all its accompaniments, is more frequent. The tumour may compress the lung and grow into its substance and occasionally bleed; or it may compress the œsophagus and produce dysphagia, therefore avoid passing an œsophageal sound. Of blood-vessels, the superior vena cava, the

innominate or the subclavian veins are those usually compressed, more rarely the pulmonary artery and thoracic duct.

Physical Signs. Inspection is extremely important and should be done with the patient stripped in a oblique light. Look carefully from several points for evidence of pulsation, especially in the second and third spaces, right and left, on the manubrium, above the sternal notch and in the interscapular and infrascapular region. The true aneurysmal expansile pulsation is only seen when the sac reaches the chest wall. The non-aneurysmal pulsations it is well to bear in mind are: the general thoracic shock with a violently beating heart, cardiac pulsations transmitted to neighbouring abnormal solid or liquid masses, and pulsating subclavians. Palpation over an aneurysm is like feeling the apex beat; when the aneurysm is deep a general heave replaces the expansile pulsation and can often best be felt by placing one hand in front and the other behind the chest. Tracheal tugging and a difference between the pulsations in arteries on opposite sides of the body should be sought for. Percussion may give no dullness. Sometimes no sound is heard, sometimes the normal heart sounds are accentuated, especially the second; a to-and-fro murmur is only heard in insufficiency of the aortic valves. A humming-top murmur means a communication between the aneurysm and one of the larger blood-chambers, heart or vessel. There may be a marked difference in the blood pressure of the two arms, but the height of the blood pressure affords no indication of aneurysm. The heart is not invariably enlarged, but it may be dislocated by pressure of the sac. After a careful and complete examination by the routine methods, evidence of pressure on bones, lungs, bronchi, trachea, œsophagus, blood-vessels and nerves should be sought for by all methods available. The X-rays afford considerable help in differentiating aneurysm from tumours, dynamic dilatation, hypertrophy of the heart, etc. An aneurysm filled with clot may fail to show any expansive pulsation.

2. **Aneurysm of the Descending Thoracic Aorta** may reach a great size, is often latent, and is apt to grow backwards and erode the vertebrae or ribs, or to encroach upon the lungs. Nerve root symptoms, with herpes zoster and hyperæsthesia, are seen. The pain may simulate angina or be continuous and excruciating, needing enormous doses of morphia. Rupture may occur into the œsophagus or pleura.

3. **Aneurysm of the Abdominal Aorta** is oftenest seen at or near the celiac axis; it is most commonly of the saccular form. Rupture may take place into the retroperitoneal tissues, peritoneal cavity, pleural cavity, mediastinum

and pericardium, or into one of the hollow viscera. Rupture into the retroperitoneal tissues causes the symptoms of the "acute abdomen." The tumour may compress the lower end of the œsophagus, pylorus, ureter or vena cava. Usually there is severe pain, referred to the abdomen flanks or back, according to the site of the tumour; all grades of severity are met with. Nausea and vomiting, hæmatemeses or dysphagia, may suggest disease of the alimentary canal. Embolism and thrombosis of the branches of the aorta cause the symptoms associated with their special fields.

Prognosis and Treatment. The outlook is exceedingly grave. The subjects of syphilis should receive thorough treatment and should, if possible, be kept under supervision for several years. The Wassermann reaction enables treatment to be controlled with greater precision. When the aneurysm is there and its syphilitic origin has been established, vigorous anti-syphilitic treatment should be pursued. Salvarsan should not be given. Potassium iodide should be given. For the cure of the aneurysm itself the most important are (1) rest, (2) diminution of the intake of fluid. This, the Tufnell treatment, should be continued for six weeks, the patient being in bed. Fluid should be gradually diminished to eight ounces, the diet being otherwise light and nourishing, limited gradually to ten ounces of solid food. This method requires considerable fortitude on the part of the patient, but often gives remarkable results.

The surgical methods should not be recommended unless other methods are not available or have been tried.

Of symptomatic treatment, rest may relieve cough and dyspnœa. Bleeding may help dyspnœa when there is venous obstruction. Morphia or chloroform is necessary if the patient is suffering much pain. Temporary relief may be given by tracheotomy, even though the constriction is below; a soft catheter should be passed beyond the constriction if possible. Neuralgic pains are often relieved by potassium iodide. With severe pain morphia is necessary, and the dose should be kept at the minimum.

W. O.

A. G. G.

THROMBOSIS

Definition: "The formation of a solid mass or plug in the living heart or vessels from constituents of the blood" (Welch).

The distinction between a thrombus and an embolus is, of course, that a thrombus is formed in situ, whereas an embolus is carried to its site from a distance.

Factors in the Production of Thrombi.—These are as follows—

1. *Slowing of the Circulation.* This is seen in the anatomical disposition of thrombi, which are prone to select parts where the velocity of the blood flow is least.

2. *Changes in the Chemistry of the Blood.* An excess of calcium salts is believed to favour thrombosis.

3. *Injury to the Wall of the Vessel or Heart.* This leads to irregularity of the surface, and thus induces clotting of the blood. The injury is usually of the nature of inflammation, and is generally set up by bacterial action. Less often it is due to trauma.

4. *The Action of Bacteria.* The more careful the investigations made upon thrombi, the more apparent it becomes that the infective element plays an important part in their formation.

Disease Processes in which Thrombosis Occurs—

1. *Infective Diseases.* This group is by far the most important.

(a) *Typhoid Fever.* In this disease thrombosis is not uncommon. According to Thayer's figures its frequency is 2·5 per cent. The commonest form is venous; arterial plugging is uncommon, and cardiac thrombosis is rare. The veins most often affected are, in order of frequency, the femoral, popliteal, iliac, veins of the calf and superficial veins of the leg (e.g. internal saphenous). Of the factors above discussed, the most important is probably that of sluggish circulation, due to prolonged rest and low diet. Those who regard the part played by calcium salts as of great importance lay stress upon the influence of a milk diet in inducing thrombosis. The complication usually arises during convalescence, but occasionally precedes the fall of temperature. As in all causes of femoral thrombosis, the left leg is more often affected than the right. In a few instances both legs suffer.

(b) *Pneumonia.* (c) *Influenza.* Thrombosis has been described as a complication of both these infections.

(d) *Tuberculosis.* Thrombosis is not very uncommon in phthisis, and is probably due to the pyogenic cocci present as secondary infections. It may be multiple. In tubercular peritonitis it is by no means uncommon to find thrombosis proceeding in the mesenteric vessels.

(e) *Appendicitis* sometimes leads to plugging of abdominal veins (mesenteric). In *post-operative* conditions thrombosis not infrequently occurs, whatever the region operated upon.

(f) *Syphilis* is a common cause of arterial thrombosis, but more as a secondary effect of obliterative arteritis than as a primary condition.

(g) *Local infections* may be associated with venous thrombosis elsewhere in the body, e.g. pyorrhœa may be present, apparently as a definite causal factor, in femoral thrombosis.

2. *Anæmia.* Chlorosis is the form of anæmia most often causing, or found in association with, thrombosis. The vessel is almost always a vein.

3. *Gout.* Recurring attacks of phlebitis with thrombosis occurring in persons having a "gouty" habit of body are usually attributed to this diathesis. It must be remembered, however, that many so-called "gouty" manifestations are traceable to infective processes. There appears to be an hereditary factor in some of these cases of "gouty" thrombosis.

4. *Pregnancy.* Thrombosis connected with pregnancy may occur at two periods—before confinement, as a direct result (apparently) of pressure from the gravid uterus, and after parturition, in the form (usually) of "white leg."

Symptoms. These depend upon whether the vessel thrombosed is arterial or venous and the particular vessel affected. Cardiac thrombosis gives rise to no symptoms apart from the dilatation of the heart chambers which is usually associated with it. Only those instances of thrombosis commonly met with, and calling for diagnosis and treatment, will be here dealt with.

Thrombosis of Peripheral Veins.—The onset may be quite abrupt, even with a rigor, or it may be insidious. *Fever* is not infrequent, unless in plugging of quite small veins. A common form of fever is an intermitting type (101° to 97° F.). *Sweats* may occur. *Pain* is the most constant of all symptoms, associated with *local tenderness*. The *diagnostic sign* is the presence of a tender, firm cord of thickening in the course of the vessel affected. *Œdema* of the limb, or part of the limb, drained by the plugged vein is quite common. The *skin and subcutaneous tissues* may be inflamed and may therefore be red and tender. The limb tends to be *cold* as the result of deficient circulation. A *leucocytosis* is present, even in typhoid fever.

The *course* of a case of venous thrombosis varies with the cause and with the size of the thrombus. After the first seven to ten days there is a tendency to resolution of the inflamed area, and the thrombus undergoes "organization." The fever subsides, and pain and tenderness gradually disappear, but the œdema is apt to persist if a large vein be blocked.

The *diagnosis* is from neuritis, and sometimes from arthritis, when pain is the chief symptom; and from cardiac or renal dropsy when the œdema is the main feature. As already stated, the diagnostic point is the presence on palpation of the thickened vessel.

The *sequels* of peripheral venous thrombosis are as follows:—(i.) *Embolism*, usually pulmonary in situation. This is more common in the thrombosed veins of parturition and chlorosis

than in infective conditions such as typhoid fever. It may be a fatal event, and its possibility must always be borne in mind during examination and treatment of a patient with venous plugging. (ii.) *Residual œdema* of a limb, etc. This will depend upon the efficiency of the collateral circulation if the vein is completely blocked, and upon the degree to which it is blocked if the block is not complete. (iii.) *Enlarged collateral veins*, often varicose. (iv.) *Nutritional changes* in the limb, increased size (apart from œdema), coarseness of skin, etc.

T. J. H.

DISEASES OF THE GREAT LYMPH VESSELS

I.—Diseases of the Thoracic Duct

The chief and practically the only symptoms of thoracic duct disease are those of obstruction, but it is well to emphasize the importance of the duct in the spread of disease to the general blood system. Bacteria causing disease in the area drained by the duct, especially the abdominal area, are specially liable to enter the lymphatics of the abdomen and gain entrance through the receptaculum chyli, etc., to the general circulation. This occurs in dysentery, typhoid fever, general gonococcal infections, suppurative conditions, etc.; and it is not apparently necessary for any local lesion to be present, the entry being effected across unaffected tissue. The symptoms are chiefly those of the general disease. The importance of this duct in the production of miliary tuberculosis cannot be overstated. Apart from the large field of possible tuberculous disease draining into the duct it is often directly invaded in the thorax by tuberculosis of the lung, pleura or glands. Tubercle bacilli have been found in the duct in cases of *tabes mesenterica*. This manner of infection probably accounts for tuberculous lesions far removed from the original site, *e. g.* a testicular affection subsequent to a pulmonary.

Obstruction in the thoracic duct or its main branches may be due to affections within the lumen or of its walls, thrombosis, parasites, inflammations, especially tuberculosis, compression from without by enlarged glands, tumours, exostoses, cicatricial constriction and rarely by a high pressure in the left innominate vein. Compression may be complete and yet a collateral circulation may prevent obstructive symptoms. Obstruction may show itself in one or more fields producing the following conditions—

1. **Chylous Ascites.**—The general features differ in no way from ordinary ascites; the puncture fluid is, however, milky. Another condition liable to be mistaken for this is pseudochylous ascites, in which there is no obstruction to the thoracic duct; the same

cannot be said of all its branches, though in those cases no anatomical lesion has been described. The fluid in chylous ascites accumulates rapidly, is yellowish, of constant opalescence with repeated tapplings, contains fatty globules in fair amount and has a specific gravity above 1012; pseudochylous ascites accumulates slowly, is pure white, the opalescence increases or diminishes with successive tapplings, it contains less fat and has a specific gravity less than 1012. The distinction of the two is not absolute.

2. **Chylothorax** presents the same symptoms as hydrothorax and the same types of fluid are present as in chylous ascites.

3. **Chylopericardium** is very rare, it has been noticed in tuberculosis of the lungs, carcinoma of the pleura and chronic disease of the heart, but no separation into two forms has yet been made.

4. **Chyluria** gives a milky appearance to urine and contains pinkish coagula; massive coagulation sometimes occurs and blood may be present. One common cause in addition to obstruction of the thoracic duct is one or other variety of *filaria sanguinis hominis*. It is intermittent, and varies with the food taken. Symptoms referable to an affection of the kidneys, pain in the back or groin, may precede or accompany it. Great exhaustion and emaciation ensues if it persists.

5. **Chylous cysts** are either retroperitoneal, deeply situated near the receptaculum chyli or freely movable and situated in the mesentery or omentum. They are single and multiple and vary greatly in size. The fluid they contain shows all variations of chylous or lymphatic fluid. Multiple cysts are often seen in chronic peritonitis. Small cysts rarely produce symptoms, but larger ones give a fluctuating abdominal tumour with occasional secondary symptoms of pressure or dislocation of other organs.

Treatment. Tapping, except for purposes of diagnosis, is not advisable in the massive effusions. All measures should be taken to promote the absorption of the fluid by lessening the fluid intake, rest, etc. Mesenteric cysts may sometimes be enucleated by operation.

II.—Diseases of the Smaller Lymph Vessels

1. **Lymphangitis** is seen as the result of a general and a local process, and the type of the infection gives rise to different forms recognizable by the clinician such as simple, acute, purulent and chronic proliferative lymphangitis. General lymphangitis is seen in the infectious diseases such as scarlatina, smallpox, measles, chicken-pox, syphilis, plague and filariasis. Any local infection sufficiently severe will give lymphangitis of the vessels draining the part. The inflamed vessel is marked by a wavy tender

red line along its course, often slightly raised and cordlike, with irregular thickenings. The associated lymph glands are inflamed, enlarged and possibly tender, and there may be peripheral cedema. A general infection, local suppuration, calcification or restitution may ensue. Chronic lymphangitis of deep lymph vessels occasionally constricts deep veins and produces stasis in superficial vessels.

2. **Obstruction (Lymphangiectasis).**—Chylous ascites, chylopericardium, chylothorax and chyluria not due to obstruction of the thoracic duct may follow localised obstruction of lymph vessels, though this may not be evident. Obstruction of the skin lymphatics gives rise to chronic cedemata such as lymph scrotum or chronic cedema of the legs (elephantiasis) in which the dermal tissues are enormously swollen and indurated. Chronic lymphangitis, such as from eczema or chronic erysipelas, lupus syphilis,

varicose ulcers, destruction of the lymph vessels draining a part, as in removal of carcinomatous or tuberculous glands, obliteration by malignant disease, are some of the commoner causes of the condition. There are, however, two well-defined types of elephantiasis: (a) elephantiasis arabum, a tropical and subtropical disease due to the presence in the lymphatics of the affected part of the ova of one or other form of *filaria sanguinis hominis*, and (b) a congenital or inherited form (Milroy's disease) whose pathology is unknown. It begins gradually, but often there are acute attacks not unlike anæmio-neurotic cedema and the disease appears to bear some relation to other vasomotor neuroses. In the early stages an ordinary pitting cedema may be frequent, in the later the tissues become indurated and fibrotic, showing ulceration or weeping surfaces.

W. O.

A. G. G.

DISEASES OF THE BLOOD

PERNICIOUS (ADDISONIAN) ANÆMIA

It would seem that with the advancement of knowledge in the future all anæmias will be proved to be "secondary"; those cases for which no definite etiological factor can be discovered must until then be regarded as "primary" or "essential." The so-called "pernicious" anæmia is one of these, and, as Addison first stated, is "a general anæmia occurring without any discoverable cause whatever, cases in which there had been no previous loss of blood, no exhausting diarrhoea, no chlorosis, no purpura, no renal, splenic, miasmatic, glandular, strumous or malignant disease." Many conditions have been associated with this disease as causal factors: pregnancy, parturition; repeated small hæmorrhages are said occasionally to lead to it; in some cases there is a history of syphilis. It may arise during gastric cancer, or the latter during the former. The clinical, febrile characters, and more recently the results of bacteriological investigations, point to this anæmia as probably arising from bacterial infection, producing hæmolysis and exhausting hæmogenesis. The experimental use of certain hæmolysins, such as toluylenediamine, ricin, saponin, pyridine, pyrogallol and the toxic products of the *Bothrioccephalus latus* produce a condition practically identical with this anæmia.

Many cases have been associated with oral sepsis and pyorrhoea alveolaris, and I have had experience of cases preceded by suppuration in the antrum. Others are associated with toxins derived from the alimentary canal, in which there is gastritis and enteritis. The infective

process may be regarded as an indirect cause, some additional factor being required to determine true Addisonian anæmia, the one paving the way for the other. The hæmolysis takes place in the portal area, iron is deposited in the liver, and to a less extent in the spleen and kidneys. The true nature of the toxin responsible for the disease is unknown. Few patients are able to date the onset or attribute the disease to any special cause, but mental worry, exhaustion, bad smells are associated by them with the onset of their illness.

It is a disease of adult life, but has been known to occur in children. It is not regarded as hereditary, but it may affect several members of a family. Males and females suffer equally. It attacks poor and rich alike, and people of any nation. It is not known to occur in epidemic form. It may be that further research will solve the problem of this disease and place it eventually in the category of secondary anæmias.

Symptoms. No better general account of the symptoms and course of the disease can be given than that of Addison, who first described it and called it "idiopathic anæmia." "It makes its approach in so slow and insidious a manner that the patient can hardly fix a date to the earliest feeling of that languor which is shortly to become so extreme. The countenance gets pale, the whites of the eyes become pearly, the general frame flabby rather than wasted, the pulse perhaps large, but remarkably soft and compressible and occasionally with a slight jerk, especially under the slightest excitement. There is an increasing indisposition to exertion, with an uncomfortable feeling

of faintness or breathlessness in attempting it; the heart is readily made to palpitate; the whole surface of the body presents a blanched, smooth and waxy appearance; the lips, gums and tongue seem bloodless, the flabbiness of the solids increases, the appetite fails, extreme languor and faintness supervene, breathlessness and palpitations are produced by the most trifling exertion or emotion; some slight œdema is probably perceived about the ankles; the debility becomes extreme, the patient can no longer rise from the bed; the mind occasionally wanders; he falls into a prostrate and half-torpid state, and at length expires; nevertheless to the very last, and after a sickness of several months' duration, the bulkiness of the general frame and the amount of obesity often present a most striking contrast to the failure and exhaustion observable in every other respect." Certain symptoms associated with various organs may be mentioned in further detail. The pallor of the skin passes into a peculiar lemon-yellow tinge and pigmentation may occur in smaller or larger areas. Pigmentation of the buccal mucous membrane is seen occasionally. Oedema of varying degree is not uncommon, especially during exacerbations and may remain during a remission, an unfavourable sign. Hæmorrhages may take place from the mucous membranes, hæmoptysis and pleural hæmorrhages also. Hæmatemesis, melæna and hæmaturia may occur. Nutrition remains good without loss of body weight. Pain and tenderness of bones, especially the tibiæ and sternum, are not uncommon. Periods of pyrexia occur, but are not proportionate to the severity of the anæmia. Cardiac distress and palpitation are constantly present and systolic hæmic murmurs heard over all valve areas, rarely there are diastolic murmurs. The heart dilates. Venous murmurs are present in nearly all cases. The pulse tension is low, and its frequency is affected by slight exertion. Except for dyspnoea the respiratory organs are unaffected. The appetite is capricious; there may be complete anorexia. The mucous membrane of the mouth and tongue are hypersensitive to acids and condiments. The tongue is often shiny and smooth. Hæmorrhages, vesicles, desquamation and even serpiginous ulceration may occur, with pyorrhœa and dental caries. Epigastric pain and tenderness, vomiting which may become uncontrollable, are common; free hydrochloric acid may be diminished or absent; constipation is rare, but distressing; diarrhœa is present in a large number of cases.

The liver may be slightly enlarged and the spleen also. Lymphatic glands are not enlarged. The urine is often high-coloured from urobilin, the urea varies in amount and uric acid is sometimes in excess. Occasionally

there may be a trace of albumin, or even peptone or albumose. Leucin is almost constantly present and tyrosin occasionally. In a few instances sugar, diacetic acid and acetone have been present. There may be an excess of indican, and iron and phosphates are both said to be increased. There is usually no deposit and rarely casts. Symptoms referable to the nervous system point to implication of the brain, spinal cord and peripheral nerves. Headache, vertigo, insomnia are sometimes distressing. Loss of interest in surroundings and indifference to the progress of the disease are manifest. Mania, melancholia, transient delirium and coma which may last some days, often precede death. Loss of memory, aphasic attacks, transient hemiplegias, immobility of the pupils may occur. Tabetic and spastic symptoms follow changes in the cord. Paræsthesia, numbness and tingling in the extremities are complained of, but well-marked peripheral neuritis rarely develops. Ocular symptoms consist of flashes of light and visual hallucinations; retinal hæmorrhages are frequent, but optic neuritis is rare. Cerebral hæmorrhage is uncommon. Tinnitus, pulsation sounds, and deafness are sometimes present. Occasionally there may be loss of taste and smell. Although the anæmia may improve while the nervous symptoms progress, once the latter are evident, though slight at first, they denote a fatal termination at an early period.

The blood examination reveals marked changes. The blood is pale in colour and clots badly; the whole volume is reduced in some cases, raised in others. Total hæmogoblin is reduced. The percentage of hæmogoblin in the peripheral circulation is low and as a rule does not fall below that of the erythrocytes, so that the colour index is above normal. This is very characteristic, and although the index may be normal or even subnormal, this generally occurs during a remission, and it may vary within short periods; the lowering of the index is generally coincident with a rise in the erythrocyte count. The colour index may register 1.5 or more. The erythrocytes are numerically decreased, commonly about 1,500,000 per c.mm.; but they may fall much lower. They are increased in bulk and may contain sufficient hæmogoblin for physiological purposes compatible with life. The total proteids are decreased, specific gravity and alkalinity are reduced. Water and sodium chloride are increased, potassium and iron diminished. The erythrocytes are very susceptible to hæmolysis and hypotonic solutions and the serum is hæmolytic to normal erythrocytes. The morphological changes are marked; increase in size of the erythrocytes is the rule—megalcytosis—as compared with other anæmias;

they lose their concavity, many are of a richer colour; poikilocytes and microcytes are present. Polychromasia, basophilic stippling and irregularity of staining are marked features.

Nucleated erythrocytes of all sizes and shapes—microblasts, normoblasts, megaloblasts—are present in variable numbers; the latter are very characteristic, but may be scanty. Rouleaux formation is poor or absent.

Leucocytes are below normal numbers, the count may average only 2000. The loss is in polymorphonuclear cells, lymphocytes being relatively increased.

Coarse eosinophile cells may be increased. Myelocytes are rare. Blood platelets are scanty and fibrin formation lessened. The principal character of the blood is that it is both megaloblastic and megalocytic. The changes are always most marked during relapses, and least so during remissions.

Prognosis. The course of the disease is irregular and the duration variable. Some cases, by their rapid progress, may be termed acute. In every case the outlook is grave. Remissions and relapses occur again and again. Remissions may be prolonged and the disease drag on for many months and even years. Instances have been recorded where life has been prolonged for ten and even twenty years after the disease was recognized.

Diagnosis. The diagnosis of pernicious anæmia rests principally upon the blood examination, taken in conjunction with the clinical course. The principal diseases which may simulate it clinically are malignant disease, syphilitic cachexia, post-malarial anæmia, chronic tubal nephritis, infective endocarditis, chlorosis, the leukæmias, secondary anæmias, anæmias due to metallic and other poisons, post-hæmorrhagic anæmias from any cause, colitis, bothrio-cephalus anæmia, ankylostomiasis, chronic dysentery, lardaceous disease, Addison's disease, and system diseases of the spinal cord.

Treatment. The possibility of early diagnosis, and the remarkable natural attempts at recovery, are two important factors to be remembered in the treatment of this disease. During recent years the outlook has been more promising. Much depends upon the mode of onset, cases of a subacute or chronic type are more hopeful than the acute. The peculiarities of the digestive disturbances do not permit any hard-and-fast rules in dietary, and the medical attendant will have to exercise much ingenuity in selecting for individual cases nourishing food which is easily tolerated and digested, without causing gastric irritation. It is difficult to combat the capriciousness of appetite. It is not advisable to give too much "slop"

food. Gastric irritation and vomiting have to be treated by the usual remedies, such as bismuth, soda, hydrocyanic acid; gastric and intestinal antiseptics should be aimed at, and for this purpose salicylic acid is most useful, perchloride of mercury, salicylate of bismuth, charcoal, carbolic acid, salol, β -naphthol. Stomach lavage may be found beneficial. Intestinal antiseptics is also an important factor in treatment by the administration of drugs for the purpose, such as salol, β -naphthol, preparations of lactic acid bacilli, irrigation of the large bowel with weak solution of potassium permanganate. Oral antiseptics should be rigorously carried out, the teeth and mouth generally being cleansed with a reliable antiseptic wash three or four times a day. Pyorrhœa and decayed teeth demand the services of the dentist.

The principal remedy which has a definite and direct action upon the disease itself is arsenic; under its influence improvement rapidly takes place, this is especially noticeable during the first course of its administration. Relapses are delayed, and when they take place improvement may follow its administration again, but as time goes on the benefit becomes less. It is usually given in the form of Fowler's solution, commencing with two-minim doses, well diluted, after food, increased until fifteen minims are taken for a dose three times a day by the end of three or four weeks. It should be gradually lessened again, and due care should be taken to note any signs of intolerance, such as gastric irritation, vomiting and diarrhœa. Arsenic should be administered throughout the remissions. It is doubtful if large doses are desirable. Small doses may be administered over a number of years if properly regulated and with occasional intermissions. Other preparations of arsenic may be substituted at times, but they have no special advantages over the one mentioned. Ronceigno, Levico, Guberquelle or other arseniated waters may be used. Cacodylic acid and cacodylate of soda have been used, and more recently cases have been treated with intravenous injection of "606" Ehrlich-Hata with benefit.

Iron in this disease is useless and may do harm. Phosphorus and quinine have fallen into disuse. Glycerine in drachm doses three times a day has proved useful. Strong hydrochloric acid in 10–15 minim doses in mucilage-water immediately after meals, and repeated in half-an-hour, is beneficial, also the administration of red bone marrow from time to time. It may be given fresh in sandwiches, in capsules, or glycerine extract; several ounces daily are required. The marrow may be mixed with port wine, made into a paste, and incorporated with a table jelly.

Antistreptococcic (polyvalent) serum has been

strongly advocated and is certainly beneficial. It may be given subcutaneously or per os. Injections of 5 or 10 c.c. should be made at intervals of a few days, or even daily. Due care must be taken to observe any effects on joints or skin eruptions. The possibility of anaphylaxis must be considered with reference to serum; when given by the mouth this is said not to occur.

The transfusion of defibrinated healthy human blood has given excellent results in some cases, probably due to an antitoxic effect of the serum, or by stimulating blood formation. Recently it has been injected into the gluteal region in doses of 10 to 20 c.c. with benefit.

R. J. M. B.

SECONDARY ANÆMIA

Acute Post-hæmorrhagic Anæmia.—This is associated with rapid and more or less profuse loss of blood, arising from a wound of a large vessel, bleeding externally or into one of the body cavities, or from spontaneous hæmorrhage associated with abortion, the puerperium, tubal pregnancy, uterine tumours, ulceration of mucous membranes, simple or malignant, typhoid fever, pulmonary tuberculosis, aneurysm, varicose veins, hæmorrhoids, pancreatic disease, splenic anæmia, cirrhotic liver, and the hæmorrhagic group of blood diseases.

Symptoms. These comprise collapse, pallor, weakness, vertigo, syncope, aphonia, ocular spectra, tinnitus, parosmia, great anxiety. The body perspires, the urine may be increased. The pulse is frequent, soft, and variable in rhythm and tension. Nausea and vomiting occur. As the weakness increases, somnolence, aphasia, paraphasia, and delirium may come on, with extreme dyspnoea. Later, perspiration ceases, the eye becomes lustreless, muscular contractions or general convulsions may occur, the pulse and respirations are feeble and slow, the temperature falls, and death ensues if the hæmorrhage does not cease or cannot be controlled.

Should the hæmorrhage cease, the symptoms which follow will depend on the amount of blood loss. Profound anæmia may remain for some time. The heart is irregular in rhythm, with palpitation on slight exertion. Syncopal attacks may occur. Hæmic murmurs are to be heard; and small hæmorrhages may take place from the mucous membranes. There are dyspnoea, loss of appetite, headache, neuralgias, transitory aphasias, fatigue, ocular disturbances, retinal hæmorrhages, optic neuritis and atrophy. As recovery takes place these symptoms disappear; the prospect is influenced by age and nutrition, and is less favourable in infancy and old age.

Blood Changes comprise loss of volume, hydræmia, lowered specific gravity, erythrocyte loss, hæmoglobin loss, both of which are most noticeable a few days after the hæmorrhage has ceased. The erythrocytes are distorted, normoblasts appear; endoglobular changes occur. There is first a relative, and then absolute leucocytosis, mostly due to neutrophiles. Blood plates are increased. The hæmoglobin does not recover as quickly as the erythrocyte count. In three weeks to a month the blood will have recovered itself, even when the hæmoglobin has been reduced to twenty-five per cent.

Treatment. The arrest of traumatic hæmorrhage comes within the domain of surgery. In spontaneous hæmorrhage absolute rest is essential. The administration of opium holds a high place. Hæmorrhages from special localities require to be treated on special lines. Many drugs have been advocated as hæmostatics: perchloride of iron, lead acetate, gallic and tannic acids, stypticin, hamamelis, turpentine, salts of calcium, ergot, adrenalin chloride, gelatine by mouth or rectum, inhalation of amyl-nitrite, trinitrine, nitrite of soda. There is a marked diversity of opinion as to their individual utility. Their application will be dealt with under special articles.

Transfusion of normal saline or defibrinated human blood may be called for, or salines may be given slowly by the bowel. The administration of normal horse serum by the mouth or subcutaneous injection has been found useful in many instances.

After the acute symptoms have passed off rest for a long period must be assured, the general health cared for, the diet be nourishing and easily assimilable. Iron is useful. The relief of symptoms must be treated on general principles.

Simple Chronic Secondary Anæmia.—In contrast to the preceding form of anæmia, this is generally associated with small and often-repeated hæmorrhages, or the general causative factors of anæmia in general. In this category fall lack of fresh air, a diet insufficient in iron, the drain made upon the blood by prolonged suppuration, albuminuria, and the toxic conditions associated with it. The toxæmias accompanying pyrexias, infective processes, syphilis, malaria, malignant neoplasms, metallic poisons, such as lead, arsenic, mercury, benzene derivatives; the presence of helminthes in the blood, tissues or alimentary canal. Oral and intestinal sepsis are productive of the condition.

Symptoms. These differ slightly, if at all, from the later stages following acute hæmorrhage. The skin may assume a sallow colour. There is muscular weakness and an easily fatigued nervous system. There is a tendency to œdema; spontaneous hæmorrhages may occur.

Digestion is disturbed, the appetite is capricious, with pain after food, constipation, dyspnœa, palpitation, etc. Other symptoms as well as the anæmia, and associated with the special causal factor, will be present in individual cases.

Blood Changes.—These are due to hæmolytic and exhaustion of hæmogenesis. The changes may resemble those of chlorosis or even pernicious anæmia. The total volume may vary. The blood drop is pale and watery, and the cellular elements collect together in the plasma. The reduction of hæmoglobin varies, it may be profound. The same applies to the erythrocytes; hæmoglobin and erythrocyte loss may be equal, or the hæmoglobin loss be greater, so that the colour index is low. There is excess of water, chlorine and sodium, loss of potassium and phosphates. Iron is diminished and specific gravity is lowered; alkalinity varies; coagulation time may be shortened. The morphology of the erythrocytes is altered, they are usually of small size, stain feebly and irregularly. Poikilocytosis and basophile staining are present. Normoblasts may appear. Leucocytosis is generally present, neutrophile in type. The eosinophile count may be high. In some cases there may be leucopenia with relative leucocytosis. The blood platelets are increased.

Treatment. In reference to the treatment a study of the causal factors will give the first intimation of rational methods to be exercised in the hope of cure. Prior to all therapeutical measures, the cause, if possible, must be removed, or the individual from it.

Rest, fresh air, genial and health-giving surroundings, attention to diet, and proper food are essential. Attention to the digestive functions is desirable, along with the administration of an easily assimilable preparation of iron. Special cases will require special treatment, according to the etiological factor; such will be described under the separate diseases associated with secondary anæmia, and to which the reader is referred. R. J. M. B.

CHLOROSIS

Chlorosis is a form of anæmia commonly found in females about the age of puberty, and has a close relation to the evolution of the sexual organs. It is rarely, if ever, found in its true form in males. Recurrences are common. There is evidence of an hereditary and family tendency. It may occur in women of any nationality. Although the general causes of anæmia may play a part in the determination of this condition, it is doubtful if they can produce it exactly in an individual free from chlorotic predisposition. It affects the poor and rich, those living in the country or the city. Virchow's theory that it is part of

a general hypoplasia of the vascular system and genitalia is not satisfactory. Perversion of the metabolism and absorption of iron, as suggested by Bunge, is not considered to be supported by evidence. Its association with constipation in certain cases, with unhealthy surroundings, sepsis, toxic conditions, gastric symptoms, Graves's disease and so on, has led to these having been regarded as direct causes. There is evidence of emotion being an exciting cause, and it has also been regarded as symptomatic of a peculiar neurosis.

Hæmorrhage from any cause may aggravate the condition, it is doubtful if it can produce it in reality. It has been attributed to lack of iron in the food. It is regarded by some to be due to defective hæmogenesis, by others to a degree of hæmolytic also. The condition predominates during the child-bearing period of life and is considered in this respect as the exaggeration of a natural condition of the blood associated with this physiological process. Those who hold that the internal secretions of the genital organs are associated with chlorosis, regard it as due to lack of stimulation of hæmogenesis by these at a time when physiological loss of blood by menstruation has to be replaced.

Symptoms. These are characteristic. They are varied, and comprise tiredness, exhaustion, dyspepsia, dyspnœa, and palpitation. Pallor of the mucous membranes appears early. The skin is creamy in appearance and the cheeks have a pink flush. In severe cases the complexion becomes sallow or even of a greenish tinge, more noticeable in the brunette. Some pigmentation may appear about the joints. Morning lassitude and evening vivacity are the general rule. Emaciation is not common, the chlorotic may gain weight. Slight œdema about the ankles may appear. Digestive disturbances, pain after food, flatulence, heartburn, capricious and perverted appetite or complete anorexia, gastroptosis, enteroptosis, constipation, are commonly present. The circulatory system is disturbed, the heart may dilate, the pulse is soft and easily influenced by exertion or emotion. There may be venous pulsation. Hæmic murmurs may be audible at any area, but most commonly at the pulmonary. Their intensity does not seem to be dependent on the severity of the chlorosis. The *bruit-de-diabie* is present in the veins of the neck, and in severe cases the hum may be heard in the orbital veins and over the cerebral sinuses. There is tendency to vertigo and fainting in the erect posture. Venous thrombosis may occur, especially in severe cases. Alterations of disposition, dulled cerebration, headaches, tinnitus aurium, deafness, ocular disturbances and changes, various neuralgias, stigmata of hysteria, may occur. Amenorrhœa is one of the principal

symptoms; on the other hand, menstruation may be too frequent and profuse. Leucorrhœa is common. Polyuria is often present, the urine pale and of lower specific gravity than normal, but with no special clinical alterations.

Chlorosis is generally regarded as afebrile, but pyrexia occurs at indefinite periods, apart from any recognizable complication.

The course of the disease may be acute or chronic and may persist for a long time, with relapses and remissions.

The blood in chlorosis is pale and watery-looking. The principal and characteristic change is the disproportion in the decrease of erythrocytes and hæmoglobin, the latter always falling much below the former. As a rule the erythrocytic loss is not great. In all cases the colour index is below normal, and thus contrasts with the high index of pernicious anæmia. The total volume of blood is increased, due to plasma and cellular elements, red and white, but the hæmoglobin value of each erythrocyte is low. The total blood volume in severe cases may be double the normal. The specific gravity is lowered. Phosphates, potassium and iron are lessened, whilst calcium and magnesium are increased. Coagulation is rapid. The erythrocytes are pale, of small size, and stain feebly. In severe cases poikilocytosis is marked. Normoblasts may be present; microcytes and megalocytes are rare. Polychromasia and punctate basophilia may occur in severe cases. Blood platelets are increased. The leucocyte count is unaltered. Leucopenia, if it occurs, is said to be of unfavourable import. There is a relative lymphocytosis. The neutrophiles are decreased, the eosinophiles vary.

Diagnosis. This rests upon the blood examination. In cases where there is a marked fall of erythrocytes secondary anæmia may have been superimposed on the chlorosis. Metallic poisons, especially lead, produce anæmias which may be mistaken for chlorosis, rheumatism, syphilitic anæmia, tuberculous, renal and malignant disease have to be excluded; splenic anæmia is associated with a large spleen. The heart condition has to be considered in reference to organic disease. Ankylostomiasis is accompanied by some degree of leucocytosis and eosinophilia. Addison's disease may be mistaken for it. Pernicious anæmia is distinguished by the blood picture. Post-hæmorrhagic anæmia may resemble it clinically.

Treatment. Chlorosis is very amenable to treatment. The return to health is often rapid and permanent. At and before the onset of puberty its occurrence may be prevented by a liberal diet especially containing meat, fat, green vegetables rich in iron, and fresh fruit.

The medicinal treatment is centred in the administration of iron in some form. It is

the specific remedy. The most active salt is the sulphate. In whatever form the metal be administered it should be in full doses, after meals, regularly, increasing the dose and continuing full doses for many weeks. Failure depends upon insufficiency of dose. Begin with two grains of the dried sulphate three times a day for a week, and increase weekly by a grain until five or more are taken for a dose; this should be kept up for three months and then reduced gradually. On the slightest sign of recurrence the iron should be resumed. A laxative may be administered occasionally. Other preparations of iron may be chosen to suit the idiosyncrasies of the patient. The digestive organs, when deranged, require attention. In some cases arsenic in combination with iron is useful. Preparations of "organic iron" have been lauded, but have no special therapeutic value over the inorganic form.

Antiseptic treatment of the bowel in addition to the iron seems to hasten recovery. The reduction of blood volume by limitation of fluid intake, purgation, diuresis and diaphoresis is also advocated, and even venesection to stimulate blood formation—these are refinements of treatment which have some support. A salt-free diet may prove beneficial and the administration of calcium lactate relieve headache. Bone marrow is useful at times.

A sojourn at a chalybeate spa may be advised where change of air is necessary. The waters are dilute enough to be tolerated by the empty stomach. Among such spas may be mentioned Schwalbach Spa, Tunbridge Wells, Cheltenham, Melksham, Harrogate, Trefriw. The waters of the last are extremely rich in iron; there are two springs, one milder and containing more lime and magnesia, the other stronger in iron; it is best to commence with the milder water first, and after a week proceed to the stronger. The mild water contains 171·25 grains of protosulphate of iron, the strong water 381·80. These waters are readily taken, have no odour, the dose is comparatively small, and they are most efficacious in the treatment of chlorosis and chronic secondary anæmias, with their concomitant digestive and nervous disturbances.

The village of Trefriw is situated in one of the most beautiful valleys of North Wales.

If arsenic be requisite in combination with iron it may be obtained in Levico or Roncegno waters.

The general treatment of chlorosis comprises rest in bed in severe cases for two or three weeks and a generous diet containing meat and vegetables rich in iron. The avoidance of fatigue, mental and physical, early hours and plenty of fresh air without fatiguing exercise, are essential. Cold must be avoided. Oral sepsis should be rectified.

To sum up, the main treatment is the administration of iron in full doses and for prolonged periods.

R. J. M. B.

LEUKÆMIA

Leukæmia is a disease characterized by a persistent increase of leucocytes in the blood, associated with gross clinical changes in the spleen or lymphatic glands or both, with anæmia and hyperplastic changes in the bone marrow. Two clinical forms were originally recognized, in which splenomegaly and enlarged lymphatic glands were the principal features respectively; the bone marrow, however, is changed in both, and both may show clinical features in common. The classification rests upon the blood changes. In one the blood picture shows myeloid characteristics and the marrow changes correspond, so that this variety has been designated "myelogenous" or "myeloid" leukæmia. In the other the blood presents a so-called "lymphocytic" or "lymphoid" picture and the marrow does the same, this being called "lymphatic" or "lymphoid" leukæmia. Intermediate between these are mixed varieties with clinical and hæmatological features common to both. The typical myeloid may change through the mixed variety to a characteristic lymphoid type.

What the ultimate nature of the cytology of leukæmia may be is practically unknown. Efforts to elucidate this on chemotatic grounds have not resulted in the production of a myeloid blood state. Its relation, as evidenced by cell proliferation, to malignant neoplasm has much to support it.

It may be that more exhaustive investigations may reveal connections between it and the more uncertain blood states classified as pseudo-leukæmias, leukanæmia and chloroma.

Both forms of the disease may be acute or chronic, the myeloid more often chronic, but the "lymphoid" occurs in acute form more frequently than has previously been considered the case. Leukæmia may occur at any age, from infancy to senility; the myeloid is most common at the middle period of life, the lymphoid generally at an earlier period, but both forms may occur in children. The particular cause of the disease is unknown. It has been held to be due to bacterial invasion. When we consider those extremely acute cases, resembling in many ways acute specific infective fevers, the possibility of transmission, and the lesions of the alimentary tract permitting entrance of some infective virus, there is a possibility of its origin being founded upon an infective process. No specific organism has yet been established as the causal factor. Löwit described a parasitic body in the blood which he termed the hæma-

mœba leukæmiæ, but its presence has not been substantiated by other observers. White and Proeschles consider the disease due to spirochæta lymphatica, but without confirmation by others. A certain number of cases give a history of previous malaria, others that the onset followed injury. Heredity may have some predisposing influence. Lower animals may suffer from the disease, and it has been found in dogs, horses, oxen, swine, cats, mice and fowls.

Myeloid Leukæmia.—*Symptoms* usually chronic, occasionally may be acute. The onset is as a rule insidious. The first symptoms are usually dyspnœa, palpitation, pain or discomfort in the left hypochondrium, anorexia, dyspepsia, abdominal distension, enlargement of one or other group of lymphatic glands, or pains in the bones or sternum. Anæmia shows itself sooner or later, the skin becomes pallid, dusky, sallow or bronzed. There is a marked tendency to hæmorrhages, notably epistaxis. The spleen becomes enlarged and may reach the pubes, the surface smooth, notch palpable and consistence firm. It may be tender, and occasionally friction may be heard over it, or even a souffle, or it may pulsate. It may decrease in size after hæmorrhage or diarrhœa. The liver enlarges but remains smooth; ascites and peritonitis may be present: œdema of the legs occurs. When glands enlarge they are usually axillary or inguinal; they are not tender, do not break down or infiltrate the skin. Internal glands when enlarged may produce pressure-symptoms according to their situation. The lingual glands and tonsils may enlarge.

Cardio-vascular symptoms are those of anæmia. Vascular thrombosis may occur, also hæmopericardium. There are no special respiratory symptoms; hæmoptysis may occur, occasionally pleuritic effusion or hæmothorax. Gastro-intestinal symptoms are more or less always present, vomiting and diarrhœa may be distressing; hæmatemesis may be alarming, melæna is uncommon; there may be ulceration of the bowel.

Various skin rashes may appear, and in acute types purpura is common.

Symptoms referable to the nervous system are generally due to local hæmorrhages. Headache is frequent. There may be facial paralysis, deafness, vertigo and tinnitus aurium simulating Menière's disease. Leukæmic retinitis and hæmorrhages may be seen on the fundus oculi. Cerebral hæmorrhage may cause death. Loss of virility, amenorrhœa or menorrhagia in women, persistent painful priapism in men are symptoms associated with the sexual apparatus.

The urine contains excess of urea and uric acid. Hæmaturia is uncommon.

The disease may be subfebrile throughout;

there may be periods of apyrexia alternating with pyrexia of remittent type; there may be intermittent fever with profuse sweats.

The Blood in Myeloid Leukæmia. The exuding drop may not differ much from the normal in appearance, it may be opaque or rarely creamy, films appear granular or greasy. The leucocytic increase varies, but may reach 1,300,000, with a ratio of one white to two reds. In addition to an increase of cells common to normal blood—*e.g.* polymorphs—adventitious cells appear: *Myelocytes* up to sixty per cent. of all leucocytes present; as long as they are present at all they denote the persistence of the disease. All sizes and transitions are met with. *Eosinophile cells* are a striking feature; they may be mononuclear, transitional or of the usual hæmal type. *Basophile*, “mast,” cells are a constant feature, representing one to ten per cent. of the leucocytes. *Polymorphonuclear neutrophiles*. The absolute number of these cells is increased, the percentage relative to the others is low. They vary in size and granulation. *Lymphocytes*, though they may be absolutely increased, are relatively diminished and take a subordinate position; the small variety may be only one per cent. Large lymphocytes are present in greater numbers; these are to be regarded as of myeloid origin and when in large numbers denote a “mixed leukæmia.” *Erythrocytes*. Erythrocyte loss at an early stage is not a marked feature, later they may fall to 2,000,000 per c.mm. Erythroblasts are common. Megaloblasts occur, but principally normoblasts. Of all blood states in which erythroblasts occur myeloid leukæmia is the most common. Endoglobular changes are present. *Hæmoglobin* is diminished and the colour index low. Coagulation time varies. The alkalinity is diminished and the specific gravity variable. Blood platelets vary in number. Charcot-Leyden crystals appear after death, or in dried films. Xanthine bases are increased. Certain organic acids have been found; some observers have found uric acid.

Diagnosis. This is rarely difficult and depends upon the blood picture.

Treatment of Myeloid Leukæmia. Natural remissions of the disease are not uncommon. Endeavours on general principles to sustain the bodily health must be carried out. The danger of hæmorrhage in relation to exercise and trauma must be remembered.

Apart from symptomatic treatment arsenic is the staple drug for the disease. Under its influence the leucocyte count falls and the anæmia tends to disappear. It should be given in gradually increasing doses, as in pernicious anæmia. Quinine has been found useful in cases associated with malaria. Iron in combination with arsenic is useful. Phosphorus has

had its advocates. Intestinal antisepsis should be aimed at. The application of X-rays has given surprising results. In some cases it surpasses all other treatment. The spleen diminishes, the leucocyte count falls, and the general condition improves. The earlier the case the better the result. Old-standing cases do not respond so rapidly, some not at all, and repeated courses of treatment lose their efficacy or may even be harmful. The X-rays seem to destroy the leucocytes and hinder fresh formation. The granular eosinophile and basophile cells go first, then the neutrophile. The lymphoid cells are numerically unaffected, but their power of development into cells of the several series is stopped, and they may not recover this function. Hence, a myeloid may change to a lymphoid type if the rays are used in excess. The use of the rays should be controlled by the blood picture. Excessive use of the rays may inhibit the development of the bone marrow. During treatment there may be severe constitutional disturbance with fever, so that there should be short exposures and occasional intervals. The rays may be applied over the spleen, the epiphyses and shafts of the long bones and the sternum. Ten to twenty minutes' exposure at a time over one place or several places in all is the average duration required, applied every day, every other day, or at longer intervals, according to results. Care must be exercised to guard against X-ray burns. Intercurrent febrile infections cause amelioration of leukæmia in some cases, and on these grounds vaccine therapy by the introduction of dead organisms, *e.g.* streptococcus, may prove useful and is worth consideration.

X-ray treatment does not cure the disease. Radio-therapy is said to be very beneficial and rapid. Splenectomy answers no useful purpose and is inadvisable.

The intravenous injection of “606” Ehrlich-Hata has been tried, with variable result.

Transfusion of blood has no satisfactory effect. Inhalation of oxygen is said to have been beneficial in early stages. In acute leukæmia naphthalene tetrachloride in eight-grain doses every three hours has been used successfully (Drysdale).

Lymphoid Leukæmia.—This disease may be acute or chronic, varying in degree and duration rather than in kind.

Acute Lymphoid Leukæmia.—*Symptoms.* The onset may be insidious or sudden. Prodromal symptoms, comprising weakness, headache, dyspnœa, vertigo, fever, pain over the spleen, arthritis, pallor, puffiness of the face, epistaxis, inflammation of the buccal mucous membranes, naso-pharynx and tonsils may usher in the disease for a few days; these, however, may be absent, and the onset be quite sudden. The

principal symptoms are the progressive, rapid enlargement of the lymphatic glands, slight enlargement of the spleen, occurrence of rigors or "chills," irregular pyrexia and pains in the bones, ulcerative stomatitis, necrotic patches in the mouth, on the tonsils, palate or pharynx, a tendency to hæmorrhages, purpuric eruptions of varying intensity, retinal hæmorrhages and the pathognomonic blood picture.

The lymphatic glands may be very slightly or not at all affected in extremely acute cases, and may escape notice. They vary in consistence, are not usually painful or tender, except when there is marked buccal inflammation, the submaxillary glands may be tender or matted. The spleen may become enormous in children and rupture has occurred. The condition of the mouth may simulate noma. Hæmorrhages may be severe and produce symptoms according to their site; they may occur from any mucous membrane, or into serous cavities, and even into viscera, *e.g.* pancreas. The liver is enlarged and tender. There may be diuresis, anuria, albuminuria, hæmaturia, and a green tinge of the urine as in chloroma. Uric acid is increased; priapism may occur. Enlarged glands may produce pressure symptoms and signs according to their position. Pyrexia is a constant symptom, and is very irregular. There is marked anæmia. The thymus may become enlarged and noticeable on percussion.

The disease may last from a few days to a few months. Emaciation, anæmia and asthenia are progressive; death takes place from asthenia, complicating hæmorrhage or coma. The prognosis is bad. Remissions have occurred, but the termination is always fatal.

Chronic Lymphoid Leukæmia. — *Symptoms.* The onset is very insidious. In this form all the symptoms mentioned under the acute may occur, but are generally less severe and the course of the disease is much more prolonged. It is marked by progressive pallor, emaciation, and pyrexial attacks at intervals. Remissions may take place and the disease drag on for years. In this form there is marked glandular enlargement; the cervical, axillary and inguinal are more commonly noticed, but enlargement of the thoracic, abdominal and pelvic glands takes place. The glands remain separate, soft and elastic. They retain their oval shape, do not infiltrate, and are rarely painful or tender. The spleen is constantly enlarged, sometimes to a marked degree. The thymus enlarges, as does the liver. The skin is dry and itches from urticaria. Lymphomatous nodules may appear on any part of the body, especially the face; there may be lymphodermia perniciosa. Hæmorrhages are not common except in acute exacerbations of the disease. Growths in the neighbourhood of nerves cause pain or paralysis. Deafness

may occur; lymphoid deposits may take place in the conjunctivæ and eyelids, also in the retina. Enlargement of internal glands causes pressure and other symptoms according to the site.

The prognosis is unfavourable. Death is due to interference with the functions of internal organs from pressure or infiltration, or from asthenia. After definite cachexia has become established the fatal termination is rarely postponed for more than a year. Acute exacerbations may occur at intervals, and one proves fatal.

The Blood in Lymphoid Leukæmia. The blood picture in the acute and chronic forms differs in degree rather than in kind. There is usually a marked anæmia. There is an absolute increase of *mononuclear cells*, the so-called "lymphoid" cells. These occur in two varieties, large and small, the large associated with the acute, the small with the chronic disease. The large cells are of the type of leukoblasts, and the smaller probably derived from the same source and less fully developed.

The ratio of whites to reds varies. The whites may reach anything from 30,000 to 900,000 per. c.mm.

Mononuclear or Lymphoid cells may total ninety per cent. or more of all leucocytes, small, large or intermediate sizes. *Polymorphonuclear neutrophiles* are absolutely and relatively diminished. *Eosinophiles* are rare. *Myelocytes* may be present in small numbers. *Basophile cells* scarce. *Erythrocytes* are diminished and may fall to 1,000,000 or less. They reveal changes common to all anæmias. *Normoblasts* are common, especially in acute cases. *Megaloblasts* are present in variable numbers. *Hæmoglobin* is decreased and falls below erythrocyte percentage with a low colour index. *Blood platelets* are said to be increased.

Diagnosis. This is based on the high leucocyte count with excess of lymphoid cells. The principal conditions resembling it are splenic anæmia in adult or child, myeloid leukæmia, lymphadenoma, chloroma, leukanæmia, general tubercular adenitis. In chloroma there are usually the growths in the head and other places. The blood picture reveals the true nature of the disease. Cases may be mistaken for severe purpuric conditions, for ulcerative or gangrenous stomatitis, enteric or other infections. The blood examination will decide the condition.

Treatment of Lymphoid Leukæmia. There are no known methods capable of hindering the progress of or curing the acute form of the disease. In the chronic form arsenic acts beneficially at first, but fails in relapses. Bone marrow does good occasionally; other organic extracts have failed.

X-ray therapy has been found beneficial in a few cases. The rays should be projected over the glands, bones or spleen. In acute cases they are not desirable and may prove harmful. Surgical interference may be necessary when the glands cause pressure symptoms, but only in the chronic form; the tendency to hæmorrhage must be remembered. Iodine may be useful applied over superficial glands.

R. J. M. B.

SPLENIC ANÆMIA

This term is used to denote a condition of idiopathic enlargement of the spleen with anæmia, but without enlargement of the lymph glands. The main clinical features are the splenic enlargement, chronicity, hæmorrhagic tendency, and anæmia of chlorotic type without leucocytosis, but more commonly leucopenia. Another type, described by Gaucher, often occurs in more than one member of a family, is associated with enlarged liver, less anæmia which comes on late, no marked special symptoms, and with a different pathological anatomy and pathogenesis; the histology of the spleen and bone marrow is described by Gaucher as "épithéliome primitif."

Splenic anæmia usually occurs in early adult life, in some cases it may be the survival of the disease in infancy. Males are more commonly affected. There is no real hereditary tendency, but it may occur in more than one member of the same family. There is sclerosis of the spleen, a variable amount of cirrhosis of the liver, and changes occur in the portal veins with calcification and stenosis. The superficial lymph glands do not enlarge, but there is some hyperplasia of the hæmolympth glands; the marrow may become foetal or lymphoid. The gastrointestinal tract shows few changes; there may be some sclerosis of the pancreas and kidneys. No cause for the disease is known, and it is not correlated with such diseases as malaria, syphilis, alcoholic cirrhosis of the liver and leukæmia. It is supposed to be due to an intoxication of unknown nature. It has been supposed that the spleen is primarily at fault, in view of the benefit derived from splenectomy; thrombosis and changes in the portal vessels are important factors, and some cases have followed abdominal traumatism.

Symptoms. These may be classified as (a) those due to the anæmia, and are the same as those from anæmia generally, *e.g.* loss of strength, palpitation, dyspnœa, headache, odema of the ankles, etc. (b) Those due to the splenomegaly, pain and dragging in the left side, with a feeling of distension. (c) Hæmorrhages from the nose, stomach and bowels; also from the gums, lungs, kidneys and uterus,

and in severe cases petechial hæmorrhages into the skin.

The skin and mucous membranes are pallid. Melanoderma is not uncommon. The spleen, easily palpable, may reach below the iliac crest, the abdomen is distended, and in a fair percentage of cases there is ascites. The liver may or may not be enlarged. There is usually fluctuation of the body temperature; it may become hectic in character, especially in the late stages. As the disease progresses there comes a terminal stage with cirrhosis of the liver, jaundice and ascites, at which period it has been termed Banti's disease.

Blood. The changes comprise loss of red corpuscles, the average count being 3,000,000, but it may fall below this. Corpuscular changes proportionate to the degree of anæmia occur; normoblasts, and occasionally megaloblasts, appear. "Blood crises" may occur. The hæmoglobin is low and the colour index below unity. Leucopenia is the rule, with a relative lymphocytosis. Rarely myelocytes may appear. Mast cells are sometimes increased, eosinophiles remain unaltered.

Diagnosis. This rests upon the extremely chronic course, some cases lasting over twenty years, the splenomegaly without definite cause, and the absence of a blood picture which appears in other diseases associated with splenomegaly, the absence of glandular enlargement, and the tendency to severe hæmorrhages. There may be difficulty in differentiating between syphilitic splenomegaly, thrombosis of the portal vein with splenomegaly, hepatic cirrhosis from alcohol and syphilis, and hæmochromatosis, which, however, is associated with glycosuria. Kala-azar presents the Leishman-Donovan bodies in the splenic blood.

Treatment. Medicinal treatment is not satisfactory. Iron is of doubtful value. Arsenic has not the same effect as in other anæmias and the leukæmias. The administration of perchloride of iron with chloride of calcium, along with intestinal antiseptics, has been found useful. Hepatic extract and bone marrow have been used with benefit.

Splenectomy has proved successful in several cases, in some has been curative, in others has prolonged life. When there is ascites other operative measures may be taken, with a view to establishing collateral circulation. Occasionally the exposure of the spleen to the X-rays has been followed by reduction of size and relief of pain. In one of my cases, when almost in *extremis* with ascites and general edema, the administration of pituitary extract was followed by restoration to health.

The general health should be sustained, and hæmorrhages should be treated on the usual lines.

R. J. M. B.

PURPURA

Purpura is a symptom of disease consisting of spontaneous extravasations of blood into the skin, mucous membranes and internal organs, with or without hæmorrhages from the mucous membranes. Purpura may and does occur in many conditions associated with altered blood states, or from mechanical interference with the circulation. It is seen in scarlet fever, measles, typhus, typhoid, variola, cerebro-spinal fever, plague, tuberculosis, septic infections, rheumatic fever, the leukæmias, chloroma, severe anæmias, hæmophilia, Hodgkin's disease, cirrhosis and acute atrophy of the liver, nephritis, infective endocarditis and other heart diseases, scurvy, syphilis and general cachexias. It may also occur as a result of absorption of poisons, lead, mercury, iodine, phosphorus, aniline, and benzol derivatives. Some diseases of the central nervous system, *e.g.* tabes, may show it. There are a series of purpuras which are less understood, and which arise spontaneously. These are the so-called idiopathic purpuras and comprise: Purpura simplex, purpura rheumatica, purpura hæmorrhagica, and Henoch's purpura.

Purpura Simplex.—Previous to the eruption there may be some constitutional disturbance, with throat and joint pains. The eruption appears as dull red, bright red, or purple spots, circular in shape, on different parts of the body. The spots vary in size from a pin's head to one-quarter or even half an inch in diameter. They do not disappear on pressure and are not raised above the surrounding surface. They fade in two or three days, leaving a brownish stain. They come out in crops, so that spots of different colour, from red through purple to yellow, may be present in the same patient. They mostly appear on the ankles and lower extremities, but may appear on the trunk and upper extremities to a less extent. Recovery usually takes place in two or three weeks.

Purpura Rheumatica (Peliosis Rheumatica or Schönlein's Disease).—It is doubtful if this condition should any longer be classified with the idiopathic purpuras, because of its close association with rheumatism.

In this form there is purpura, hæmorrhagic erythema or urticaria associated with rheumatism or arthritis, and it is accompanied by more constitutional disturbance than the preceding, with pyrexia, sore throat and occasionally endo- or pericarditis. It appears on the lower limbs and about the joints. At first the spots in some cases may be slightly raised above the surface (*P. papulosa*). Urticaria may be present, and occasionally vesicles and pemphigoid eruptions appear. Erythema nodosum

may be present. Brown discoloration follows the eruption. Anæmia, gastro-intestinal disturbance and albuminuria may be present. The condition is worse in the evening, and better in the morning. It is liable to relapse, may last many weeks, but is rarely fatal. When the purpura reaches to the buttocks, it may also appear about the elbow joints; the trunk and face are rarely affected. Exertion brings on an attack. When unaccompanied by arthritis at the time the condition may be followed by rheumatic fever at a later date.

Purpura Hæmorrhagica (Morbus Maculosus: Werlhof).—A more severe form than the preceding. In this condition not only are there cutaneous extravasations, but also hæmorrhages from the mucous membranes. It is more common in females and in comparatively early life. It develops quickly and begins with headache, gastric pain, vomiting and malaise, followed by extravasations into the skin and mucous membranes, with hæmorrhages from the latter. The extravasations are large, raised, reddish and purple, often oedematous and pitting on pressure. Any part of the body may be the seat of purpura. Vesicles and bullæ may form. The usual colour changes take place. There may be epistaxis, or buccal, gastric, intestinal, pulmonary and genito-urinary hæmorrhages. Anæmia rapidly appears. Constitutional disturbance is severe. Pyrexia may reach 104–105° F. Pains are frequent in the joints and limbs. Hæmorrhage into the retina and on the brain may occur. The condition may be fulminating and rapidly fatal, or it may last a few weeks. In favourable cases recurrences may take place every few days and recovery ensue after many weeks.

Henoch's Purpura.—The principal feature of this disease is the association of severe abdominal symptoms and arthritis with purpura. It may begin either with arthritis or abdominal symptoms, the latter comprising repeated attacks of severe colic, vomiting and mæna. The colic is intense, the abdomen tender; the vomiting severe, often bilious, but not often hæmorrhagic. Hæmorrhage may take place into the suprarenal capsules. The abdominal symptoms may be so severe as to suggest the advisability of laparotomy. Intussusception of the bowel has taken place. Hæmorrhage may take place occasionally from the nose, lungs or kidneys. Nephritis with albuminuria is often present. In addition to the purpuric extravasations there may be purpuric oedema, urticaria and exudative erythema. There is little or no fever. The attacks last a few days, and recur at intervals for weeks or months. There may be long intervals and the disease last for years. Children are more commonly affected, but the disease is seen in adults.

Iodic Purpura.—This form of purpura is generally confined to the lower extremities, and below the knees. It is similar to the ordinary eruption, but without pain or swelling. Iodide of potassium is responsible for it in most cases. Iodic acid causes it, but the tincture of iodine is said not to do so. As a rule the condition is mild, but the drug sometimes produces severe symptoms, with hæmorrhagic vesicles, bullæ, and necrosis of tissues. It may prove fatal, especially in children.

Diagnosis. Purpura is but a symptom and easily recognized; the underlying condition calls for diagnosis. It may simulate bruises or exudative erythema, in the latter, however, the colour fades on pressure. Specific infective fevers must be taken into account. Blood disorders associated with purpura, such as the leukæmias, especially the acute lymphoid, grave anæmias and chloroma must be settled by microscopical examination. In children the acute lymphoid leukæmia very often resembles it most closely. Scurvy is accompanied by brawny swellings and spongy bleeding gums, and there is a history of improper food with lack of fresh vegetables. Malignant sarcomatous growths may sometimes resemble purpura hæmorrhagica. The possibility of poisons must be remembered. In mild form the eruption may be mistaken for the petechiæ due to insect bites.

Treatment. All cases should be confined to bed. Nourishing food is required, especially in cases due to infection, or with cachexia.

Oil of turpentine in ten-minim doses is serviceable. Antifebrin has been advocated. Salicylates have little to recommend them. Adrenalin in association with liquor arsenicalis acts well in some cases. Calcium chloride or lactate in ten to twenty grain doses have been recommended, with the hope of increasing the coagulability of the blood; their action is open to doubt, and they are said to have no influence on the disease of the walls of the blood-vessels. Ergot and hamamelis have their advocates. Normal horse serum ought to be given a trial, as it has the reputation of lessening the hæmorrhagic tendency; it seems to act well in some cases in doses of 10–30 c.c. three or more times a day. In syphilitic cases iodides should be used with caution. Iron has been found useful in the form of sulphate or perchloride, and is certainly advisable to combat anæmia. The exhibition of arsenic is said to prevent recurrences.

The possibility and great tendency for hypodermic medication to cause serious local extravasations should be remembered. Local astringents may be applied to bleeding mucous membranes.

R. J. M. B.

HÆMOPHILIA

Hæmophilia is a condition depending upon a congenital defect in the coagulating power of the blood, and characterized by a tendency to severe and uncontrollable hæmorrhages, spontaneous or traumatic, occurring subcutaneously into the tissues, from mucous membranes, and by effusion into the joints. The condition is hereditary and may be transmitted for many generations. Atavism is through the female; daughters of “bleeders” remaining healthy, although they transmit the defect to their male children.

The diathesis is seldom transmitted through the male, even if he himself be a “bleeder.” The disease is seen in males, rarely in females, the latter even may or may not show excessive menstruation, but may show a tendency to post-partum hæmorrhage. Males generally die off before the usual age of reproduction. Women of bleeder families are usually prolific and beget large families.

Wickham Legg classifies the disease in three degrees. (1) Common in men, rare in women, with a tendency to every kind of hæmorrhage, spontaneous or traumatic, interstitial or superficial; (2) with spontaneous hæmorrhage from mucous membranes only; (3) with spontaneous ecchymoses only, occurring in women of bleeder families.

Hæmophilia manifests itself usually before the second year of life. It occurs in all classes and in people of varied physique. It takes on a peculiar periodicity, especially in spontaneous hæmorrhages and articular effusions, generally associated with periodic and coincident lessened coagulation power. The incidence is often nocturnal, and this tendency applies to both spontaneous or traumatic hæmorrhages.

A spontaneous attack is often heralded by prodromal symptoms, such as irritability, a general feeling of fullness and headache, with a sensation of fullness about the joints; in some cases there may be a partially comatose state.

Symptoms. Attention may be first drawn to the condition by the appearance of subcutaneous extravasations or bruising from the most trivial cause; or a slight cut being followed by uncontrollable hæmorrhage.

Spontaneous Hæmorrhage may take place from any mucous membrane, the most common being epistaxis, which may prove fatal in twenty-four hours; or bleeding from the gums; less commonly from the lungs, stomach, bowels or kidneys. The hæmorrhage is a capillary oozing, so slow that large clots may form, fill or protrude from the mouth or nose. Putrescence of these and of swallowed blood causes distressing symptoms.

Traumatic Hæmorrhage may result from

blows, cuts, scratches or such-like injuries, and the blood be effused into the tissues or flow externally, trivial injuries producing alarming hæmorrhages. Small operations like tooth extraction, circumcision or venesection may prove fatal. Certain parts of the body in certain hæmophilics bleed more easily than others.

Joint Affections.—Articular effusions, with swelling, occur in all cases, particularly associated with exercise, and may show themselves in children on their first attempts at walking. They, however, may come on spontaneously. The fluid may be lymph or blood-stained. Repeated effusions tend to leave residual organization, which forms adhesions, with partial or even complete ankylosis. The knees are most commonly affected, next the ankles and elbows. As age advances the tendency to articular effusion lessens. The joint effusions are painful and accompanied by fever. Hæmophilics may exhibit capricious appetites, with strange depravity, some being (instinctively) lime-eaters: chilblains and urticaria are not uncommon. A serious characteristic of these people is dental caries. Rheumatic affections of the muscles and trigeminal neuralgia are occasional complications.

Diagnosis. The family history is most important. The marked tendency to multiple spontaneous or traumatic hæmorrhages, of a persistent character, associated with recurrent joint effusions, point definitely to hæmophilia. The diagnosis from purpura is not difficult as a rule; the subcutaneous ecchymoses of hæmophilia are not of the same deep purple colour as purpura. They are, as a rule, subcutaneous, as contrasted with the periosteal extravasations of infantile scurvy, and there is absence of implication of the gums, **nor is there any** deficiency of blood alkalinity. The extravasations of hæmophilia are associated with local swelling, which is not usual in purpura.

Prognosis. The danger to life is proportionate to the age; in the young it is great, as age advances the danger lessens. In all cases the outlook is unfavourable, from the probability of fatal results or chronic invalidism.

Treatment. As prophylaxis is important, it should be a rule that daughters of bleeders should not marry, or if they do so, they should not bear children.

Efforts should be made to guard members of hæmophilic families from even the slightest injury. All operations, however slight, should be avoided. When periodic attacks occur, the administration during the prodromata of a saline purge, such as sulphate of soda or magnesium, is useful, with the administration of lime salts, such as the chloride or lactate. Rest is essential. When hæmorrhage has taken place, the more hopeful measures for its control are the administration of thymus gland, up to 100 gr. daily, internally; and the local application of a solution of the dried extract, or fresh extract of the gland.

Calcium and magnesium salts together are useful internally, and the inhalation of carbonic acid gas is a valuable agent in increasing the coagulability of the blood. The administration of fresh serum (horse) by the mouth or by injection may be of value. The exhibition of the tincture of perchloride of iron in half-drachm doses every two hours has been advocated by Legg, with a purge of sulphate of soda. Preparations of suprarenal gland may be found useful in some cases. Gelatin in five per cent. solution has been advocated.

During the intervals, iron and arsenic are useful to combat the anæmia, and probably the exhibition of thymus gland may be found useful to prevent recurrence. Other styptics and mechanical measures for controlling hæmorrhage may be used. Joints, when affected, should be kept at absolute rest. R. J. M. B.

DISEASES OF THE SPLEEN, THYMUS AND LYMPH GLANDS

DISEASES OF THE SPLEEN

PRIMARY diseases of the spleen are uncommon. The majority of splenic disorders are associated with disease elsewhere, and are secondary in nature.

Variations in Size and Shape.—The spleen is an organ the architecture of which permits of considerable variation in size. The alteration is nearly always towards enlargement. Enlargement may be acute or chronic, the acute being generally associated with acute infections, especially typhoid, typhus, relapsing and malarial fevers, pneumonia and pyæmia. It also occurs as a result of embolism.

Chronic enlargement is most commonly associated with liver or heart disease, and in children with syphilis and rickets, tubercle or splenic anæmia. The principal conditions in which the spleen is chronically enlarged are cardiac disease, cirrhosis of the liver and portal congestion, lardaceous disease, leukæmia, splenic anæmia, Hodgkin's disease, erythræmia, chronic malaria, new growths and parasitic or other cysts.

The shape does not alter much when the enlargement is general, the notches may alter and the organ elongate. Accessory masses of splenic substance may occur in the neighbouring peritoneum, and are known as spleniculi.

Atrophy of the spleen is met with. It may be congenital, or is more commonly cirrhotic in nature, or due to syphilitic contraction of the fibrous capsule. A small hard spleen is met with in some forms of chronic cardiac disease.

Movable or "Wandering" Spleen.—This condition is usually found in women with lax abdomen and enteroptosis. Its position may vary from just below the ribs to the pelvis. It is due to relaxation of the ligaments; the organ may or may not be enlarged. It has followed injury, and pregnancy has been stated as a cause. Displacement may be congenital, and associated with transposition of viscera. It gives rise to symptoms of dragging and pain, in some cases torsion of the pedicle may give rise to serious symptoms, with pyrexia and necrosis. The treatment consists in keeping the organ in position by means of a well-fitting belt and pad; or, if necessary, splenopexy or even splenectomy.

Active Congestion and Inflammation.—The spleen undergoes a physiological vascular engorgement during digestion. Acute swelling occurs during infective processes with bacterial invasion. There is marked hyperæmia, cell proliferation and even necrotic cellular degeneration. The organ is soft and easily torn, it may be palpated, and is tender on pressure. If associated with aortic regurgitation it may pulsate.

Passive Congestion and Induration.—Chronic venous congestion produces enlargement and induration, the shape is usually maintained. This condition is met with in mitral disease and in dilatation and hypertrophy of the right ventricle; it is common in cirrhosis of the liver with portal obstruction, and in thrombosis of the portal vein. The organ becomes enlarged, there is hyperplasia of the trabecular tissue, the pulp is diminished and the venous sinuses are dilated and filled with blood.

Splenitis and Perisplenitis.—Acute congestion and inflammation may pass on to abscess formation, but this is extremely rare. Accompanying splenitis there may be inflammation of the capsule and perisplenitis, resulting in adhesions to the abdominal wall or adjacent organs.

Infarctions and Abscess.—Emboli in the splenic arteries may be either benign or infective. Benign infarcts are derived from the cardiac valves or thrombi in the cavities, especially in mitral stenosis. The infective are seen most often in ulcerative endocarditis and septic conditions. They may also arise from thrombi in the splenic veins. They form conical masses, and may occupy a large area. The septic infarcts may result in abscess. The symptoms are those of enlargement, sudden pain, tenderness and occasionally friction on auscultation over the spleen.

Lardaceous Disease.—This change affects the vessels and Malpighian follicles. In the "diffuse" form, or "bacon spleen," the organ is uniformly smooth and retains its original shape. The change takes place in the vessels and pulp. In the so-called "sago spleen," which is the more common, the Malpighian bodies are affected and the organ is speckled with granules or masses. Tincture of iodine produces a mahogany colour in the waxy material. There is generally lardaceous degeneration of other viscera in association with the splenic change.

Tuberculosis.—In acute miliary tuberculosis the spleen may be profusely studded with tubercles without causing any enlargement. The capsule also may be infiltrated. Occasionally masses of caseous tubercle are found, of a bright yellow colour.

Actinomycosis.—Nodules and abscesses due to actinomycosis are sometimes seen, but they are very rare.

Syphilis.—The spleen is often enlarged in congenital, but also in acquired syphilis. Gummata may be present, but they are rare. Lardaceous disease of the organ is present in advanced syphilis. Syphilis may attack the capsule, forming large plates of cartilaginous consistence. The capsule may contract and cause shrinking of the organ.

Leukæmia.—In the leukæmias the spleen enlarges and in the myeloid form may reach to the pelvis. The condition is associated with characteristic blood changes, anæmia, a tendency to hæmorrhages, diarrhoea and ascites. Infarcts are common; they are painful and tender.

Lymphadenoma.—The organ is not very much enlarged; it is due to lymphadenomatous deposits; and associated with glandular enlargement and paroxysmal pyrexia.

Erythræmia.—The spleen may attain a great size, and the condition is accompanied by cyanosis and increase in the number of erythrocytes.

Malarial Spleen.—The organ is large, hard and smooth. There is a history of malarial infection. There is anæmia and failure of strength; malarial parasites may be found in the blood.

Neoplasms.—These are rare, benign, and primary tumours exceedingly so. Secondary deposits of carcinoma or sarcoma may be found, or the organ may be infiltrated directly from adjacent malignant growth. Fibromata occur in the capsule. Malignant growths are recognized by the irregular enlargement they produce, pain, cachexia and their presence elsewhere.

Cysts.—Serous, hæmorrhagic, and dermoid cysts are occasionally found; they may simulate hydronephrosis.

Hydatid Cyst is very rare; it may form a

large tumour, with palpable fluctuation and thrill. The fluid, if drawn off, reveals the nature of the tumour.

Rupture.—This has been known to take place in typhoid and malarial fevers. It generally follows trauma. Occasionally it may result from rupture of an infarct or abscess. It causes severe hæmorrhage into the peritoneum and calls for surgical treatment.

Diagnosis of Splenic Enlargements. There are three characteristics of enlargement: the splenic notch on the anterior border, movement on respiration, and dullness on percussion without colon in front. Generally the outline is that of the spleen; it is mobile on bimanual palpation and the surface is smooth. The flank remains resonant. These features generally differentiate it from other conditions.

In addition the nature of the enlargement is decided by the general examination of the patient and the examination of the blood. In acute conditions the organ may be tender on palpation and give rise to pain in the left side.

Treatment. The treatment of splenic disease is that of the general disease of which it forms a part. In some rare instances splenectomy is called for; abscesses and cysts may require surgical interference. R. J. M. B.

DISEASES OF THE THYMUS GLAND

Persistent Thymus.—The weight of the thymus gland at birth ranges from five to fourteen grammes. It increases in size up to the age of two years, when it is mature, remains the same until the eighth to twelfth year, after which it undergoes rapid wasting, and at twenty years of age it is merely a fatty remnant, containing, however, vestiges of the gland structure. Occasionally, however, the thymus may persist even until late in life, and may be recognized clinically by an area of dullness along the left border of the sternum from the second to the fourth ribs.

Hypertrophy of the Thymus.—There is hyperplasia of the gland structures. Cases have been recorded where the gland has weighed as much as six and even eleven ounces. Enlargement has been frequently found associated with exophthalmic goitre; occasionally in myxœdema of infants, in epilepsy, acute leukæmia and Addison's disease. In lymphoid leukæmia it is usually enlarged, frequently in lymphadenoma. It has been noted in cases of myasthenia gravis and amyotonia congenita. Enlargement occurs in acromegaly. Thinness and even aneurysmal dilatation of the aorta have been found associated with persistent or enlarged thymus.

Status Thymicus, Status Lymphaticus or Lymphatism.—This extraordinary condition, which

is so often associated with sudden death, is accompanied by enlarged thymus. Two groups of cases are recognized: (1) In which infants have been found dead, or after unexpected dyspnœa have died in a few minutes. This is regarded as the result of pressure by the gland on the pneumogastric, great vessels or trachea. (2) Occurring in adults, whose sudden death has occurred under anæsthesia, while bathing, or with exertion, excitement or slight accident. In exophthalmic goitre sudden death has been attributed to enlarged thymus. In the true status lymphaticus there is a general hyperplasia of lymphoid tissue throughout the body, with enlarged spleen.

Thymic Asthma.—From the pressure of the enlarged thymus on surrounding structures in infancy respiratory disturbance is produced, with dyspnœa, stridulous breathing, cough, cyanosis, convulsions and swelling of the veins of the neck. The condition is known as thymic asthma, Kopp's or Millar's asthma. The attacks are liable to recur at intervals, and death may take place during one. They have been regarded as laryngismus stridulus, especially by continental clinicians. There are, however, cases of true laryngismus unassociated with enlarged thymus, especially in rachitic children.

Diagnosis. It may be possible to diagnose the enlargement by percussion over the manubrium sterni. The enlarged gland has been revealed by X-ray examination.

Treatment. The enlarged gland has been successfully removed in part or whole for relief of pressure symptoms. X-ray exposures have done good. Antisyphilitic remedies have been advocated.

Atrophy.—Fibrous atrophy of the gland occurs in wasting diseases of children, and it has been supposed that the general body wasting is dependent upon the lack of internal secretion of the gland. Congenital absence of the organ has been noted.

Inflammation.—Acute inflammation has occurred in rare instances, and may proceed to suppuration; it may result in acute mediastinitis, or the abscess may burst into the trachea. The condition may cause local pain and tenderness, pressure symptoms, dullness on percussion, with fever.

Other Morbid Conditions.—Tuberculosis may be miliary, fibro-caseous or cause abscess. It is rarely primary. Congenital syphilis may cause fibrosis or gummata, and cystic spaces containing puriform fluid have been found, but are regarded as post-mortem formations. Petechial hæmorrhages are not uncommon in infants, but extensive hæmorrhage may occur. Foci of necrosis have been found in diphtheria. Concretions and calculi have been found in the gland.

Tumours.—Benign tumours are very rare; adenoma, cystoma and fibroma have been noted. Malignant growths comprise sarcoma and carcinoma, and a mixed cell type called thymoma.

Sarcoma and lympho-sarcoma are more common than carcinoma. They may be the origin of mediastinal tumours. The symptoms depend upon the size and extension, and comprise cyanosis and oedema of the face, exophthalmos, dyspnoea, stridor, cough, aphonia, tachycardia and local dullness on percussion. Sarcoma produces metastases in distant organs. There may be pleural effusion.

If the tumour protrude through an intercostal space and be vascular, it may pulsate.

R. J. M. B.

DISEASES OF THE LYMPH GLANDS

The lymph glands act as a barrier between the tissues and the blood stream; they seize upon solid particles foreign to the body, *e.g.* carbon, they remove abnormal or excessive amounts of products of metabolism, and they prevent the access of products of local inflammation to other parts of the body. The lymphatic glands may become irritated or inflamed from one or other of these causes, they may be attacked by an inflammatory process by the medium of the blood, similarly to any other organ, and they are subject to the same degenerations. Their relations to tumours are peculiar, in that as well as being attacked primarily they have a special function in regard to those forms of malignant growths which tend to spread by the lymphatic system.

Inflammations of the Lymph Glands (Lymphadenitis).—The causes are: (1) toxic, such as may be seen in the local swellings of lymph glands draining muscles that have been used to excess, (2) trauma, (3) bacterial invasions. A general enlargement of the lymph glands, due to infection by the blood stream, is seen in German measles, measles, scarlatina, diphtheria, chicken-pox, influenza, plague, and many other acute diseases; of chronic diseases syphilis, tuberculosis, trypanosomiasis are the most important.

A local lymphadenitis is usually an infection by the lymphatics draining into the glands, the vessels themselves being reddened and thickened in some cases. Practically without exception, all local infections give rise to swelling and tenderness of the lymph glands guarding the efferent lymph channels; a septic finger, an infection by anthrax, glanders, vaccination, etc., will cause a swelling of the epitrochlear and axillary glands; a tonsillar abscess or other throat affection will cause the cervical glands to swell; inguinal adenitis follows infection of the

genitals or of the lower limb. Local lymphadenitis is especially common in tuberculosis.

The course of such inflammations varies with the virulence of the infection and the condition of the subject; the gland may rapidly break down and form an acute abscess, it may remain swollen for a few weeks and then subside, or it may remain swollen for a number of years and finally either break down or become calcified.

Tumour Formation and the Glandular System.

—Tumours of lymph glands may be either primary or secondary; the primary forms vary from a benign lymphoma through gradual degrees to lymphosarcoma of great malignancy. There is no clinical distinction between the milder forms of lymphoma and Hodgkin's disease. These primary tumours may be separated into two, according as there are or are not leukæmic changes in the blood, the first being lymphatic leukæmia, the second being either generalized or localized lymphocytoma. These tumours, even though very malignant and histologically sarcomata, spread for the most part by the lymph channels, though, in the later stages of the sarcomata, hæmorrhages indicating spread by the blood stream may be present. The glands may be simultaneously attacked in several different regions of the body, or, beginning in one region, they may spread successively to others. While in secondary infiltration of the glands, as, for instance, by carcinoma or epithelioma, they may be hard and discrete, in the primary affections they are often not to be distinguished from glands affected by inflammatory processes, being soft, bound together in bunches adherent to the skin, or soft even to fluctuation. Ulceration may occur. Pressure symptoms are almost invariable. Even with tumours of moderate malignancy, especially the primary ones, the patient may retain his general nutrition to a remarkable degree and cachectic symptoms may be absent. A generalized or localized benignant tumour may suddenly assume great malignancy.

The General Diseases Primarily Affecting the Glands.—(a) **Glandular Fever.**

This is an infectious form of general glandular enlargement with fever, affecting children. There is slight redness of the throat, and the glands specially affected are those behind the sterno cleidomastoid; the glands may reach the size of a goose's egg and are usually very tender. There is obstinate constipation. The fever does not last long, but the glandular swelling persists from ten days to three weeks. No rash has been observed. When the tracheo-bronchial glands are enlarged there is thoracic discomfort and paroxysmal cough, and enlargement of the abdominal glands causes tenderness and swelling. The disease usually ends favourably, though often leaving the patient anæmic and

debilitated; suppuration of the glands, acute otitis media, retropharyngeal abscess and nephritis may be complications. It often occurs in epidemic form and is more prevalent between October and June. Small doses of calomel (gr. $\frac{1}{10}$ to $\frac{1}{12}$) is the only treatment that can be recommended.

(b) **Generalized Tuberculous Lymphadenitis** is a rare but important cause of general lymphatic enlargement. There is persistent high fever, lasting many months, and great enlargement of the glands in all parts. No other system may be affected except secondarily from the glands. It is impossible, except by histological examination of an excised gland, to distinguish it from Hodgkin's disease. In children groups of glands may be involved successively and give the picture of the generalized form.

(c) **Hodgkin's Disease** is treated separately elsewhere. It is sufficient to say that there is a progressive enlargement of the lymphatic glands, usually beginning on one side of the neck, and extending to those of the thorax and abdomen. The spleen is large and sometimes the liver. The patient suffers from bouts of fever, a secondary anæmia, and later cachexia; pressure symptoms from the enlarged glands are common. The disease is usually chronic, lasts two to three years and is seldom cured; acute cases with early death are reported. The structure of the glands is distinctive.

(d) **Status Lymphaticus (Lymphatism)** chiefly affects children and young adults below twenty; the lymphatic glands are moderately enlarged throughout the body, the spleen and thymus are large and the bone-marrow hyperplastic. The disease seldom gives any recognizable symptoms beyond a slight anæmia or debility not sufficient to cause the patient to seek advice. The subjects of this condition are especially liable to sudden death, sometimes without obvious cause or during the early stages of anæsthesia, or following a prophylactic injection of diphtheria antitoxin. Post-mortem, the glands are enlarged, but only to a slight degree, and fleshy, and the thymus is distinctly large and fleshy. Diagnosis of the lymphatic constitution is difficult, because a small amount of glandular enlargement, especially of the tonsils and cervical glands, is so common in children. Dullness over the sternum may be detected. The complexion is often pale and the patient flabby.

(e) **Still's Disease** consists of a generalized arthritis, together with enlargement of and pain in the lymphatic glands. It affects children up to seventeen or eighteen. It is very chronic and partakes of the features of certain forms of chronic arthritis of adults, with moist skin, anæmia, slight temperature and much enfeeblement. Many authorities consider that Still's

disease is the same disease as chronic arthritis of adults, the glands being affected by reason of the greater development of lymphatic tissue in the young.

(f) **Generalized Lymphoma.**—The glands may be attacked simultaneously or successively. The course may be slowly progressive, with hardening and enlargement of the glands, or the glands may enlarge quickly, with tenderness, pain, fever and the ordinary symptoms of an inflammatory affection. The disease may be limited for many months to the lymph glands, but the more malignant forms quickly spread to the neighbouring organs, infiltrating especially the liver, lungs, bone-marrow, kidney and spleen.

General Diagnosis. The origin of a glandular affection, especially if inflammatory, is often patent after a careful examination of the patient. Careful search will often reveal a focus of disease drained by lymphatics which lead to the glands affected, and the treatment of such focus, whether surgical or otherwise, will be followed by subsidence of the glands. Localized glandular enlargement will strongly suggest tuberculosis, but it is important to point out that many of the so-called tuberculous enlargements of glands owe their origin to chronic streptococcal and other infections, therefore all possible foci of glandular infection should be treated before making such a diagnosis. A blood examination will confirm a suspicion of lymphatic leukæmia, and suggest Hodgkin's disease if there be a secondary anæmia and a slight leucocytosis. The excision of a small superficial gland is amply justifiable when there is a suspicion of malignant disease, and it will confirm the diagnosis of Hodgkin's disease, tuberculosis, and possibly other infections, such as by a streptococcus. Puncture of the glands is specially to be recommended when plague or trypanosomiasis is likely. Of specific reactions, tuberculin is valuable in afebrile affections; .001 c.c. of old tuberculin should be injected subcutaneously, and if no reaction, .002, .005 and even .01 at intervals of three days each. The Wassermann test can be made on a suspicion of syphilis. The X-rays give valuable information when the disease is intrathoracic or abdominal.

Cervical lymphadenitis is especially common in children. Sore throat, infections of the nose, pharynx, tonsils, larynx, gums, lips, face, scalp, alveolar abscesses, carious teeth, and eczema of the skin are some of the conditions which give rise to it. The glands immediately draining the part are those first affected, but later there is spreading. Suppuration frequently occurs, and may be difficult to detect if it lies beneath the sterno-mastoid. Retropharyngeal abscess may complicate matters. **Ludwig's angina** is a

cervical or pharyngeal cellulitis following acute adenitis, and is almost always streptococcal. The more chronic forms may be due to infection by attenuated forms of the suppurative organisms or from tuberculosis, syphilis and other chronic infections. They have to be distinguished from the enlargement due to Hodgkin's disease, lymphosarcoma and acute lymphatic leukaemia. **Tuberculosis** of the cervical glands occurs in two forms, (a) numerous shotty glands felt in nearly all regions of the neck, seen especially in weakly children of the poorer classes, (b) a localized swelling of several glands in one region, bound together by periglandular fibrosis. **Syphilitic adenitis** is usually of the generalized form in the secondary stage; gummata of the lymphatic glands are very rare. **Hodgkin's disease** or one of the tumours may begin in the cervical region of one or both sides. It is well when there is any suspicion of these to have a small gland removed for examination.

The Axillary Glands.—The axillary glands drain the lymph from the arm, the mammary gland, the side of the chest and upper part of the abdominal wall and from the back, and they communicate also with the deep cervical lymphatics. Enlargements due to infective conditions in the arm, pleura, or mamma, malignant extension from the mamma or pleura, and occasionally primary tumours are those commonly seen.

Tracheal and Bronchial Lymphadenitis is always present in acute infections of the respiratory tract; the enlargement subsides during convalescence, though occasionally tuberculosis may develop later. Tuberculosis affects these glands, frequently beginning as an infection from a deep gland, whether from abdominal or thoracic entry cannot always be ascertained, with subsequent extension to the upper glands, and often to the neighbouring portion of the lung. Caseation is often present, but a fleshy enlargement of numerous glands is not inconsistent with extensive tuberculosis of the glands themselves and the connecting lymphatic vessels. The symptoms are: (1) cough, often paroxysmal and simulating whooping-cough, due to irritation of the respiratory branches of the vagus; (2) venous obstruction, a very common symptom, seen in enlargement of the thoracic, cervical and dorsal venules, one or both of the jugular veins, which normally cannot be seen, are found not to collapse in the upright position or readily in deep inspiration; (3) loss of appetite and anæmia. If the enlargement is greater, so as to cause serious pressure symptoms, then dyspnoea, dysphagia, stridor, bronchial stenosis and cyanosis may be seen. Malignant affections of the bronchial glands are usually confined to one side, causing stenosis of the

bronchus, dullness, loss of breath sounds, etc. The tumour, starting in one of the mediastinal glands, spreads towards one or other side along the lymphatics of the bronchi, implicating the glands on its way. The X-rays often give a very decisive picture.

Mesenteric Glands.—Acutely inflamed glands cause severe gastritis and enteritis; they cannot always be discovered on examination. In the tuberculous affection the patient may be anæmic, badly nourished, and the abdomen distended and tympanitic. There is fever, but the glands cannot easily be felt because of the distension. The peritoneum may become affected by direct extension, the glands may enlarge and caseate, or they may become fibrosed or calcified. These glands may be the only ones affected, often in association with pulmonary tuberculosis. The affected glands may form large tumours. Old tuberculous glands in the mesentery may give rise to obstruction by bands or from a volvulus, or to pain sufficiently severe to require removal of the glands. At the same time it is certain that many such enlargements give rise to no serious symptoms, as do tuberculous glands elsewhere. Malignant disease of these appears as a growing bunch of enlarged nodules affecting the neighbouring glands in all regions, giving rise frequently to pressure symptoms.

Inguinal and Femoral Glands.—The commoner conditions are associated with disease in the external genitals or inflammatory lesions of the lower limbs. Painful swelling of these glands often appears after excessive walking or running. Local tuberculous enlargement is not very common.

Treatment. In the milder local inflammatory conditions, even tuberculous, it will suffice to eradicate all sources of infection and to give attention to general hygiene. The tonsils and teeth in cervical adenitis are especially liable, without thorough antiseptic dressing, to harbour a focus by which infection can enter. If the swelling fails to disappear or lessen in a few weeks, removal should be advised if the gland is accessible to the surgeon, if not, a more prolonged course of careful hygiene and good feeding will be necessary. Of the general glandular infections specific treatment might be advisable in tuberculosis by giving tuberculin if there were no marked fever, beginning with .001 c.c. P.T.O., working up to 1 c.c.; and doing the same in successively larger doses with P.T. and old tuberculin. Inflammations and even tumours not to be treated otherwise might be improved by arsenic, which is given with considerable benefit in Hodgkin's disease and leukaemia. It may be given either as Fowler's solution or hypodermically in doses of three-quarters of a grain of sodium cacodylate per

diem. Localised bunches of glands due to tuberculosis, Hodgkin's disease, or primary or secondary carcinoma should be removed as completely as possible by the surgeon. The

X-rays do some good in otherwise inoperable malignant enlargements of the glands.

W. O.
A. G. G.

DISEASES OF THE ALIMENTARY TRACT

DISEASES OF THE MOUTH AND SALIVARY GLANDS

Oral Sepsis.—After a period of undue neglect, there is a tendency to-day to exaggerate the importance of oral sepsis in the production of many diseases of hitherto unknown causation. But after allowing for all such exaggeration it must be admitted that oral sepsis is an important factor in various forms of gastritis, grave anæmias, chronic diseases of joints, and pulmonary complications after operations. Carious teeth, pyorrhœa alveolaris, suppuration beneath dental plates and accumulations of tartar are the chief starting-points. Pyorrhœa alveolaris is produced by inflamed and infected granulation tissue between the teeth and gums, followed by retraction of the gums and exposure of the denture below the enamel, with consequent periostitis and its sequels. In the numerous crypts thus formed anaerobic bacteria multiply, protected from the air by concretions of tartar. The pus formed is swallowed or absorbed by the neighbouring lymphatics.

The dental surgeon can aid in oral hygiene by scaling, filling and extraction, but plates and bridges must be looked upon as potential sources of infection. Naturally the use of the toothbrush with some antiseptic powder night and morning will be enjoined. Mouth washes should be used freely, such as potass. chlorat. gr. xv, alum gr. v, tinct. myrrhæ ℥ x, aq. camph. ad 3 i, or sp. chlorof. ℥ xl, tinct. cocci ℥ xx, sp. vini. rect. 3 i, salol to saturation, a few drops of this solution to be added to an ounce of water. Dilute hydrogen peroxide is of great service. In more severe cases the line of suppuration should be swabbed with strong hydrogen peroxide, which can also be injected into deep-seated pockets. A rather drastic method in obstinate cases is to dip a small swab of cotton-wool round a wooden match into formalin and rub this over the affected area. It is advisable to cocaine first and only to treat a small area at a time.

Stomatitis—

1. **Acute**—the result of various irritants, such as tobacco, strong alcoholic drinks, food which is too hot or too highly seasoned, or associated with dentition or dyspepsia. The mucosa is swollen and red, the tongue indented by the teeth, the saliva thick and the sense of taste

impaired, mastication is painful and the breath may be offensive.

Treatment. Chlorate of potash internally is beneficial in nearly all inflammations of the mouth, as it is excreted again by the salivary glands. Hæmaturia or hæmoglobinuria has followed its indiscriminate use. This result is less common than it used to be; possibly the drug is prepared in a greater state of purity. Locally boroglyceride, diluted, is preferable to mel boracis, which forms a culture medium for organisms. If the condition tends to become chronic, silver nitrate solution (three grains to the ounce) may be applied.

2. **Aphthous.**—Small, slightly raised, white plaques starting as vesicles and surrounded by a red areola, occur most commonly in children. The condition is distinct from thrush and usually depends on some constitutional condition which calls for attention. The local treatment is the same as for acute stomatitis.

3. **Mycotic (Thrush).**—White patches produced by the *oidium albicans* form on the tongue and inner margins of the lips in debilitated children, and occasionally in old or very cachectic people. The mouth is dry. The patches can be removed by rubbing. It is infectious and may be conveyed by dirty feeding-bottles or comforters. Alkaline mouth washes should be used, as thrush thrives in an acid medium. Chlorate of potassium should be given internally.

4. **Ulcerative**—secondary to carious teeth, pyorrhœa or poisoning with mercury or phosphorus. It starts round the teeth, the gums swell and ulcerate, receding from the teeth, which loosen and may drop out. Caries of the bone may occur, and I have seen perforation of the hard palate. The neighbouring lymphatic glands swell. Mastication is very difficult and there is much fœtor. Chlorate of potash internally is specially useful. A mouth wash of a dilute solution of permanganate of potash or of hydrogen peroxide (five volumes per cent.) should also be given.

5. **Gangrenous (Cancerum Oris)**—a rapidly spreading gangrene, usually starting on the inside of the cheek, in debilitated children, generally after measles. A small ulcer is seen, surrounded by a leaden-coloured brawny swelling. The skin over it is glazed. The fœtor is characteristic and extreme. The child appears very ill. Prompt scraping away of the affected part and application of pure carbolic acid to

the edges is the most effective treatment, combined with nourishing food and stimulants.

Salivary Glands—

Alterations of Secretion.—The parotid gland normally secretes a watery saliva, the sublingual a very viscid saliva, while that of the submaxillary is intermediate. The drier the food the more watery the saliva and the more mastication required. The normal amount is about 1500 c.c. in the twenty-four hours. The reaction is alkaline, but may become acid in some forms of dyspepsia, gout and diabetes, probably from microbic infection. Sugar may be found in diabetic saliva, or urea in uræmia.

There may be apparent increase in the amount of saliva from difficulty in swallowing, as in tonsillitis or bulbar palsy. True increase (sialorrhœa) may be due to (1) *nervous causes*, such as epilepsy, hysteria, Graves' disease, paralysis agitans, tabes (in crises), chorea, and lesions of the chorda tympani nerve; (2) *digestive causes*, stomatitis, nausea and in hyperchlorhydria, where the saliva is poured out in gushes (to which the name pyrosis strictly applies) in the vain attempt to neutralize the excess of acid; (3) *reflex causes*, such as pregnancy, when it may be the precursor of pernicious vomiting; (4) *toxic causes*, e. g. mercury, potassium iodide and uræmia.

Diminution of secretion occurs when much fluid is being lost elsewhere, and in fright. Xerostomia, persistent dry mouth from suppression of the secretion, is a very obstinate affection due to disturbance of the nervous centres. *Treatment*: small doses of pilocarpine and the galvanic current.

Diseases of the Salivary Glands.—The parotid gland is more liable to disease than the others. The enlargement of the socia parotidis below and in front of the ear gives a characteristic aspect. (For specific parotitis—mumps, see *Infective Diseases*.)

1. **Parotitis from Ascending Infection** may occur under many conditions, which have one feature in common, a dry dirty mouth. Pneumonia, typhoid, typhus, cholera and cachectic states are examples. Rectal feeding is a common cause. Ascending infections may also be secondary to salivary calculi, stomatitis and hemiplegia, from accumulations in the paralysed side of the mouth. The gland is tender and swollen, the skin over it stretched, shiny, and slightly red. There is some oedema round the edge of the gland. Not infrequently suppuration follows, as indicated by fluctuation, more reddening and a hectic temperature.

Treatment. Prophylaxis by frequent cleansing of the mouth with dilute permanganate of

potash solution must be diligently practised in conditions where parotitis is likely to occur. Glycerine should not be employed in the mouth wash as it leads to subsequent desiccation. Where the patient's condition permits, the salivary glands should be kept active by giving bismuth lozenges, "thirst-quenchers" or acid drops. When parotitis has occurred hot fomentations should be applied. If suppuration follows the gland must be incised.

2. **Tuberculous Parotitis** is very rare.

3. **Toxic Parotitis.**—(a) *Lead.* This only occurs in chronic lead poisoning. It is slow and insidious, starting first on one side, but ultimately becoming symmetrical. It is not painful, only producing a feeling of tension and a difficulty in turning the head. The lobulations of the gland may be felt. The swelling is mobile, and not attached to the overlying skin, which is unaltered. The mouth is dry if the duct becomes stenosed, otherwise there is salivation and fœtor. Occasionally there is compression of the seventh nerve as it passes through the gland, causing some facial paralysis. The condition is aggravated by mercury or potassium iodide. It may be complicated by an acute ascending infection. The diagnosis is made by the other signs of plumbism, the insidious onset and bilateral distribution. The treatment is that of plumbism, with careful attention to the teeth and gums. Five to fifteen grains of cryogenin ter die has been recommended.

(b) *Iodine.* Parotitis may be caused by iodide of potassium or iodine. The onset is very rapid, with coryza, lachrymation and redness and swelling of the pharynx. It is often said that if the dose is increased these symptoms may disappear. Cushing doubts the truth of this. Prompt recovery follows cessation of the drug.

(c) *Copper* resembles the parotitis of lead poisoning, but the line on the gums is green.

(d) *Mercury.* This is really an ascending septic parotitis following mercurial stomatitis.

4. **Mikulicz's Disease.**—A chronic symmetrical inflammation of the salivary and lachrymal glands. There is sometimes general hyperplasia of the lymphatic glands. The condition may arise in leukæmia or tuberculosis. Pfeiffer recommends treatment by X-rays.

For salivary calculi and new growths of the salivary glands see surgical section.

W. L. B.

ŒSOPHAGUS

For Diseases and Examination of the Œsophagus the reader is referred to the Surgical Section.

DISEASES OF THE STOMACH

ACUTE GASTRITIS

I.—Acute Catarrhal Gastritis

Etiology.—Acute catarrhal gastritis is due to chemical irritation of the mucous membrane. A large and indigestible meal—especially if the patient is already suffering from chronic catarrh, excess of strong alcohol and an overdose of an irritating drug are common causes. In other cases the irritant is a toxin produced by the action of bacteria outside the body, or in the stomach, the organisms being introduced in the food or water, several individuals being often simultaneously affected. This is probably the cause of most cases which have been called idiopathic or ascribed to a chill. The toxins of uræmia and those produced in influenza, septicæmia and other acute infections may be excreted into the stomach and give rise to gastritis.

Symptoms. The symptoms start acutely, soon after the entrance of the irritant into the stomach, but they may be postponed for several hours when the attack is due to a toxin produced by decomposition within the stomach. A sensation of fullness and discomfort is felt in the epigastrium; heartburn is common, and in severe cases there is acute pain; tenderness is diffuse and not often severe. The appetite is completely lost, but thirst is excessive. The tongue is covered with a thick dirty fur. Vomiting, preceded by nausea, almost always occurs; the food eaten at the previous meal is first rejected, mixed with mucus; subsequently mucus with saliva, bile and occasionally small quantities of blood, is vomited. Severe constipation is present unless the irritant has also acted upon the bowel, in which case there is diarrhoea.

The patient is pale, prostrated and complains of headache. The temperature is generally slightly raised, but it may be high, especially in children, and the pulse is rapid.

Prognosis. Recovery generally takes place within twenty-four or forty-eight hours, but in toxic and infective cases it may be delayed for several days. Occasionally the condition passes into chronic gastritis, or the stomach may remain irritable for a considerable period.

Treatment. The patient should be kept warm in bed and hot applications made to the abdomen. If the stomach is not spontaneously emptied a drachm of sodium bicarbonate should be given in half a pint of water. If this does not cause vomiting, it may be necessary to wash the stomach out, or an injection of gr. $\frac{1}{30}$ of apomorphine should be given, but the emetics

which irritate the gastric mucous membrane should be avoided.

Chloroform water often relieves the nausea; castor oil or salts should be administered if there is constipation. No other drugs need be given except in the rare cases in which very severe pain persists after the stomach is empty, when an injection of morphia may be required. Nothing but water should be taken until all the acute symptoms have disappeared; arrowroot may then be mixed with the water, and, as the appetite returns and the tongue cleans, dilute citrated milk, farinaceous food, eggs, and lastly fish, chicken and meat can be added to the diet.

II.—Acute Suppurative Gastritis

Etiology. This very rare disease is due to the invasion by streptococci or other organisms of the submucous tissue through a carcinomatous ulcer, or less frequently through a chronic ulcer or the wound left after an operation on the stomach. In very rare cases the point of invasion cannot be recognized.

Symptoms. Epigastric pain and tenderness are severe. Vomiting is always present; in rare cases the vomited matter contains pus, owing to the rupture of a localised abscess into the lumen of the stomach. Peritonitis always supervenes in the course of two or three days. The general symptoms present are those common to severe infections.

Prognosis. A local submucous abscess may burst inwards and spontaneous cure result, but more commonly it ruptures outwards, producing general peritonitis. Diffuse suppurative gastritis always ends in peritonitis.

Treatment. In very rare cases a localised abscess has been treated successfully by operation.

III.—Acute Phlegmonous (Toxic) Gastritis

Etiology. Phlegmonous gastritis results from the ingestion of irritant poisons.

Symptoms. The local symptoms are similar to those of acute suppurative gastritis, except that the vomited matter frequently contains blood and sometimes sloughs. The patient is generally more or less collapsed, the exact symptoms depending upon the particular poison.

Prognosis. Death frequently occurs from shock, general peritonitis or the effect of the poison on other parts of the body. If the patient recovers the mucous membrane is always more or less atrophied, and pyloric obstruction or hour-glass contraction frequently develops.

Treatment. An attempt should be made to neutralize the poison chemically and to dilute

it. When this is impossible the stomach should be washed out. It is generally advisable to inject morphia to relieve pain and to keep the patient quiet. A. F. H.

CHRONIC GASTRITIS (CHRONIC GASTRIC CATARRH)

Etiology. Chronic gastritis is generally due to repeated chemical or mechanical irritation of the gastric mucous membrane. The most common chemical irritants are alcohol and tea, which are particularly deleterious when taken in a concentrated form on an empty stomach. Less frequently strong coffee, curry and other spices, and drugs, such as purgatives, mercury, copaiba and creosote, cause gastritis. Prolonged contact of less irritating food may have the same effect; consequently very large meals, food taken late at night, and stasis, due to atony or pyloric obstruction, lead to catarrh. The irritating secretions and organisms swallowed in pyorrhœa alveolaris and other septic conditions of the mouth and naso-pharynx are common causes. Coarse and insufficiently masticated food lead by mechanical irritation to gastritis. A chronic catarrh may also follow acute gastritis. Lastly, it is a common result of the congestion of the mucous membrane in diseases of the heart, lungs and liver. It is most likely to occur in individuals predisposed by anæmia, tuberculosis, gout, Bright's disease or a recent attack of influenza or other acute infection.

Symptoms. The symptoms develop very gradually or begin after an acute attack. A sensation of pressure and fullness is felt in the epigastrium immediately after meals; it is relieved by eructation and vomiting and is often accompanied by pain between the shoulders and occasionally by heartburn. Tenderness is slight and ill-defined. In the early stages the secretion of hydrochloric acid may be increased (acid gastritis), but it is more commonly diminished. The appetite is generally poor, the tongue furred and chronic pharyngitis is present, especially in alcoholic cases, the patient complaining of an unpleasant taste in the mouth and the breath being foul. Nausea is common and may be followed by vomiting of small quantities of half-digested food and mucus. In alcoholic gastritis vomiting before breakfast is frequent, the vomit consisting of alkaline, mucous fluid, largely composed of saliva and swallowed secretion from the inflamed pharynx and œsophagus. Constipation is common, except when atrophy of the mucous membrane has led to achylia, in which case it may be replaced by diarrhœa. The general health may remain good for years, but in chronic cases the patient is sallow and complains of a feeling of slackness, general

malaise, headache and insomnia, and frequently becomes hypochondriacal.

Diagnosis. In the early stages of chronic gastric irritation no mucus may be secreted, so that catarrh cannot be said to be present, although the symptoms are identical with those of chronic gastritis. If there is wasting, cancer may be simulated, especially if the secretion of hydrochloric acid is deficient. The presence of occult blood in the stools and lactic acid in the gastric contents is almost conclusive evidence in favour of cancer, and the good effect of dieting is lasting in catarrh but very temporary in cancer. The definite relationship between the amount of discomfort and the quantity and quality of the food distinguishes catarrh from nervous dyspepsia, in which the symptoms are also more irregular; the presence of mucus in the vomit or after a test meal is conclusive evidence against uncomplicated nervous dyspepsia.

Prognosis. There is always a liability to acute and subacute attacks of gastritis, and this may persist to a less extent after the chronic catarrh has disappeared. The prognosis is otherwise good, except when prolonged catarrh has resulted in achylia gastrica from atrophy of the mucous membrane.

Treatment. All factors concerned in the production of the condition must be removed as far as possible. The teeth should be put into perfect order and artificial ones supplied when necessary. The food should be thoroughly masticated and the last meal begun at least three hours before going to bed. The bowels should be kept regular by diet, and, when this is insufficient, by liquid paraffin or saline aperients. No alcohol and no tea or coffee are allowed unless milk be added and the former is weak and freshly brewed. Pickles, mustard, pepper, curry, tough meat, skins and pips of fruit, coarse and raw vegetables, cheese (except cream cheese), and new bread are prohibited. In severe cases it may be necessary to start with a stricter diet, which is gradually increased in the manner described in the treatment of gastric ulcer.

The diet and regular life at Karlsbad, Kissingen, Homburg and other health resorts is often useful, the drinking of the saline and alkaline waters probably contributing to the good results.

A bitter and acid mixture before meals stimulates the appetite; if gastric secretion is deficient hydrochloric acid and pepsin, as described in the treatment of achylia gastrica, may be given. When heartburn is present an alkaline powder should be substituted for the acid. If there is much fermentation glycerinum acidi carbolici, ℥ v, should be given in chloroform water after meals. In cases which resist

other treatment gastric lavage should be tried last thing at night; it should only be continued if it is found to wash away excess of mucus.

A. F. H.

GASTRIC ULCER

I.—Acute Gastric Ulcer

Etiology. Acute gastric ulcer occurs most frequently in chlorotic girls, when it is often associated with pyorrhœa alveolaris, rapid eating and the consumption of indigestible food. It may also occur in acute and chronic appendicitis, which may therefore be complicated by hæmatemesis. It is occasionally found post-mortem in chronic nephritis, cirrhosis of the liver and other diseases.

Symptoms. Recurrent attacks of indigestion generally occur, which are indistinguishable from chlorotic dyspepsia and are perhaps due to this and not to the ulcer. The chief symptom is pain soon after meals, accompanied by widespread, deep and superficial tenderness; it is uninfluenced by diet, but relieved by vomiting and rest in bed. The diagnosis must remain doubtful in the absence of hæmatemesis, which is often profuse, very rarely fatal and may occur apart from any indigestion. Perforation is rare, but may also occur without previous symptoms.

Prognosis. Acute ulcers can develop into chronic ulcers, but the majority heal rapidly, leaving so small a scar that neither obstruction nor hour-glass stomach results. There is a great tendency to relapse, but the patient is able to take full diet without discomfort between the attacks.

Treatment. For the treatment of hæmorrhage, *vide Hæmatemesis*. The diet should be rapidly increased until everything but obviously indigestible food is taken. The patient should be kept in bed until three weeks after the cessation of hæmorrhage and pain. The teeth should be attended to and the patient be instructed to eat slowly. Iron and arsenic should be given for several months.

II.—Chronic Gastric Ulcer

Etiology. Men are more commonly affected than women; no age is exempt, but most cases occur between thirty and fifty. All the chemical and mechanical irritants which cause chronic gastritis help in the production of gastric ulcer. There appears to be something in the nature of an "ulcer diathesis," which makes certain individuals throughout their lives specially liable to gastric and duodenal ulceration.

Symptoms. The onset is generally insidious, the symptoms first appearing after big or indigestible meals and gradually becoming more easily produced. The pain, which is often burning in character and may be very severe,

is situated in the middle of the epigastrium and may radiate upwards and to the back; it is much more marked after solid than liquid food. In cardiac ulcers it begins immediately after meals and in pre-pyloric ulcers between two and three hours after, intermediate intervals indicating an ulcer on the lesser curvature. The pain generally disappears spontaneously after about an hour; it is completely relieved by emptying the stomach by vomiting or a tube and by alkalies; food produces incomplete and very temporary relief, which is generally also obtained on lying down and by warm applications. A small area of tenderness, the position of which is constant for each case, is present in the epigastrium and often to the left of the spine; it is greater than in any other gastric disease and is most marked or only present when there is spontaneous pain. It is associated with rigidity of the left rectus, and an area of cutaneous hyperæsthesia may be present, especially in neurasthenic and chlorotic patients.

With increasing pain vomiting appears; it occurs at the height of the pain, a small quantity of acid fluid, with a little well-digested food, being brought up. Occult blood is frequently found in the stools and vomit, but disappears rapidly when the patient is dieted. In a much smaller proportion of cases obvious hæmatemesis occurs; when the blood is abundant it is bright in colour and the stools are tarry; when less abundant it is coffee-coloured and mixed with food and is only recognizable in the stools by chemical examination. Melæna may also occur without hæmatemesis. The appetite is good at first, but fear of pain leads to diminished intake of food, with consequent weakness and loss of weight. The tongue is clean, but constipation is commonly present.

In uncomplicated cases the size of the stomach is normal, though there may be a slight delay in evacuation, and a spasmodic stricture is occasionally observed with the X-rays in the centre of the stomach when the ulcer is situated on the lesser curvature.

Diagnosis. Hæmatemesis or the presence of occult blood in the stools excludes all other gastric disorders except cancer. In cancer, occult blood is constantly present in the stools in spite of diet, hydrochloric acid is diminished instead of being normal or increased, and lactic acid is present; the presence of a tumour, anorexia, and wasting out of proportion to the diminished intake of food are further points in favour of cancer. In nervous dyspepsia the pain and tenderness are irregular in position, time of onset and relation to the quantity and quality of food, and are less constantly relieved by alkalies. In chronic gastritis the pain and tenderness are more widespread and less severe. For the diagnosis of duodenal from gastric ulcer

vide Duodenal Ulcer. The gastric symptoms associated with gallstones and chronic appendicitis may simulate ulcer, but the relation of the pain to the nature and time of meals is less regular, and less relief is given by alkalies; tenderness is present over the gall bladder or the right iliac fossa respectively in addition to the epigastrium. It should be remembered that gallstones, and still more frequently chronic appendicitis, may be associated with gastric ulcer.

Course and Prognosis. In favourable cases permanent recovery follows medical treatment, but recurrences due to the breaking out of an old ulcer or the formation of a new one are common sequels of indiscretions in diet, depressing emotions and exposure to cold and damp. Perforation may lead to general peritonitis or a localised abscess; if the perforation occurs slowly, especially if it is posterior, adhesions develop, which occasionally give rise to pain. The commonest situation of an ulcer is on the lesser curvature, near the pylorus; if it spreads to the pylorus it is likely to cause stenosis on healing. The cicatrization of a large ulcer in the body of the stomach may cause hour-glass constriction. Very chronic ulcers may become carcinomatous, but such ulcers may form definite tumours without being malignant.

Treatment. As soon as a definite diagnosis of gastric ulcer has been made, the patient should be kept in bed for at least four weeks. For the treatment of hæmatemesis and the rules for commencing feeding after it, *vide Hæmatemesis.* The patient should drink two ounces of milk, with three ounces of water, to which 4 gr. sodium citrate and 5 gr. magnesia are added, every other hour when awake, half an ounce of olive oil being given immediately before. When pain and tenderness and faecal occult blood have been absent for two days an extra ounce of milk may be added, and the next day another ounce, after which the three ounces of water may be replaced by citrated milk; then a raw egg may be added successively to one, two and three feeds. If there is no return of pain or tenderness, intervals between the feeds should be lengthened and the diet increased by the successive addition of junket, jelly, bread and butter, fish, chicken, vegetable purées and finally meat; solid food should not be minced, but should be thoroughly chewed. If there is constipation, enemata and liquid paraffin should be given.

For at least a year the patient should be extremely careful with his diet, following the general instructions given in the article on hypersecretion. The food should be thoroughly chewed; when it is impossible to give sufficient time for a meal nothing should be taken except chocolate or a glass of milk. The teeth, which

should have been put into perfect condition before treatment began, must be kept in good order. Half an ounce of olive oil should be given before meals and an alkaline powder should be used whenever there is a suspicion of discomfort after food.

Complications such as perforation, pyloric obstruction and hour-glass contraction must always be treated surgically; with regard to hæmorrhage *vide Hæmatemesis.* In uncomplicated cases an operation should only be performed if medical treatment does not lead to complete relief, or if there is another recurrence after the treatment described has been twice tried. Gastro-enterostomy should be performed and when possible the ulcer excised. A. F. H.

TUBERCLE OF THE STOMACH

Tubercle of the stomach is very rare. In miliary tuberculosis the mucous membrane may be involved, but no symptoms are produced. In advanced phthisis a tuberculous ulcer may form, generally near the pylorus. The symptoms are indistinguishable from the dyspepsia common in such cases, unless hæmatemesis occurs; this may, however, be due to the presence of a simple ulcer. A tuberculous ulcer may cause death by perforation or hæmorrhage, and may lead to pyloric obstruction. A. F. H.

SYPHILIS OF THE STOMACH

Syphilis of the stomach is probably less rare than is generally supposed. A gummatous infiltration of the submucous tissue occurring on the lesser curvature near the pylorus may form a tumour suggestive of cancer or an ulcer, with symptoms of ordinary gastric ulcer, including hæmorrhage; in either case it may produce pyloric obstruction. Syphilitic endarteritis may further be the cause of an ulcer anatomically and clinically indistinguishable from the simple variety. The possibility of syphilis should always be considered when an ulcer resists ordinary treatment, if there is a history of syphilis or evidence of syphilis is present elsewhere and the Wassermann reaction is positive. The diagnosis would be confirmed by the rapid improvement with mercury and iodide, in spite of the failure of other treatment. The same treatment should be adopted when other evidence of syphilis is present in patients with a tumour, the permanent disappearance of which would prove its gummatous nature. A. F. H.

GASTROPTOSIS.—*Vide Visceroptosis*

PYLORIC OBSTRUCTION

Etiology. Pyloric obstruction is due in the vast majority of cases to the results of gastric

or duodenal ulceration or to cancer. In infants obstruction may result from hypertrophy of the pylorus; the obstruction occasionally found in young adults without obvious cause is perhaps due to incomplete recovery from this condition. External pressure very rarely gives rise to pyloric obstruction, and simple adhesions between the pylorus and the neighbouring viscera do not often interfere with the passage of food into the duodenum.

Symptoms. The patient complains of a sensation of discomfort and fullness soon after meals, which may be followed by attacks of severe pain. Vomiting is a frequent symptom in severe cases; it may occur before breakfast, and articles of food may be brought up which were eaten many hours or even days before. Wasting is progressive and the tissues become abnormally dry and inelastic; the patient has generally little appetite, but complains of great thirst. The urine is scanty and obstinate constipation occurs. Tetany is a rare complication in severe cases.

In addition to the symptoms already enumerated others depending upon the cause of the obstruction, such as gastric ulcer or carcinoma, are also present.

Pyloric obstruction leads to dilatation of the stomach. For the signs of this, together with the methods of distinction between atonic dilatation and dilatation due to obstruction, and between malignant and non-malignant obstruction, *vide p. 213*.

Treatment. The treatment of pyloric obstruction is gastro-enterostomy. It is useless to waste time in well-marked cases with lavage or other medical treatment, as the improvement which follows operation is immediate and progressive. Only when the patient is already so emaciated that doubts are raised as to whether he is strong enough to undergo an operation is it justifiable to try by lavage, by the administration of saline solution by the rectum, and by giving frequent small and concentrated feeds to improve his condition before the operation is performed. By this means a considerable gain in weight may occur and the dilatation may diminish, so that the chances of a successful result of the operation are increased. The patient should be weighed every day, as if there is no gain in weight the operation should be performed in spite of the risk.

When the obstruction is only partial and an active ulcer is present, the effect of medical treatment may be tried, as the obstruction is largely due to the surrounding inflammation, which disappears when the ulcer heals, and if the ulcer is not very large the scar produced may give rise to no obstruction.

A. F. H.

HOURLY-GLASS STOMACH

Etiology. *Functional Hour-Glass Stomach* occurs when atony is associated with ptosis of the stomach (orthostatic form), the sagging of the dropped organ when food enters it being so great that the lumen of its body is obliterated, so that when more food is eaten it is held up in the proximal segment of the stomach; the obstruction disappears on lying down. When a gastric ulcer is situated in the body of the stomach a spasmodic stricture may occur, which varies in degree from time to time and disappears when the abdominal muscles are vigorously contracted. *Organic Hour-glass Stomach* results from cicatrization of a gastric ulcer and less commonly from cancer.

Symptoms and Signs. The symptoms of orthostatic and spasmodic hour-glass stomach are respectively those of atony and gastric ulcer. The symptoms of organic hour-glass stomach are similar to those of pyloric obstruction due respectively to gastric ulcer and cancer, with the exception that the amount vomited is generally less, and greater relief is obtained on lying down. Visible peristalsis and stiffening cannot be observed, unless the proximal segment is unusually large. Inflation occasionally shows a division of the stomach into two parts, but the X-rays are the only reliable method of diagnosis: the constriction can be seen whether the patient is standing or lying down, and in the former position the neck passes from a point somewhat higher and to the right of the lowest part of the proximal segment.

Treatment. In organic hour-glass stomach an anastomosis should be made between the upper segment of the stomach and the lower segment or the jejunum.

A. F. H.

CARCINOMA OF THE STOMACH

Etiology. Carcinoma of the stomach occurs most frequently between the ages of forty and sixty, and is rare before thirty and after seventy. Clinical pathological evidence shows that it may develop from chronic gastric ulcer.

Symptoms. When an individual above the age of forty, who has hitherto had a good digestion, suddenly begins to suffer from gastric symptoms, the possibility of cancer should always be considered. In about one quarter of the cases a long history of dyspepsia, suggesting gastric ulcer, is present, the local symptoms having recently altered in character and the general symptoms become more marked. The patient suffers from epigastric discomfort and a sensation of pressure after food; this soon becomes continuous and is accompanied by

pain. At an early stage the appetite diminishes, the patient having a special repugnance for meat. Flatulence is commonly present, the gas brought up being at first odourless, but subsequently foul. Vomiting is generally present sooner or later; it is very abundant and occurs at long intervals when the pylorus is involved; in cancer of the cardia it occurs immediately after swallowing. It is commonly preceded by pain and nausea, both of which it temporarily relieves. The vomited matter sometimes contains altered blood and looks like "coffee grounds." Vomiting of blood alone is rare, but in a very large proportion of cases blood constantly oozes from the surface of the growth, so that "occult blood" is present in the fæces; the oozing is unaffected by diet, so that occult blood in three consecutive stools of a patient with gastric symptoms, who is on a fluid diet, is almost pathognomonic of cancer. The growth sooner or later involves the pylorus in a considerable proportion of cases; the special symptoms then present are described in the section on pyloric obstruction.

The patient rapidly loses strength and weight, the emaciation being more than can be accounted for by the vomiting and diminished intake of food. In the late stages the disappearance of subcutaneous fat, loss of elasticity of the skin, œdema of the abdominal wall, back and ankles, and anæmia give the patient a characteristic cachectic appearance.

Signs. In the earlier stages nothing abnormal is found on abdominal palpation, but sooner or later a hard, moderately tender tumour is generally felt. It is often most palpable when the stomach is empty, but may only become obvious after inflation. In doubtful cases palpation should be repeated under an anæsthetic. When the pylorus is involved all the signs of dilatation due to obstruction are present.

In doubtful cases a test breakfast should be given; the results of this are described elsewhere.

The liver should always be examined for secondary deposits. Direct spread to the peritoneum and omentum is frequent, and irregular abdominal masses of this nature are often palpable; ascites may occur as a result of the malignant peritonitis. A small gland just beneath the insertion of the left sterno-mastoid muscle is occasionally involved and secondary deposits may occur in the inguinal glands and in the recto-vesical fossa; not infrequently the growth spreads along the urachus to involve the umbilicus, where a hard nodular mass can be felt.

Complications. Perforation may occur, general peritonitis being usually prevented by the presence of old adhesions, a local abscess forming; less frequently the colon becomes involved and a gastro-colic fistula results, the patient

then rapidly dying from emaciation due to constant fæcal vomiting and severe diarrhœa. Severe hæmorrhages are unusual. Other terminal complications are suppuration, gastritis, pylephlebitis, suppurative parotitis, thrombosis, septic pneumonia, empyema and infective endocarditis.

Prognosis. The average duration of life after the appearance of the first symptom is nine months; it is rarely much longer unless the growth has developed on the top of an old ulcer, and it may be less than three months. Temporary improvement may occur as a result of rest and careful dieting. Death is most frequently due to exhaustion; in other cases it results from one of the complications already mentioned.

Diagnosis. Apart from the discovery of a tumour, the constant presence of occult blood in the stools is the most important sign distinguishing a growth from other gastric disorders. The absence of free hydrochloric acid is of somewhat less value; of other symptoms, the loss of appetite, and the wasting out of proportion to the diminished intake of food, are most characteristic. Addison's anæmia may closely simulate a growth of the stomach; the presence of occult blood in the stools is distinctive of the latter and does not occur in the former, and the colour index of the blood is always less than the normal in cancer.

Treatment. Medical treatment is only palliative. The patient should be allowed to eat what he likes, but small, frequent and nutritious meals are most suitable. Attempts should be made to stimulate the appetite by means of a mixture containing hydrochloric acid and a bitter, and the mouth and tongue should be kept as clean as possible. Drugs must be employed for the relief of pain, and in the later stages injections of morphia are generally essential and no hesitation should be felt in giving very large doses.

If pyloric obstruction is present the abdomen should be explored, unless the patient is *in extremis*, as, even if a radical operation is impossible, gastro-enterostomy produces marked, though temporary improvement. Apart from this indication laparotomy should never be performed unless there is a distinct chance of removing the whole tumour. The presence of secondary deposits anywhere in the body and any marked degree of cachexia render the attempt quite useless. The most favourable cases are those in which a probable diagnosis has been made in the absence of a tumour or in the presence of a small, localised and movable one. At the operation a considerable margin of normal stomach and the lymphatic glands in the neighbourhood should be simultaneously removed.

A. F. H.

SARCOMA OF THE STOMACH

Etiology. Sarcoma of the stomach occurs with one-fortieth the frequency of carcinoma. Males and females are equally affected and no age is spared, but the disease is relatively more frequent under the age of thirty than carcinoma.

Symptoms. The symptoms and signs do not differ from those of carcinoma. The possibility of sarcoma, should, however, always be considered in patients under the age of thirty.

A. F. H.

HÆMATEMESIS

Etiology. Hæmatemesis results most frequently from gastric ulcer. It occurs, generally in smaller quantities, in cancer of the stomach and in rare instances as a result of injury or poisoning. The term *gastrostaxis* has been applied to the hæmorrhage which has been supposed to occur, especially in chlorotic girls, in the absence of any organic lesion; but it is probable that very small, rapidly healing and often multiple acute ulcers are present in such cases. Hæmatemesis may result from the congestion of the mucous membrane in cirrhosis of the liver and rarely in heart failure, and bleeding from the stomach may occur in hæmorrhagic diseases. Finally, blood from the naso-pharynx, mouth, œsophagus and lungs may be swallowed and vomited.

Diagnosis. The possibility of malingering should be considered in hysterical girls if nocturnal hæmatemesis occurs during menstruation; the absence of blood from the fæces would confirm such a suspicion. Direct examination of the nose, gums and pharynx excludes the possibility of the blood coming from these sources. In cirrhosis of the liver œsophageal varices are more frequently the source of the hæmorrhage than the stomach itself. Severe hæmorrhage rarely occurs in carcinoma of the œsophagus, in which the diagnosis is generally clear from the other symptoms and the X-ray examination. Hæmatemesis may be distinguished from hæmoptysis by the fact that in the former the blood is generally dark, partly coagulated and mixed with more or less food, whereas in the latter it is bright red, frothy and unclotted; in the former the symptoms and signs point to gastric disease, in the latter to disease of the lungs or the heart; in the former melæna is a constant sequel and the hæmorrhage is not often repeated, whereas in the latter no melæna occurs and the patient generally continues to expectorate blood-tinged sputum for several days.

Treatment. The patient should be kept in a supine position, and should not leave his bed even to micturate or defæcate until there

has been no hæmorrhage for forty-eight hours. In order to keep him completely at rest it is generally advisable to inject morphia, but no other drug is indicated. Nothing should be given by mouth for twelve hours; small quantities of dilute citrated milk may then be given as described in the treatment of gastric ulcer, but if hæmorrhage recurs starvation should be continued for three days and rectal salines administered. No addition should be made to the milk until forty-eight hours after the disappearance of all blood from the stools. An enema may be given for constipation on the third day after the hæmorrhage.

If the hæmorrhage continues to a dangerous extent the throat should be cocaineized and a stomach-tube passed; the stomach is emptied by compression and then washed with iced water until the latter is no longer tinged with blood, when a drachm of adrenalin chloride may be left in the stomach with the last half-pint of water. If collapse is serious, saline solution should be administered continuously per rectum.

As it is very rare for death to occur from a single hæmorrhage, no operation should be performed, except in patients past middle age, when the hæmorrhage probably occurs from a sclerotic vessel which cannot contract; an attempt should then be made to ligature the bleeding point. If hæmatemesis recurs more than once in large quantities or repeatedly in small quantities, gastro-enterostomy should be performed and, if possible, the ulcer should be excised.

A. F. H.

DISEASES OF THE INTESTINES

Methods of Examination

1. *Size, Shape and Position.* The cæcum and iliac colon are the only parts of the bowel which are always palpable under normal conditions. Other parts of the colon can be felt when in a state of spasm or when filled with hard fæces, and tumours, except in the neighbourhood of the splenic flexure and in the pelvis, can often be recognized by abdominal examination at an early stage. In all intestinal cases a rectal examination must be made, as by this means not only the rectum but also the pelvic colon can be palpated. The size, shape and position of the whole colon in the horizontal and erect postures can only be satisfactorily investigated by means of the X-rays, a bismuth meal or enema having previously been given.

2. *Motor Functions.* Abnormalities in the passage of food through the small intestine can be discovered by listening over the cæcum at intervals after the first meal of the day, as normally the sounds begin to be heard in

this situation four hours after breakfast. Intestinal stasis can be recognized in well-marked cases by palpation, if the colon has previously been emptied by means of enemata; accumulation of fæces in the ascending colon, for example, indicates stasis in this situation, and the presence of a large quantity in the rectum or pelvic colon, unaccompanied by a desire to defæcate, proves the existence of dyschezia.

A rough indication of the degree of intestinal stasis can be obtained by giving three charcoal lozenges at 6 p.m., as under normal conditions the stools passed on the following morning should be black. The only accurate method, however, by means of which the rate of passage through each part of the bowel can be determined is by means of the X-rays. Two ounces of bismuth oxychloride are given at breakfast, the bowels having previously been thoroughly emptied by enemata. Periodical examinations are then made, the position of the most advanced part of the bismuth shadow at any time being of more importance than the persistence of the shadow in some more proximate portion of the alimentary canal. The cæcum is normally reached in four hours, the hepatic flexure in six, the splenic flexure in nine and the pelvi-rectal flexure in twelve hours.

3. *Chemical Functions.* The stools should first be examined whilst an ordinary diet is being taken; if necessary a second examination may be made after the patient has been on a fixed diet containing a considerable quantity of milk and some raw meat for two days. The consistence, smell, colour and reaction of the stools should be noted, abnormal acidity indicating excessive fermentation and abnormal alkalinity excessive putrefaction. The presence of mucus, blood or pus indicates organic disease; if the two former are intimately mixed with the stools, the blood being only present in an altered condition recognizable by chemical means but not by the microscope, they are derived from the small intestine; the larger the fragments of mucus and the brighter the colour of the blood the lower is their source. The presence of pus always indicates disease of the colon, as any produced in the small intestine is digested. A small quantity of the stool should be rubbed with water and placed on a black plate; fragments of undigested food may then be recognized, excess of meat fibres indicating insufficient pancreatic digestion, excess of vegetable residue insufficient cellulose digestion ("fermentative intestinal dyspepsia"), and the presence of fibrous tissue deficient gastric digestion.

In cases of diarrhoea a small quantity of fæces mixed with water should be incubated for twenty-four hours in an apparatus in which the gas evolved can be collected. If more than

a very small quantity is produced the condition is abnormal. Its smell and the reaction of the stool after incubation indicate whether the evolution of gas is due to excessive fermentation or excessive putrefaction.

Microscopic examination shows the presence of pus, shreds of fibrous tissue and the ova of intestinal worms.

Chemical examination is of no great importance, except for the recognition of "occult blood"; for this the patient should be put on to a meat-free diet for three days.

A bacteriological examination of the stools is often useful in colitis. The presence of a relative excess of streptococci, or the presence of abnormal organisms, such as pneumococci or tubercle bacilli, may be discovered. In some cases it may be necessary to estimate the opsonic index against the different organisms found in the stools in order to discover which is the cause of the disease.

4. *Sigmoidoscopy Examination.* In all cases in which there is any possibility of organic disease of the colon a proctoscopic and sigmoidoscopic examination should be made after the colon has been washed out with water enemata. In cases associated with constipation an aperient should be given twenty-four hours before the examination. It is most satisfactorily performed without an anæsthetic in the knee-elbow position, but it is generally advisable to inject morphia an hour before, and when the anal canal is ulcerated a general anæsthetic may be required.

A. F. H.

FUNCTIONAL DISEASES OF THE INTESTINES

I.—Constipation

All cases of constipation may be divided into two classes, according to which of the two great physiological processes which maintain the regular action of the bowels is deranged. In the first, *intestinal constipation*, the passage through the intestines is delayed, whilst defæcation is normal; in the second, *dyschezia*, there is no delay in the arrival of the fæces in the pelvic colon, but their final excretion is not adequately performed.

Intestinal Constipation.—Delay in the passage of fæces through the intestines is due to the motor activity of the intestines being deficient, or to the force required to carry the fæces to the pelvic colon being excessive. The motor activity of the colon may be deficient owing to weakness of the musculature, deficient reflex activity, inhibition or uncontrolled and irregular action. Weakness of the musculature may be due to congenital hypoplasia, which is the cause of the constitutional constipation from which several members of a family may suffer;

acquired hypoplasia, which is the cause of senile constipation and the constipation which may follow such local diseases as dysentery; and functional insufficiency without structural change, as in chlorosis, acute fevers and the cachexia of cancer and tuberculosis. The reflexes which maintain intestinal activity may be deficient owing to the stimulation being too weak on account of lack of mechanical and chemical stimulants in the food or of want of exercise. They are also deficient when the excitability of the mucous membrane is impaired as a result of catarrh and of long-continued irritation by purgatives. Lastly, constipation is a very frequent symptom of neurasthenia and hypochondriasis, as the depressed condition of the nervous system leads to a diminished response to the stimuli which normally excite intestinal activity. The inhibitory sympathetic nerves may be stimulated directly in lead poisoning, centrally by depressing emotions, and reflexly in painful diseases and injuries of any part of the body, but particularly of the abdominal and pelvic viscera.

Constipation may result from painful spasm, induced reflexly by the presence of an irritant in the colon of a patient with an abnormally excitable nervous system (*enterospasm, spastic constipation*). The nervous factor is shown by the neurotic temperament of most patients affected with spastic constipation and the frequent history of worry or overwork immediately preceding an attack, as well as by the good effect of belladonna. The irritant which gives rise to the exaggerated reflexes is in most cases hard faeces, the retention of which results from the ordinary neurasthenic constipation, which is generally present in the intervals between the attacks. Similar spasmodic contractions of the intestines occur as a result of poisoning by nicotine and lead.

The work to be done by the intestinal musculature is excessive whenever the bulk or consistence of the faeces offers more than the normal degree of resistance, especially as the result of insufficient consumption of water and of excessive loss of water in the urine in diabetes, and when there is a diminution in the intestinal lumen owing to organic stricture, pressure exerted from without and intussusception.

Dyschezia.—Dyschezia is due to a want of proper proportion between the power of expelling the faeces from the pelvic colon and rectum and the force required to do this completely. It may therefore be due to inefficient defaecation, or to an obstacle to efficient defaecation, such as abnormally hard and bulky faeces and functional and organic strictures of the rectum and anal canal. Dyschezia due to inefficient defaecation is most commonly the

result of disregarding the call to defaecation either on account of ignorance or laziness, or of fear of pain in diseases of the anus and the neighbouring organs. If the call to defaecation is disregarded, the sensation of fulness in the rectum passes off owing to relaxation of the tonic contraction of its muscular coat. If it is again disregarded after its return on the arrival of more faeces in the rectum, further relaxation occurs. More and more faeces accumulate in the rectum, the muscular coat of which becomes more and more relaxed. As the force required to empty the rectum when over-distended with faeces is much greater than that required under normal conditions, evacuation is now likely to be incomplete, even if a great effort be made, and it may finally become impossible without mechanical aid. Consequently faeces are always present in the rectum instead of only for a few minutes before defaecation, and the lumen of the rectum is permanently increased owing to its atonic condition.

Dyschezia may be due to various other causes, such as weakness of the voluntary muscles of defaecation, the assumption of an unsuitable position during defaecation, and hysteria. But whatever the primary cause, the final result is the same. The incomplete evacuation of the rectum results in an accumulation of faeces and consequent atony and dilatation of the rectum.

Congenital deficiency of the muscle-sense of the rectum causes the dyschezia which occurs not uncommonly in infants, in whom the slight additional distension produced by the introduction of a finger or a piece of soap into the rectum results in an adequate stimulus. In the majority of cases the muscle-sense develops when the infant grows older, but occasionally this may be the starting-point of dyschezia which lasts through life. The rectal muscle-sense is abolished or defective in diseases of the spinal cord, in which the defaecation centre itself or the fibres connecting it with the brain are involved.

In addition to the two great classes of constipation already considered there is a third, which is due to the quantity of faeces formed being insufficient to produce an adequate stimulus in the pelvic colon and rectum, and to a less extent in the rest of the colon. The insufficient bulk of faeces is due to an inadequate quantity of food residue reaching the colon as a result of anorexia or of oesophageal and pyloric obstruction, or to excessive digestion of food, the result of a "greedy colon."

Symptoms. Defaecation generally occurs with insufficient frequency. Sometimes, however, the bowels are opened daily or several times a day (*pseudo-diarrhoea*) when the total quantity is insufficient and the stools are abnormally hard and dry.

It is important to distinguish the symptoms of constipation from those of the conditions, such as neurasthenia and chlorosis, which may give rise to it. There is no doubt that neurasthenia, hypochondriasis, insanity, epilepsy, asthma, nephritis, diabetes, chlorosis, painful pelvic disorders and many other diseases may be greatly aggravated by constipation. Apart from these conditions, headache, slackness, abdominal discomfort, colic and neuralgic pains in the back and down the legs may result directly from constipation. In rare cases a faecal tumour and faecal obstruction occur. Finally constipation may be the direct cause of hæmorrhoids, various forms of colitis, appendicitis and diverticula and volvulus of the colon.

Treatment. Under no circumstances should the patient fail to make an effort to open his bowels after breakfast, even if he feels no desire to do so, and a call to defæcation felt at any other hour in the day should be obeyed at once at whatever inconvenient time it may occur. Sufficient time should always be spent over the act of defæcation, and it may be advisable to pay two visits to the closet at short intervals. In order to prevent the temptation to hurry over defæcation the closet should be clean, devoid of smell and properly warmed in winter. In dyschezia a footstool nine inches lower than the seat should be provided, so that the crouching position may be assumed during defæcation.

It is important to see that sufficient food is taken, as constipation is often as much due to its insufficient quantity as to its unsuitable quality. The diet should contain an increased proportion of fat and of vegetable foods, especially those which contain much cellulose, organic acids and sugar. In addition to that taken with meals, a glass of cold water should be drunk before breakfast, another half an hour before dinner, and a third just before retiring to bed.

The majority of cases of constipation can be cured without drugs if proper treatment is instituted at a sufficiently early stage. In dyschezia purgatives are either absolutely useless, or they only have an effect when fluid stools are produced, a considerable quantity of fluid and nutritive material being thereby wasted. In curable diseases, such as chlorosis and neurasthenia, and in chronic renal diseases, diabetes and insanity, all of which conditions are aggravated by the constipation which is commonly present, purgatives should be regularly given. They are also useful for making the stools soft when defæcation is painful as a result of inflamed hæmorrhoids or anal ulcer and in diseases of the pelvic organs, and when straining at stool is accompanied by danger, as in patients liable to cerebral hæmorrhage.

In those cases of constipation due to other causes, in which non-medical treatment proves insufficient, purgatives must also be used, but an effort should be made to dispense with drugs at the earliest possible moment. The stool produced by an aperient should be normal in size and consistence, and should not deprive the body of any water or nutritive material which ought to be absorbed. The dose should be so regulated that one stool is passed every day and the desire to defæcate is felt immediately after breakfast. The aperient should cause no pain or discomfort, and should not irritate the intestinal mucous membrane sufficiently to produce any inflammatory change. If it is probable that the purgative will be required permanently, one such as aloes, cascara or senna should be chosen, which is likely to maintain its good effect without any increase in the dose being required.

In constipation due to a greedy colon the bulk of the fæces must be increased by the administration of some unirritating substance, such as liquid paraffin or agar-agar, which passes through the intestines without undergoing decomposition or absorption. Liquid paraffin is particularly valuable when the fæces are hard and dry; it is therefore useful in certain other forms of constipation besides that due to a greedy colon, as, for example, in diabetes. In dyschezia also the soft stools which result from its use are expelled with less difficulty than ordinary fæces. From one drachm to half an ounce should be taken with meals two or three times a day.

The majority of cases of moderately severe constipation are more or less cumulative, excess of fæces being always present in the large intestines. It is therefore necessary that the colon should be completely evacuated before other methods of treatment are adopted. It is generally possible to empty the bowels completely by means of a dose of castor oil, followed, if necessary, by a saline purge. In severe cases, however, it is necessary to remove the accumulation of fæces from the large intestine by enemata before other treatment is attempted, and in rare instances the rectum can only be emptied by means of the finger.

It is essential in treating dyschezia to keep the rectum and pelvic colon empty, so that they may in time regain their normal tone and contractile power. This can only be accomplished by the regular use of enemata of water or glycerine. The bulk of the water enemata and the strength of the glycerine enemata should be gradually reduced. As a rule the tone and contractile power slowly return and a cure finally results. In very exceptional cases the atony and paralysis of the rectum are so complete that recovery is impossible; in

such cases treatment by enemata, though it does not cure, is the only way in which a regular evacuation can be obtained.

A cold bath or a cold douche after a hot bath is a very valuable addition to the series of stimuli which lead to the morning evacuation. The spasm in spastic constipation is often benefited by a hot bath, and when constipation is due to some painful pelvic condition the latter and the associated spasm of the sphincter ani may be relieved by the use of a hot sitz-bath.

Regular exercise in the open air is one of the most important means of preventing constipation, especially in individuals who follow a sedentary occupation. It increases the appetite, diverts the mind, strengthens the voluntary muscles of defæcation and stimulates the intestinal movements. When any of the voluntary muscles of defæcation are weak, considerable benefit can be gained by the performance of Swedish exercises every morning and evening. Whenever constipation is due to want of activity of the intestinal musculature, the condition of the latter may be improved by deep abdominal massage.

Dyschezia is often associated with viscerop-tosis, both being due to weakness of the abdominal muscles. In such cases a proper support is of great value (*vide Viscerop-tosis*).

A. F. H.

II.—Diarrhœa

Diarrhœa is a condition in which fluid stools are passed. Defæcation generally occurs several times in the day, but mere frequency is not diarrhœa, as it may even occur in constipation. The actual cause of diarrhœa is the abnormally rapid passage of fæces through the colon, which allows insufficient time for fluid to be absorbed. This may be due to (1) excessive stimulation and (2) over-excitability of the neuro-muscular mechanism which controls the intestinal movements.

1. *Excessive Stimulation of Motor Activity.* This may result, especially in neurotic individuals, from excitement, but it is most commonly due to excessive stimulation of the intestines by excess of vegetable food, decomposing meat or cheese, the toxins of uræmia, Graves' disease and septicæmia, and the products of excessive fermentation of carbohydrates and of putrefaction of proteins. Excessive fermentation occurs as a result of the insufficient digestion of cellulose and gives rise to the symptoms of "fermentative intestinal dyspepsia" (*q. v.*). Excessive putrefaction may result from absence of gastric juice (*gastro-genous diarrhœa*; *vide Achylia Gastrica*); an abnormal quantity of organisms reaches the intestines and the connective tissue of meat is insufficiently softened, so that protein and fat

are protected from the digestive juices in the small intestine and reach the colon in excess, where they are liable to undergo putrefaction. The chemical stimulants of intestinal movements already referred to also stimulate the secretion of intestinal juice and mucus. In severer cases, where definite inflammation or ulceration have resulted, serous exudation also occurs. Moreover, in acute colitis, especially when associated with ulceration, absorption is diminished, so that the fæces remain fluid as they traverse the colon. Thus additional material is provided for the action of putrefactive organisms, which at the same time increase in number, as the intestinal contents act as a favourable culture medium for them.

Treatment. In all cases mechanical irritation should be avoided as much as possible; the food should therefore be well chewed, and raw vegetables, pickles, raw fruit, nuts, porridge, whole-meal brown bread, tough meat and hard-boiled white of egg should be avoided. Water, weak tea and milk may be drunk; aerated waters should be avoided, but a small quantity of alcohol, especially in the form of whisky, may be allowed.

In fermentative diarrhœa starch should at first be completely excluded from the diet, but sugar, malt extract and milk or kephir are allowed. When the diarrhœa has stopped, cellulose-free starch, such as arrowroot, may be given, but no potatoes, white bread or rice for several weeks, and no vegetables containing a greater quantity of cellulose until still later.

A lacto-vegetarian diet is most suitable for putrefactive diarrhœa. Some of the milk may be replaced by sour milk. No meat should be allowed until the diarrhœa has ceased for a fortnight.

For the drug treatment of diarrhœa, *vide Colitis*.

2. *Over-excitability of the Neuro-muscular Mechanism which controls Intestinal Movements.* When the mucous membrane of the colon is acutely inflamed or ulcerated any mechanical or chemical stimulant is likely to produce an excessive reflex response, so that the tendency to diarrhœa in such cases is increased. The taking of food reflexly stimulates intestinal activity; in some neurotic individuals the effect is so much exaggerated that a liquid stool is passed immediately after each meal.

Treatment. This condition can be overcome by means of bromides and belladonna, and in severe cases codein, given before meals. A. F. H.

III.—Intestinal Flatulence

Etiology. An excess of gas in the intestines—intestinal flatulence—may result from (1) excess of gas being added to that already present, or (2) too little gas being eliminated.

1. Excess of gas may be added to that already present as a result of (a) excessive production of gas by fermentation of carbohydrates and, to a much less extent, putrefaction of proteins, and (b) aerophagy (*q.v.*). Excessive fermentation occurs whenever the diet contains excess of vegetable food, in infective colitis, in which there may also be excessive putrefaction, and in the condition known as fermentative intestinal dyspepsia, which is due to deficient digestion of cellulose.

2. Too little gas is eliminated from the intestine owing to (a) deficient absorption in colitis and obstruction to the portal circulation in heart failure and cirrhosis of the liver, and (b) deficient expulsion in constipation, which may cause retention of gas as well as of faeces.

Symptoms. Intestinal flatulence gives rise to a sensation of fullness and pressure in the abdomen and the occurrence of borborygmi. If severe, the distension may lead to palpitation and dyspnoea by pushing the diaphragm upwards. Distension of the intestines acts as a stimulant to their contraction, so that flatulence is often associated with colic, which is at once relieved on passing flatus.

In *fermentative intestinal dyspepsia* the tongue is furred, the appetite poor and the abdomen somewhat tender. The bowels are opened several times a day, the stools being unformed, yellow, frothy and smelling of butyric acid. They contain much starchy residue; when put in an incubator they undergo excessive fermentation.

For *treatment*, vide *Constipation, Diarrhoea and Aerophagy*. A. F. H.

ORGANIC DISEASES OF THE INTESTINES

(Vide also *Cancer of the Intestine, Intestinal Obstruction and Intussusception*.)

COLITIS

I.—Catarrhal Colitis

(a) *Acute.*—*Etiology.* Acute catarrhal colitis occurs most frequently as a result of food poisoning, either alone or associated with acute gastritis and enteritis. It may also be a symptom of specific fevers and various toxæmias, especially uræmia and Graves' disease, and may result from the ingestion of poisons.

Symptoms. The chief symptom is diarrhoea, the stools being frequent, fluid and offensive; they contain mucus, sometimes blood, but no food residue, unless the small intestine is simultaneously affected. Abdominal discomfort is present and paroxysms of colicky pain are frequent. In severe cases there may be well-marked general symptoms with a high temperature and a rapid pulse. As a rule the condition

rapidly improves, but it may develop into chronic colitis.

Treatment. Nothing but water should be taken by the mouth during the first twenty-four hours; cellulose-free starches may then be given, but no further change in diet is permissible until the diarrhoea has ceased, after which the return to normal diet should be gradual. No attempt should be made to stop the diarrhoea for the first twenty-four hours, but if it continues after that opium may be given. The pain can best be relieved by the use of warm applications. The patient should be kept strictly confined to bed until the diarrhoea has ceased for twenty-four hours.

(b) *Chronic.*—*Etiology.* The most common cause of chronic catarrhal colitis is constipation, the catarrh being the result of irritation by retained faeces. It is generally most marked in the distal part of the colon, where retention is most common. The constant consumption of irritating food and the habitual use of certain drugs, especially aperients, may lead to chronic colitis. Infection of the bowels with pathogenic organisms, introduced in the food or water or coming from some septic focus in the mouth, may cause a chronic infective, catarrhal colitis, which may also be the sequel of an acute attack.

Symptoms. Diffuse discomfort and a sensation of fullness are commonly present in the lower part of the abdomen. Slight attacks of colic may occur, but in many cases there is no actual pain. The abdomen is often somewhat distended and tender. The discomfort is generally worse after meals and is relieved if the bowels are well opened. In cases due to mechanical irritation constipation is commonly present, the stools being hard and coated with mucus. In infective cases there is generally diarrhoea; mucus and occasionally blood are found in the fluid stools, but there is no excess of food residue in uncomplicated cases.

Treatment. In cases due to irritation by faeces, food and drugs, a cure rapidly results on relieving the constipation, altering the diet and stopping the drugs respectively. The teeth should be put into good order and the food must be thoroughly masticated. If possible the use of purgatives should be avoided, though liquid paraffin is often useful, as it makes the stools soft. In infective colitis milk soured by the lactic acid bacillus should be taken unless the stools are already acid, and a non-irritating diet should be ordered. In severer cases the colon should be washed out with an antiseptic solution, such as sodium salicylate (thirty grains to the pint), once a day immediately after the bowels have been opened spontaneously. Belladonna should be given before meals, with the addition, if the diarrhoea persists, of codein

II.—Muco-Membranous Colitis

Etiology. Muco-membranous colitis occurs four or five times more frequently in women than in men. It generally begins between the ages of twenty and forty-five. Two predisposing factors are invariably present—constipation and an abnormal nervous system. Retention of fæces in an individual with an abnormally irritable nervous system may lead reflexly to over-activity of the motor and secretory fibres of the colon, causing respectively painful spasms and excessive secretion of mucus. The irritation of retained fæces generally results at the same time in the production of a true catarrh, which is sometimes increased by injudicious treatment with irritating purgatives or injections.

Symptoms. Attacks of muco-membranous colitis, which are often brought on by depressing emotions, may occur at intervals of weeks or months or may continue without intermission. During an attack a dull aching pain or discomfort is more or less constantly present, and paroxysms of colicky pain may occur at intervals. The pain is situated most frequently in the left flank and iliac fossa and just above the pubes; at the same time the descending, the iliac and the pelvic colon are often tender and can be felt as a contracted cord, in which scybala can sometimes be distinguished. Less frequently there is pain and tenderness in the cæcum and ascending colon, which are felt to be more firmly contracted than usual. The passage of fæces and membranes or of the latter alone, whether spontaneously or as the result of treatment, generally gives relief.

The constipation present in the intervals becomes much more severe during an attack. The stools consist of hard, small scybala, which may occasionally be moulded into thin or flat pieces owing to spasm of the anal sphincter. Defæcation is often accompanied by painful straining, and it generally leaves a sensation that something is still present in the rectum. Attacks of spurious diarrhœa may occur, owing to excessive irritation of the colon by the retained fæces leading to a localised acute colitis. The mucus is excreted alone or with fæces as membranous shreds, which may in well-marked cases form tubular casts of the colon; they are often called skins by the patient and have been mistaken for tape-worms.

Diagnosis. There cannot be much difficulty in diagnosis if the stools are seen, but in some cases membranes are only discovered on examining the ejecta after irrigation of the colon. The attacks of pain may closely simulate appendicitis or biliary colic, but the passage of the membranes clears up the diagnosis.

Associated Conditions. Muco-membranous

colitis is occasionally secondary to the constipation which results from cancer of the intestine; it is therefore important to make an examination of the rectum and pelvic colon by the sigmoidoscope in all cases in which cancer might possibly be present. Pain in the right iliac fossa is not uncommon, but in the majority of instances this is not due to appendicitis, but to the colitis affecting the cæcum and ascending colon. In rare instances chronic or recurrent appendicitis, by producing constipation, may give rise in predisposed individuals to muco-membranous colitis, which may then be cured by appendicectomy. Visceroptosis, including movable kidney, is frequently present with muco-membranous colitis. Neurasthenic dyspepsia, with atonic dilatation of the stomach, is common. The appetite is poor and the patients are often pale and thin.

The passage of *intestinal sand* is almost always associated with muco-membranous colitis. Its first appearance generally coincides with that of the membranes; occasionally it is only observed after the colitis has existed for several months or years, but it is probable that in many such cases its presence is at first overlooked. Only small quantities are generally passed. It is composed of irregular brown granules, which are never crystalline and which must be distinguished from the false intestinal sand formed of wood cells, which is sometimes passed by individuals who have eaten a large quantity of pears and more rarely of bananas.

Prognosis. Muco-membranous colitis is a very chronic disease. If treatment is begun at an early stage recovery generally follows, but when the condition has been present for many years the outlook is very unfavourable, and even if improvement occurs the likelihood of a relapse is considerable. The disease does not in itself shorten life, but when severe and of long duration it may cause a patient to become completely bedridden.

Treatment. Treatment must be directed to the removal of the two underlying factors—the abnormal condition of the nervous system and the constipation. The patient should be encouraged to think as little as possible about her illness and be forbidden to make minute daily examinations of her excreta. She should avoid over-work and excitement, but her mind should be kept well occupied and a sufficient amount of exercise in the open air should be taken every day. She should go to bed early, and in some cases it may be advisable to have breakfast in bed, but it is generally unwise for the patient to be kept completely at rest, a Weir-Mitchell treatment being definitely contra-indicated. Removal from the home surroundings to a hospital or some health resort is often very useful.

In the majority of cases the best results are obtained with a generous mixed diet, but coarse food which leaves a large quantity of residue and chemical irritants should be avoided. Thin and anæmic patients, who have often unwisely restricted their diet, should be encouraged to eat, even if anorexia be present.

At the commencement of treatment every trace of fæces accumulated in the colon must be removed by means of castor oil and enemata; in severe cases injections of six to ten ounces of olive oil at night should also be given. Once the colon is empty, care must be taken to prevent the reaccumulation of fæces. In very mild cases a change in diet and the administration of belladonna are all that is required, but an aperient, preferably castor oil, is generally needed in addition in order to obtain a daily evacuation.

Severe cases require local treatment. This can be given at home, but it is generally more effective at one of the spas, such as Plombières, Châtel-Guyon and Harrogate, at which there are special facilities for intestinal lavage. Between one and two pints of the natural water or normal saline solution at a temperature of 100° F. are introduced at a pressure of one foot into the colon from a douche-can. It is retained for ten or fifteen minutes, after which the patient gets up and evacuates the water, which is generally accompanied by scybala and mucus. The proceeding is then repeated, a smaller quantity of fæces but more membranes than after the first injection being generally expelled. Injections of soap and water, antiseptics and astringents should be avoided, as they tend to aggravate the condition by irritating the mucous membrane.

In the very exceptional cases, in which all other treatment has failed, an appendicostomy should be performed, so that the colon can be flushed with water introduced through the appendix.

III.—Parietal Colitis; Pericolicitis; Multiple Diverticula of the Colon

Etiology. Hard fæcal masses retained in the iliac and pelvic colon often give rise, as already described, to catarrh of the mucous membrane. A greater degree of irritation leads to superficial necrosis of the mucous membrane with production of stercoral ulcers, and inflammatory infiltration of the submucous tissue occurs. In chronic cases there may be a general thickening of the colon (parietal colitis); the inflammation then frequently extends to the peritoneum with the production of pericolicitis.

Multiple diverticula of the iliac and pelvic colon occur in elderly, stout, constipated individuals. They give rise to no symptoms unless pathological changes occur in them.

Owing, however, to the stagnation of fæcal material within them they are very liable to inflammation and ulceration, parietal colitis and pericolicitis resulting.

Symptoms. Parietal colitis produces few symptoms until the peritoneum is involved, but the presence of a thick and tender iliac colon in constipated individuals suggests the presence of parietal colitis. So long as no peritonitis develops, pyrexia and rigidity are absent. The stools may contain mucus and small quantities of blood, and there may be occasional attacks of spurious diarrhoea. Pain may occur on exertion and during defæcation, but it is rarely well marked until the peritoneum is involved; the colon is then fixed and more tender, and the abdominal wall over the left iliac fossa is rigid.

The irregular sausage-shaped tumour formed by the inflamed colon, especially in cases of multiple diverticula, has frequently been mistaken for cancer, especially when symptoms of chronic or acute obstruction have been present. The sigmoidoscope should be used in cases of doubt, as, although cancer of the iliac colon cannot be seen with it, inflammation and ulceration of the mucous membrane of the pelvic colon may be visible if the tumour is due to colitis.

On rare occasions a stercoral ulcer of the colon or of a diverticulum perforates. When adhesions to the bladder are already present, the perforation may occur into the bladder; a vesico-colic fistula is indeed much more frequently the result of inflammatory changes in the colon than of cancer. When perforation occurs into the peritoneal cavity the symptoms are strikingly similar to those of peritonitis due to appendicitis, except that the left side is primarily involved instead of the right. The attack may subside without complication, or local or general peritonitis may result.

Treatment. No aperient should be given, the colon being kept empty by means of injections of olive oil given in the evening and retained during the night and by saline enemata given in the morning. The stools should be kept soft by the administration of liquid paraffin, and the food should be such as to leave the smallest possible residue. Pain can be relieved by warm applications and by belladonna and codeine. If a local abscess, general peritonitis or intestinal obstruction develops, the abdomen should at once be opened.

IV.—Ulcerative Colitis

Chronic ulcerative colitis is one of the most troublesome conditions occurring in the intestinal tract. It is met with sporadically in men and women—rarely after the age of forty—and is a slow pyogenic infection of the mucous membrane of the colon, sometimes

localised to a single part, sometimes in multiple foci, occasionally involving the entire colon. The actual mode of infection is unknown, though it may be associated with an anal fissure, piles, injuries during childbirth, etc. The infective agent is most frequently streptococcus or *B. coli*, and occasionally staphylococcus, pneumococcus or other organisms.

Symptoms. The disease begins insidiously. A patient, who may have been constipated for years, finds that he is passing mucus with his motions. The constipation and passage of mucus give place to numerous offensive stools, which are found to contain blood and pus. Localised pain and tenderness in the course of the colon is usually a marked feature at this stage. The temperature rises, and there is frequently evidence of general infection as shown by rigors, vague muscular pains or swellings in one or more joints. The appetite remains good, and the general condition and appearance of the patient are much better than the severity of his symptoms would seem to warrant.

Diagnosis. An examination by means of the sigmoidoscope should be made in every case. The mucous membrane in the immediate neighbourhood of the anus is often healthy, but the upper part of the rectum is ulcerated. The mucous membrane bleeds easily. It is covered with a foul-smelling secretion consisting of blood, pus and mucus, and there are often shreds of ulcerated mucous membrane. A swab should be taken from the surface of an ulcer for bacteriological examination and for the preparation of a vaccine, if it is thought necessary.

Differential Diagnosis. Dysentery, cancer, polypus, tuberculous and syphilitic inflammation have to be excluded before the diagnosis of ulcerative colitis is made. The history and the absence of any hepatic symptoms exclude dysentery; the sigmoidoscope will show that cancer of the lower part of the large intestine is absent, though this is the commonest mistake; and by the same instrument it will be possible to show that no polypus is present. Tuberculous ulceration occurs in a different type of patient; syphilitic ulceration is rarely so extensive nor does it occur without other signs of spirochaete infection.

Treatment. The treatment of ulcerative colitis is extremely unsatisfactory, because the ulceration continues until the patient becomes immune to the infection causing it. The principles of treatment, therefore, consist in keeping the ulcerated surface of the mucous membrane as clean as possible, and allowing the inflammatory products to be removed as soon as they are formed. The diet should be such as will leave only a minimum of residue, and the intestine should be irrigated once or twice a day with one or two pints of fluid, nitrate of

silver (quarter grain, gradually increased to two grains, to the ounce) being the most useful.

Ipecacuanha is worth trying in the earlier stages; chlorodyne will usually relieve the abdominal pain, and aspirin the pain in the joints and muscles, which may be associated with ulcerative colitis. Vaccine therapy and ionized irrigations have not yielded the good results expected of them. Appendicostomy may be necessary in the more severe cases. It gives relief in many instances, because it allows the whole mucous membrane to be thoroughly cleansed, but there is no evidence that it cures the ulceration or tends to shorten the course of the disease.

D'A. P.

A. F. H.

TUBERCULOUS ENTERITIS AND COLITIS

Etiology. Miliary tubercles may be present in the intestines in general tuberculosis, but they have no clinical importance. Primary infection of the bowels from tuberculous milk is not infrequent in children, but is very rare in adults; the presence of chronic intestinal catarrh predisposes to the infection. Secondary infection from the swallowing of tuberculous sputum is very common, ulceration being present in fifty per cent. of fatal cases of phthisis, in some of which, however, it is probably due to pyogenic organisms and not to the tubercle bacillus.

The bowel in the neighbourhood of the ileo-cæcal sphincter is most frequently involved, the lower end of the ileum, the appendix and the cæcum being attacked, either alone or with the adjacent parts.

Symptoms. Frequently no symptoms are present, although extensive ulceration may be found post-mortem. Tuberculous enteritis should be suspected in children suffering from diarrhoea with fever, abdominal distension, enlarged glands, wasting and weakness. It should also be suspected when phthisis is associated with diarrhoea, especially if abdominal pain and tenderness are present.

The diagnosis can only be made with certainty if tubercle bacilli are found in the stools and with a considerable degree of probability if blood is passed, as diarrhoea may result from lardaceous disease without tuberculous ulceration.

Hyperplastic Tuberculosis of the Cæcum is a rare condition, in which the ileo-cæcal sphincter and a small part of the ileum may also be involved; chronic intestinal obstruction and the presence of a tumour give rise to suspicions of cancer, which can only be dispelled after exploration.

Complications. Perforation of a tuberculous ulcer is rare, owing to the adhesions which form

between the coils of intestine. Cicatrization of an ulcer may lead to single or multiple strictures, but as these are incomplete and the contents of the bowel are generally fluid, obstruction is rarely produced. External adhesions and the formation of bands may, however, lead to acute intestinal obstruction.

Treatment. The treatment is the same as that of ulcerative colitis due to other causes. It is most important in cases of phthisis to instruct the patient never to swallow his sputum.

A. F. H.

DUODENAL ULCER

Etiology. Acute duodenal ulcers may occur in uræmia and after burns, but they are of little clinical importance. The etiology of chronic duodenal ulcers is much the same as that of chronic gastric ulcers, the two conditions being not infrequently associated together. Duodenal ulcers, however, are considerably more common in men than in women.

Symptoms. The onset is generally insidious, the first symptom complained of being a sense of fulness three hours after the largest meals. This is gradually replaced by pain, which occurs between two and four hours after every meal, the interval being longer the larger the meal. It frequently wakes the patient in the early part of the night, particularly if the last meal was finished less than three hours before going to sleep. It is generally situated in the middle line rather nearer the umbilicus than the ensiform cartilage; it may radiate to the right or be situated on the right side only. The pain is often associated with a feeling of hunger and is relieved by taking food; it is therefore commonly known as "hunger-pain." It is also relieved by alkalis, and when the stomach is emptied by means of a tube or by vomiting; vomiting is, however, rare in uncomplicated cases. Periods of "hunger-pain" lasting for some weeks or months alternate with periods of more or less complete freedom from symptoms. The attacks are much more common in cold weather than in hot and are liable to be brought on suddenly by exposure to cold, by worry and by indigestible meals. In addition to the typical "hunger-pain" sudden attacks of severe cramp may occur in the epigastrium independently of meals. There is frequently tenderness and rigidity to the right of the epigastrium, especially when spontaneous pain is present; cutaneous hyperæsthesia is rare.

Hæmorrhage may never occur, but in the majority of cases occult blood is found from time to time in the stools. Severe hæmorrhage is less frequent, but in rare cases it is the first symptom; it always results in melæna and may also give rise to hæmatemesis. The appetite

remains good and the patient does not lose weight or strength. He generally suffers from a feeble peripheral circulation.

The stomach is shown by the X-rays to be hypertonic, the greater curvature rarely reaching the level of the umbilicus, and the stomach empties itself with unusual rapidity. Constipation is almost invariably present. A test meal shows the presence of an excessive quantity of hydrochloric acid.

Diagnosis. When the symptoms have only been present for a short time an ulcer is not as a rule present, but a pre-ulcerative condition, the nature of which is not exactly known; this is likely to result in ulcer if not adequately treated.

The diagnosis from gastric ulcer depends upon the later onset of pain, the greater relief on taking food, the rarity of vomiting, the occurrence of occult or obvious blood in the fæces when the gastric contents contain none, the frequent situation of pain and tenderness to the right of the middle line, the more frequent periods of complete freedom from symptoms and the hypertonic condition of the stomach. The symptoms may closely resemble those of gall-stones, but in the latter condition the pain is much less regular in its time relations, and tenderness over the gall bladder and pain referred to the right shoulder are frequently present.

Course and Prognosis. The prognosis is very good in early cases if the patient is in a position to avoid exposure to cold and to take a suitable diet. The longer the history, the less likely is it for relief to follow medical treatment, but so long as intervals of complete freedom from symptoms occur, the chance remains fairly good.

When a large ulcer heals it may lead to obstruction, the first symptom of which is generally vomiting. When vomiting is present and the stomach is found by the X-rays to be enlarged instead of small, medical treatment is very unlikely to give much relief.

Perforation may occur and lead to general peritonitis or much less commonly to a localised abscess.

Treatment. The treatment is the same as that of gastric ulcer (*q. v.*), with the exception that after the acute symptoms have disappeared the patient should take a small quantity of food between the larger meals, the times being so arranged that during the day no period longer than two and a half hours passes without food being taken. Something should also be eaten last thing before going to sleep, and milk and biscuits should be placed by the bed-side to be taken if the patient wakes during the night.

The indications for operation are similar to those in gastric ulcer, but as the results are more

uniformly favourable, less hesitation should be felt in recommending gastro-enterostomy. This should at once be performed if vomiting and dilatation indicate the presence of partial obstruction.

A. F. H.

DISEASES OF THE PERITONEUM

Acute General Peritonitis is always due to a bacterial infection, for even when the exudate is sterile, organisms can be found in the omentum. Normally the only communication between the peritoneal cavity and the exterior is by way of the Fallopian tube, and gonococcal or tuberculous infections not infrequently ascend in this way, though they may result in only a localised peritonitis. An abnormal communication is most frequently set up by perforation of a viscus, or by a perforating wound of the abdominal wall. The rupture of an abscess may introduce the infective agent. But micro-organisms can pass through the diseased intestinal wall without there being any rupture, as in strangulated hernia. A septic uterus may infect the peritoneum through the lymphatics, as may an infected umbilical cord.

The symptoms vary with the intensity of the infection—thus the streptococcus pyogenes overwhelms the patient with toxic symptoms, which are fatal before local signs have time to develop, while in less virulent infections the local signs are more prominent. Or the condition may be comparatively latent—this is apt to occur at the extremes of life, in the terminal peritonitis of Bright's disease, in the perforation of a malignant growth and sometimes in typhoid fever.

Primary Acute General Peritonitis.—The only type which can be claimed as primary is pneumococcal peritonitis. Genuinely primary cases are very rare. There is often pneumococcal septicæmia, and it is probable that at other times the appendix is really the source of infection. Some cases are fulminating, proving fatal in forty-eight hours, in others, according to Hale White, there is a critical fall of temperature about the seventh day, as in pneumonia, but a good many run a somewhat chronic course. If operated on the prognosis is better than in other forms of purulent peritonitis. In the later stages the pus is frequently sterile.

Secondary Acute General Peritonitis.—Few conditions present a more typical clinical picture;—the sunken, anxious face with its combination of lividity and pallor, the restlessness of the upper part of the body contrasting sharply with the immobile abdomen and drawn-up legs. The tongue is furred, the teeth coated with sordes. The pulse is small, weak and running, with a characteristic wiry feeling; its frequency is at least 120 and probably more.

The temperature is usually raised to about 103°, but in the most toxæmic cases it may be normal or subnormal in the mouth and axilla, while high in the rectum. This is a very grave sign. Abdominal pain is constant and severe until the patient is too poisoned to appreciate it. Persistent vomiting is the rule, becoming first bilious and then offensive, but rarely faecal. The respirations are shallow and costal in type, while the abdominal muscles are rigid and on guard, and there is marked cutaneous tenderness. The intestines become paralysed and meteorism follows. If no gurgling sounds are heard on careful auscultation of the abdomen for five minutes, complete paralysis may be assumed (Greig Smith). Such meteorism may cause almost complete disappearance of the liver dullness and an erroneous diagnosis of free gas in the peritoneal cavity may be made. Conversely adhesions may cause the liver dullness to persist even though free gas be present. Edema of the abdominal walls in the flanks is occasionally seen with peritonitis from a ruptured viscus. There is usually obstinate constipation, though in the puerperal cases diarrhoea is not infrequent. Leucocytosis is the rule. The urine is scanty and gives a strong indican reaction. The mind usually remains clear, though towards the end there may be mental confusion and then a semi-comatose state. Death may be expected within two or three days and is seldom delayed over a week. Recovery without operation cannot be anticipated, and even with operation the prognosis is extremely grave.

Diagnosis. *Thoracic diseases* involving the diaphragm, such as diaphragmatic pleurisy, basal pneumonia and pyopneumothorax may at the outset simulate peritonitis. Once suspicion is aroused the diagnosis is not difficult. The rapidity of the respirations, often forty or more, in proportion to the pulse-rate is a valuable sign; the catch in the breath at the height of inspiration is also characteristic. The pulse will usually be less than 120 and is not weak or wiry. The abdominal tenderness is chiefly superficial, and if firm, deep pressure with the flat hand is kept up the abdominal wall relaxes at each inspiration, which is not the case in acute peritonitis. *Lead colic*, from the severity of the pain, the constipation and occasional abdominal tenderness, has been mistaken for peritonitis, but is distinguished by the paroxysmal character of the pain, the relief afforded by pressure, and the absence of vomiting, or characteristic pulse. *Renal and hepatic colic* are usually accompanied by vomiting, but the locality of the pain and the direction in which it radiates should prevent confusion. *Acute intestinal obstruction* may present great difficulty, especially as the two conditions may coexist.

Visible peristalsis, rapid development of meteorism and the copiousness of the vomit all point to obstruction, and unless peritonitis is present as well the abdomen is not rigid or extremely tender, the pain is paroxysmal, fever will be absent, and the pulse will not be so frequent, small or wiry. Other less common causes of severe abdominal pain are acute pancreatitis, the torsion of a floating kidney or of an ovarian tumour, and a ruptured Fallopian tube. In all these conditions the severity of the pain and the collapse induced will closely simulate peritonitis; but the pains more localised and toxic symptoms are absent.

Treatment. When the diagnosis of acute septic peritonitis has been made, surgical interference should not be delayed longer than necessary for the patient to get over the initial shock in perforative conditions. Drainage with the minimum disturbance of the tissues is all that should be done, and no attempt should be made at an elaborate "toilette of the peritoneum," which breaks down the barriers which are being formed against the spread and absorption of the septic material, while reducing resistance by exposure. By raising the patient to a semi-sitting posture, with the knees kept flexed by pillows under them, gravity will assist in restricting the infection to Douglas's pouch. The method of intravenous or subcutaneous infusion of several pints of normal saline solution (a teaspoonful of salt to each pint of boiled water) at 110° to 115° F. has proved a valuable aid. Barnard advocated a hydrostatic pressure of not more than one foot, and infused into the subcutaneous tissues of the thigh. Others have infused into the subscapular or submammary tissues. The advantages claimed are that (1) the loss of fluid from the patient is prevented, with great improvement in the pulse, the thirst and the collapse, (2) osmosis now takes place from the tissues into the peritoneal cavity, diluting the toxins there instead of absorbing them into the blood stream, (3) toxins already absorbed are greatly diluted and their elimination by the kidneys promoted.

Opinions differ as to the advisability of purgatives. In the earlier stages, when the infective agent has not been removed, it is unwise by exciting peristalsis to spread an infection which might have remained localised. Obstruction or paralytic distension of the bowel should absolutely contra-indicate their use. The use of opium, which was formerly the routine practice, is now condemned as obscuring the condition and increasing the paralytic distension of the intestines. It is now only employed when for any reason operation is impossible and euthanasia is the aim.

Stimulants such as strychnine and brandy may be necessary, but should be used cautiously

when a very low and falling blood pressure suggests that vasomotor paralysis is impending. If intravenous infusion is being employed a better plan is to add one ounce of liquor adrenalin hydrochloride to five pints of the infusion fluid (*i. e.* 1 in 100,000).

Chronic Peritonitis.—We must distinguish between the results of a former acute peritonitis such as localised or general adhesions and a chronic progressive inflammatory condition to which alone the name of chronic peritonitis should be given. The largest number of these cases are tuberculous or malignant in origin. These will be considered separately. Bright's disease, alcohol, lead and syphilis have been given as causes of simple proliferative peritonitis, but they only act secondarily by enabling some chronic infection of feeble virulence to establish itself.

Signs and Symptoms. The onset is insidious and the symptoms vague. Sudden attacks of meteorism without obvious cause, abdominal discomfort amounting at times to pain, increased by movement, especially by walking down-stairs, may be the chief complaint. The appetite is poor and food may excite colic. The pulse is feeble and strength and general nutrition fail. The temperature may remain normal for considerable periods, but irregular attacks of pyrexia are likely to occur, corresponding to exacerbations of the disease.

On examination the abdomen appears tumid and the umbilicus red and pouting. If there is not much ascites the swelling of the abdomen may appear irregular and peristaltic waves may be seen. With more fluid the abdomen becomes globular. On palpation the thickening of the walls gives rise to a doughy sensation, and irregular, slightly movable resistances may be felt. Of these the rolled-up omentum will be the most prominent. A fluid thrill will be obtained. On percussion the note is dull over an area corresponding to the fluid and the dullness in the flanks will be replaced by resonance on rolling the patient on to his side.

The *diagnosis* from *tuberculous peritonitis* may be very difficult. Simple proliferative peritonitis is not likely to occur in children. In adults infection of old tuberculin may be required to establish the diagnosis. In *Bright's disease* and *cirrhosis of the liver* the ascites is frequently due to chronic peritonitis. In ascites due to *backward pressure* thickenings will be absent, and there will be evidence of the lesion causing this pressure.

The *prognosis* is unfavourable. Complete recovery is not to be expected. Even if the fluid becomes absorbed the resulting adhesions will seriously embarrass digestion and may cause obstruction.

Treatment. A drachm of oleate of mercury should be rubbed into the abdomen for twenty minutes daily if the skin will stand it, unless signs of mercurialism supervene. For exacerbations of pain hot fomentations, sprinkled with tincture of opium or tincture of belladonna may afford relief. Elastic pressure, applied by a belt or crêpe lisse bandages, is usually grateful and well borne. The diet, while nourishing, should contain little indigestible residue; it may consist of milk, eggs, cream, cereals, soup and a little minced meat. Malt extract, cod-liver oil and syrup of the phosphate or iodide of iron should be given.

If the effusion is excessive paracentesis must be performed. This is particularly necessary if the respiration becomes embarrassed. Two drachms of the liquor adrenalin hydrochloride made up with a half per cent. of chloretone injected into the abdominal cavity at the end of the tapping may delay recurrence of the fluid. Autoserotherapy has also been advised—1 to 10 c.c. of the abdominal fluid is drawn up into a syringe, the needle is withdrawn only as far as the subcutaneous tissues into which the fluid is injected. It is claimed that without any local reaction the ascitic fluid is absorbed with the accompaniment of profuse diuresis. But it is difficult in chronic peritonitis to exclude a tuberculous origin, and in this case there would be the risk of setting up a generalized tuberculosis.

Polyserositis (Polyorrhomenitis).—Under certain ill-understood conditions a tendency exists to inflammation of all the serous membranes. The symptoms have been described as follows—a young person is attacked with pericarditis with effusion. Later ascites slowly develops. Repeated tapping is required. Though the ascites may not progress for years, steadily increasing cachexia, chronic jaundice, which varies with the degree of ascites, but never entirely disappears, chronic splenic and hepatic enlargement and pleural effusion develop, the process spreading by continuity. Many cases are presumably of tuberculous origin. The condition is allied to chronic indurative mediastino-pericarditis which is generally tuberculous.

Tuberculous Peritonitis.—The peritoneum may become infected with tubercle (1) from the intestine by tuberculous milk or meat or by a phthisical patient swallowing his sputum; (2) by the blood stream, as in general tuberculosis; (3) by the lymphatics, as in cases secondary to tuberculosis, pleurisy or epididymitis; (4) by the Fallopian tubes in women.

The condition is met with chiefly in children and young adults, but no age is exempt. Osler found the maximum incidence to be from twenty to forty.

Signs and Symptoms. Gee described the

characteristic features as “abdominal indurations and suppurations, tympanites and ascites.” It is convenient, however, to make two main subdivisions, though it must be admitted that intermediate forms occur.

(a) With *subacute onset*—sometimes called the “wet” form. The patient presents symptoms of gastro-enteritis, the temperature rises, the abdomen becomes tympanitic and tender, so that the condition has been mistaken for typhoid fever. Then ascites develops. Later on, although exceptionally as early as the second week, indurations may be felt, consisting of the puckered and rolled-up omentum, adherent coils of intestine, and enlarged mesenteric glands. As the case proceeds emaciation may become very marked, and the abdomen is apt to become pigmented. Although the course may be protracted, recovery is quite common in this form. If the case ends fatally, it will probably be from the spread of tuberculous lesions in other parts or from intestinal obstruction.

(b) With *gradual onset*—sometimes called the “dry” form. The patient has been in failing health for weeks or even months before he begins to complain of abdominal discomfort. The abdomen becomes irregularly distended, and presents on palpation a doughy sensation with areas of greater resistance, the arrangement of these areas varying with the amount and distribution of flatus and fæces in the intestinal coils. There is usually less pyrexia than in the other type. There is always more or less gastro-intestinal disturbance, such as nausea, vomiting, constipation alternating with attacks of diarrhoea, in which the stools are highly offensive, often fatty and apparently free from bile. There may be pain on micturition from adhesions around the bladder. The tongue is often glazed, the face pinched and drawn, and emaciation may become extreme. By this time the bands, lumps and knots in the peritoneal cavity will have become very marked. There is increasing anæmia, and a great tendency to œdema about the ankles, even though the patient is of necessity confined to bed. An umbilical fistula may form, discharging pus from breaking-down glands or fæces from rupture of an intestinal ulcer into a shut-off cavity. Perforation is also apt to occur near the cæcum, but in this case a fæcal fistula is not so likely to form. In spite of remissions the prognosis in this type is very unfavourable, and death generally follows from exhaustion and lack of nourishment.

(c) A third type has been described, the *fibrous*, which may follow either of the other two, or may start as such, in which the abdomen becomes retracted, there is much constipation and a variable amount of wasting. It is ex-

tremely chronic and certainly much less common than the other types.

Diagnosis. In any case great stress will naturally be laid on the discovery of a tuberculous lesion elsewhere, such as in the lungs or genito-urinary system. In the early stages of the acuter variety the diagnosis from *typhoid fever* can generally be made by the absence of Widal's reaction, leucopenia and the characteristic form of the temperature chart. The prolonged course of the disease and the presence of indurations are important points. If the ascitic fluid is withdrawn the predominance of lymphocytes in it is suggestive of tubercle, and inoculation experiments with it will probably clinch the diagnosis. Injection of old tuberculin can only be helpful during an afebrile period. Von Pirquet's cutaneous reaction may be a help in children under eight, but above that age a positive reaction occurs in nearly every one, so that this is of no value. A negative reaction, however, is useful in excluding tubercle. An encysted collection of fluid is likely to be mistaken for an *ovarian cyst*, but the swelling is usually less definitely outlined. Moderate pyrexia and the discovery of tubercle elsewhere would be in favour of the former. Laparotomy is often required to settle the point.

Treatment. To avoid repetition this may be briefly described as a combination of that called for in tuberculosis and in chronic peritonitis. But one very important point must be emphasized—in the ascitic type, laparotomy and free drainage is of much service. The peritoneal membrane will be seen studded with grey miliary tubercles. But in the dry form, which is characterized by masses of caseous, breaking-down mesenteric glands with inextricable adhesions, it is worse than useless, and generally results in wounding the bowel and a faecal fistula.

Subphrenic Abscess is the name given to any localised collection of pus in contact with the under surface of the diaphragm. Barnard pointed out that the cruciform arrangement of the ligaments of the liver incompletely separates the subphrenic space into four divisions, the right and left anterior and posterior respectively. Of these the left posterior corresponds to the lesser sac. In addition pus may accumulate between the layers of the coronary ligament and thus be subphrenic without involving the peritoneal cavity.

Etiology. The commonest cause of subphrenic abscess is a ruptured gastric ulcer, which usually infects the left anterior space, but may involve the others. Next in frequency comes appendicitis, which sets up a purulent track infecting the right anterior or posterior divisions. Intrahepatic causes, such as tropical

or pyæmic abscesses or a suppurating hydatid cyst, usually produce an abscess between the layers of the coronary ligament, but may infect the right anterior division. Other less common causes of subphrenic abscess are gastric cancer, duodenal ulcer, splenic abscess, pyæmia, peritonitis of the vertebræ or ribs, tuberculous peritonitis limited to the lesser sac, rupture of the intestines and pyosalpinx. It is quite exceptional for an intrathoracic suppuration to cause subphrenic abscess, though the converse is common. The abdominal pressure is positive, while the intrathoracic is negative; moreover, the course of the lymphatics is against the downward passage of the infection. The recumbent posture adopted as a result of the exciting cause is a factor in the passage of pus into the subphrenic space and into Douglas's pouch. For, as Barnard showed, between these spaces the thick muscles and tissues of the loins with the kidneys and perinephric fat rise as mounds.

Signs and Symptoms. These will differ according to the cause and position of the suppuration. The onset is generally sudden in the cases starting with perforation of a viscus into the peritoneum, but it is insidious in the extraperitoneal cases, which are usually due to an intrahepatic cause, or in those where adhesions had previously formed around the site of perforation. Pain is nearly always the first symptom, combined with cutaneous hyperæsthesia or deep tenderness. Vomiting occurs next in point of time and frequency, and may be intractable. The patient presents the signs of a septic state, furred tongue, muddy complexion, leucocytosis, with rigors and sweats in the severe cases. There is remittent pyrexia, but except at the outset or when a general pyæmia is established, the temperature does not usually rise very high. When there is a free outlet for the pus into the alimentary canal the fever may be quite slight. Wasting is usually marked, so that in the more latent cases tuberculosis is often suspected. Locally, inspection will generally reveal some bulging, which, on account of the adhesions, does not move on respiration. If bulging cannot be detected, measurement may show increased circumference on the affected side. Oedema or enlarged veins over this region may be noted. On percussion dullness will be found over the position of the abscess unless, as is often the case, it contains gas. When the right anterior division is involved, as it usually is in cases of appendical origin, the liver becomes adherent to the anterior abdominal wall quite early, and cannot be displaced downwards, so that the pus has to push the diaphragm up, giving a domed shape to the upper limit of dullness. The subphrenic abscesses of intrahepatic origin, on the other hand, strip the peritoneal reflexions off the upper

surface of the liver, pushing that organ down into the abdomen. When gas is present in the abscess cavity from a ruptured viscus the signs are obscured by the appearance of a tympanitic area high up in the epigastrium or over the normal area of liver dullness, where the bell sound may be obtained. This tympanitic area travels round the chest as the patient is rolled over. Below the tympanitic area I have felt the sharp anterior edge of the backwardly rotated liver. When the amount of gas is small in proportion to the thickness of the walls there may be only a movable area of diminished dullness. When there is free communication between the abscess and a viscus as in perforated gastric ulcer, the signs may vary considerably, as the cavity will at one time contain gas and at another fluid. When the left anterior division is involved the dullness lies to the left of a line running from the xiphisternum to the umbilicus, with a convex margin towards the right side. When the lesser sac is involved the dull swelling may present between the stomach and liver, or between the stomach and the transverse colon, or between the stomach and spleen, or below the transverse colon. Thoracic signs are seldom entirely lacking. A pleural friction at the right base is the commonest, but signs of consolidation, collapse or serous effusion at either base and bronchitis are also frequently met with. Cough and dyspnoea are often present. A valuable sign is the upward displacement of the heart. X-rays are of great value. The diaphragm may be seen to be pushed up and immobile on the affected side, and a clearer area due to the presence of gas may be detected.

Course. At first there is a diffused exudate, which becomes localised as an abscess from the eighth to the fourteenth day. The importance of this in selecting the time for operation is very great. Later on the abscess may rupture through the diaphragm into the lung or pleural cavity, more commonly the former, because the lung is likely to become fixed by adhesions to the diaphragm. In this case pus is coughed up, or a secondary rupture from the lungs into the pleural cavity follows, setting up pyopneumothorax. The general peritoneal cavity may become infected, or rupture into the stomach or externally at the umbilicus may occur. Barnard's figures show that all unoperated cases die, while the present mortality in cases submitted to operation is thirty-seven per cent. A fuller recognition of the condition and better selection of the time and method of opening the abscess would probably reduce this.

Diagnosis. Two main points have to be determined in each case—is there suppuration, and is that suppuration above or below the diaphragm? The history of a disease known

to lead to subphrenic abscess, the temperature, leucocytosis and general aspect of the patient will generally serve to answer the first. *New growth of the liver* is the only non-suppurative condition likely to be mistaken for it, since wasting is marked in both and pyrexia is not uncommon in cancer of the liver. But the dome-shaped upper limit of the liver dullness, the absence of nodules in the liver, the comparative infrequency or slightness of the jaundice, and the much greater tenderness will all point to subphrenic abscess. Chronic suppuration above the diaphragm often leads to clubbing of the extremities, but not so suppuration below it. An *empyema* pushes the heart across to the opposite side, and does not float it up as a subphrenic abscess does. A *suppurating hydatid* or a *tropical abscess* will show eosinophilia, but both of these may go on to subphrenic abscess, and it is really not important to decide whether this further stage has yet occurred or not. If the cavity contains gas it may be mistaken for *pyopneumothorax*, but this commonly involves the upper part of the chest, while subphrenic abscess never reaches the upper third of the thorax.

An exploring needle will probably clinch the diagnosis, but this should only be used under anaesthesia, when all preparations have been made to follow the discovery of pus by operation. Otherwise infection of the pleural cavity or the general peritoneal cavity may result. The discovery of clear serous fluid in the pleural cavity may mislead, for this may merely be secondary to deeper pus below the diaphragm.

Treatment is purely surgical when the diagnosis has been made. The best time for operation is between the eighth and the fourteenth days, when the abscess is most likely to be localised by adhesions.

Growths and Cysts of the Peritoneum.—Occasionally **Innocent Tumours** such as fibromata, lipomata and myomata or mixtures of these may arise in the peritoneum, but they are rarely diagnosed. They may produce ascites and will probably be considered malignant until operated on. Even though innocent their removal may be a matter of considerable difficulty unless undertaken while they are of small size and before they have formed extensive adhesions.

Malignant Growths.—Primary growths may be endothelioma or a diffuse sarcomatosis, but these are very rare. Secondary growths more frequently have their primary focus in the ovary, less commonly in the testis, stomach, intestine, gall bladder or pancreas. With progressive loss of strength and flesh the abdomen begins to swell. Hard lumps may be felt on palpation. The region of the umbilicus may be infiltrated and indurated. Secondary glands

may be felt above the left clavicle and in the groins. The fluid may be bloodstained. Of the white corpuscles lymphocytes will form the greater number. Occasionally large multinuclear cells or groups of cells may be seen in the fluid which point at once to a malignant origin. If the growth started in the stomach it may be colloid in character, so that instead of setting up ascites it will fill the abdominal cavity with enormous masses of semi-gelatinous material. Anæmia and cachexia are not likely to be long delayed, and death will occur within six months as a rule.

If there is definite evidence of a primary growth the diagnosis is easy, but not otherwise. The greatest difficulty is in distinguishing it from tuberculous peritonitis, as bloodstained effusions may occur in both. In a child malignant peritonitis is not likely to occur. The rapid development of cachexia, the presence of large masses and the induration round the navel are very suggestive of new growth. Fever is a more marked symptom in tuberculous peritonitis. Cystic tumours of the ovary and broad ligaments may also lead to confusion. I have seen them cause hæmorrhagic ascites. A vaginal examination should therefore not be omitted.

It is not likely that by the time a new growth has become sufficiently diffused to produce ascites any treatment will be of avail.

Hydatid Cysts may involve the peritoneum.

Dermoid cysts, starting behind the rectum or from the ovary, may become detached from their base after forming adhesions to other parts, such as the omentum. They may become infected from the bowel, suppurating and bursting into the bowel or elsewhere.

Simple Cysts occur in the mesentery and omentum, probably from obstructed and dilated lymphatics forming fluctuating and very mobile tumours which give rise to little or no inconvenience unless they suppurate or rupture. They may present considerable difficulty in diagnosis. In one case of mine the tumour felt like a very movable kidney, but palpation did not elicit the characteristic sensation. Puncture for diagnostic purposes is to be condemned. If they are causing inconvenience or anxiety removal by laparotomy is the only right course.

Chylous and Pseudochylous Ascites.—Chylous ascites results from a lesion of the receptaculum chyli or its tributaries, usually by new growth or rupture of a chylangeioma. The fluid contains small fat globules staining with osmic acid, but very few cells, and its odour varies with that of the food ingested. On standing it generally shows a distinct creamy layer.

Pseudochylous ascites occurs in various diseases, but chiefly in malignant and tuberculous peritonitis, cirrhosis of the liver, and chronic

nephritis. The milky character of the fluid depends on a compound of lecithin and globulin which does not stain with osmic acid. The fluid is odourless and contains many cells. The prognosis in any form of milky ascites is grave, especially in the pseudochylous type.

W. L. B.

VISCEROPTOSIS (ENTEROPTOSIS, GLENARD'S DISEASE)

Etiology. The normal position of the viscera and its maintenance in different postures depend upon (1) the proper development of the thorax, and (2) the efficiency of the muscles of the abdominal wall and pelvic floor.

1. Insufficient development of the thorax is not infrequently congenital; it may also result during the period of growth from disorders of nutrition, especially rickets, from thoracic diseases, particularly those leading to fibroid lung, and from insufficient exercise. When, as a result of these factors, the thorax is long and shallow, with very oblique ribs and a narrow epigastric angle, the thoracic part of the abdomen is abnormally small, and the liver, spleen and kidneys and the part of the stomach which is normally hidden beneath the ribs are displaced downwards.

2. The most common cause of visceroptosis is a diminution in the intra-abdominal pressure. The viscera are normally kept in position by the slight positive intra-abdominal pressure, which is maintained by the tonic contraction of the muscles of the abdominal wall and the pelvic floor, their peritoneal attachments remaining slack. The position of the diaphragm also depends in part upon the difference between the negative intra-thoracic pressure and the positive intra-abdominal pressure; if the latter is reduced for any reason, the diaphragm and the organs which are attached to it descend when the vertical position is assumed. A fall in intra-abdominal pressure is most commonly due to weakness of the abdominal muscles owing to deficient general health, insufficient exercise, or incomplete return of their tone after a period of stretching has been relieved by parturition, paracentesis in cases of ascites, and the disappearance of an excessive collection of fat. The muscles of the pelvic floor may be weakened owing to general ill-health, but more frequently as a result of difficult labour. Even when the abdominal and pelvic muscles are strong, the diminution in the bulk of the abdominal contents caused by the disappearance of the normal intra-abdominal fat when for any reason a condition of emaciation develops results in a fall of intra-abdominal pressure and consequently in visceroptosis.

Effect of Posture on Visceroptosis. When the

contents of the thoracic abdomen are displaced downwards owing to its insufficient development the viscera drop no more than those of normal individuals when the vertical position is assumed. When visceroptosis is due to low intra-abdominal pressure the viscera at first maintain their normal position so long as the patient lies down, but drop as soon as gravity comes into play as a result of the assumption of the vertical position. At a later stage, when the daily descent of the viscera has continued for a considerable time, the displacement persists in the horizontal position.

The degree of ptosis of the different organs depends upon their weight and upon the length and elasticity of their peritoneal attachments which, in the absence of their natural support, act as true ligaments. Thus the stomach only drops when it is full, gastropotosis being favoured by habitual over-eating and over-drinking, particularly when the organ is also atonic. The fundus of the stomach being closely attached to the diaphragm cannot drop away from it; the pylorus is prevented from descending to the same extent as the greater curvature because of its proximity to the fixed part of the duodenum. The colon drops farthest when it is loaded as a result of chronic constipation, and an enlarged liver is more likely to become displaced than a normal one. Very movable organs, such as the small intestine and the transverse colon, drop most readily, and the loosely attached hepatic flexure always descends considerably further than the firmly attached splenic flexure. The kidneys are most likely to drop when the fat which normally surrounds them and helps to keep them in position is deficient in quantity.

Symptoms. The symptoms present when visceroptosis is due to an ill-developed thorax are not caused by the ptosis but by the general condition of malnutrition which is frequently present. The following description therefore applies exclusively to the form due to low intra-abdominal pressure. The symptoms of visceroptosis occur only when the erect position is assumed; they consequently disappear on lying down and are absent at night; they are temporarily relieved when the lower part of the abdomen is compressed by means of the hand, and in women they frequently show a steady improvement as pregnancy advances, owing to the support given to the viscera by the growing uterus.

Results. *Gastropotosis* does not lead to kinking of the pylorus, but in severe cases a kink is produced at the point where the duodenum becomes fixed; delayed evacuation then takes place, and painful digestion, which is relieved by lying down, results. Apart from this no symptoms occur unless the ptosis is associated

with atony, when the symptoms due to the latter are exaggerated.

If the displacement of the stomach is present on lying down it can sometimes be recognized by simple palpation and always by inflation. The aorta is unusually easily palpable above the umbilicus.

Ptosis of both the small intestine (*enteroptosis*) and of the colon (*coloptosis*) is generally unaccompanied by symptoms; the cæcum may fall into the true pelvis and the hepatic flexure be situated in the right iliac fossa in perfectly healthy individuals. The splenic flexure rarely drops, owing to the strength of the phreno-colic ligament; consequently in extreme ptosis of the transverse colon a sharp kink may occur at this situation and constipation and attacks of colic result. It is sometimes possible to recognize the presence of coloptosis by palpation, but accurate knowledge concerning the position of the colon and the passage of fæces through it can only be obtained by the X-rays; they are essential for the recognition of the numerous cases in which coloptosis is only present in the vertical position. The characteristic bulging of the lower part of the abdomen and retraction of the epigastrium seen on standing is due mainly to the ptosis of the small intestine.

When the liver drops (*hepatoptosis*) it rotates towards the right, or less frequently falls forward so that its upper surface bulges in the epigastrium. The condition can be recognized by palpation and percussion, the upper border of the hepatic dullness being abnormally low; it gives rise to no special symptoms. A *dropped spleen* can be easily recognized by palpation; in very rare instances great pain is produced by twisting of its pedicle. It is important to bear in mind that a palpable liver or spleen is not necessarily an enlarged one, but may simply be displaced.

In the majority of cases a *movable kidney* gives rise to no symptoms, but they may arise from obstruction of the ureter or blood-vessels, and in rare instances the drag produced by the dropping of the kidney leads to obstructive jaundice or to interference with the evacuation of the stomach or the passage of fæces round the hepatic flexure.

Downward displacement of the diaphragm results in dyspnoea, as, being constantly in the position of extreme inspiration, it is no longer possible for its normal respiratory excursions to occur. Its fixity can be observed with the X-rays; when the lower part of the abdomen is compressed the diaphragm is seen to rise and its normal movements to return, relief to the dyspnoea being at the same time experienced. The downward displacement of the diaphragm is accompanied by a similar displacement of the heart, which gives rise to no special symptoms.

The peritoneal attachments of the viscera are normally relaxed; in visceroptosis they are stretched and become true ligaments. Their sensory afferent nerves are constantly stimulated, the patient often complaining of vague abdominal discomfort, which is generally described as being of a dragging nature; it is relieved by lying down and by pressure upon the abdomen. The discomfort is most marked in neurasthenics, owing to the irritability of their nervous system; in individuals with a healthy nervous system it may be completely absent. The chronic pain in neurasthenic individuals increases the nervous depression, a vicious circle being thus produced, but neurasthenia is never a result of visceroptosis alone.

Visceroptosis leads to an alteration in the centre of gravity of the body. In order to maintain the upright position, certain muscles of the spine which are ordinarily little used are brought into action; this is a frequent cause of chronic backache.

The maintenance of the circulation when the vertical position is assumed depends to a considerable extent upon the tonic contraction of the abdominal muscles; when this is deficient, as it is in most cases of visceroptosis, the abdominal veins dilate and the pulse becomes abnormally accelerated on the assumption of the upright position; giddiness and syncope may also occur. The weak abdominal muscles frequently prevent the efficient performance of defæcation, dyschezia being thus frequently associated with visceroptosis.

Treatment. Visceroptosis due to insufficient development of the thorax requires no special treatment. In all other cases the first indication is to raise the intra-abdominal pressure. In order to do this the condition of the abdominal and pelvic muscles must be improved. Exercise and Swedish gymnastics are of great value; massage and faradism are less useful. It is essential to prevent the over-stretching of the muscles, which occurs as soon as the erect position is assumed, as it is impossible for them to regain their normal tone so long as they have to bear the weight of the viscera for the greater part of every day. In severe cases it is best for the patient to remain in bed for some weeks, as by this means the intra-abdominal pressure is reduced to a minimum and all tension is removed from the abdominal and pelvic muscles; the foot of the bed should be as high as possible, as this helps the organs to return to their proper position, which is often maintained afterwards, especially if the patient gains weight. As most patients with visceroptosis are thin they should be given a generous diet; the meals should be frequent and small in bulk, fluids being given apart from solids in order to prevent distending the stomach. In

less severe cases the patient should simply lie down for an hour or two after meals, but he should wear an abdominal support, which should exert pressure upwards, backwards and inwards over the whole of the lower part of the abdomen, the part above the umbilicus being relieved of all pressure. A support does not lead to disuse atrophy, but it allows the muscles to regain their tone by preventing them from being over-stretched; at the same time it relieves the symptoms, even if it does not replace the viscera into their proper positions. It is of no advantage to employ pads for supporting any special organs, such as the kidneys. When the pelvic floor has given way it is of the utmost importance that this should receive treatment by pessaries or other means.

Under no circumstances should any operation be performed for fixing dropped viscera, as one organ is rarely dropped alone; the effect of such operations is rarely permanent, and the neurasthenic condition of many of the patients makes surgical interference of any kind most undesirable. The only exception to this rule is in cases of movable kidney, in which serious symptoms have resulted from obstruction of the ureter or blood-vessels and an abdominal support has not given complete relief.

A. F. H.

DISEASES OF THE PANCREAS

Although the pancreas provides the most active digestive secretion in the body and plays an important part in general metabolism, diseases of this organ are comparatively seldom recognized during life. Yet, though gross lesions of the pancreas may be rare, minor inflammatory changes are not uncommon. Three main factors tend to obscure the diagnosis of pancreatic disease—

1. Disease of this organ is seldom uncomplicated, but is either consequent on or produces changes in the duodenum, liver or bile passages.

2. The digestive work of the pancreas can be largely carried out by other secretions. Even fat can be digested to a limited extent by the gastric juice and by intestinal bacteria, while fatty stools may be due to occlusion of the bile ducts or to tuberculosis of the alimentary tract, without implication of the pancreas.

3. Pancreatic disease is only one of the many causes of glycosuria, and lesions which only affect part of the gland may not be accompanied by glycosuria at all.

The following are the most reliable signs of pancreatic inadequacy—

1. *Defective External Secretion*, as indicated by—

(a) *Failure of Tryptic Digestion.* Unaltered muscle fibres will be found in the fæces after a meat meal. On the other hand, the presence of connective tissue fibres is suggestive of gastric insufficiency. Undigested elastic fibres have no significance. The muscle fibres are more easily recognized if enclosed in a tiny silk bag. Four grains of potassium iodide, swallowed in a thin wax capsule, should normally lead to the appearance of iodine in the saliva. This can be recognized by the blue colour on mixing saliva with starch paste. Similarly enclosed four grains of sodium salicylate should give a violet colour in the urine with ferric chloride. Failure to do so within two hours suggests pancreatic inadequacy or deficient motility of the stomach. More elaborate methods have proved unsatisfactory.

(b) *Failure of Starch Digestion.* Administration of unboiled starch grains is followed by their appearance in considerable quantity in the fæces. The presence of large amounts of calcium oxalate crystals in the urine is very suggestive of chronic pancreatitis unless spinach, tomatoes or strawberries have been eaten. The oxalates arise from fermentation of the carbohydrates. According to Mayo Robson and Cammidge they are present in seventy-three per cent. of the cases of chronic pancreatitis.

(c) *Failure of Fat Digestion.* Steatorrhœa, in which the unsaponified fat will be in excess of the saponified, will result. To determine this a quantitative analysis is necessary, but a qualitative examination may be helpful, since neutral fats will be present as globules melting with heat and solidifying on cooling, fatty acids as acicular crystals staining with dilute Ziehl's carbol fuchsin, and soaps as amorphous masses or like starch grains.

2. *Defective Carbohydrate Metabolism*, as indicated by alimentary glycosuria, which, if not already present, may be excited by giving two to three ounces of sugar in three-quarters of a pint of tea or coffee. In health about four and a half ounces of dextrose can be taken at one time without exciting glycosuria. It is exceptional in acute inflammations and new growth of the pancreas, more common in chronic inflammation and cysts.

3. *Evidence of Pancreatic Disintegration*—

(a) Cammidge's improved or C-reaction, in which pentosazone crystals are obtained from the urine, depends on a disintegration product of the nucleoprotein of the pancreas. In skilled hands this may be a help, though it has not proved so decisive as was hoped.

(b) Fat necrosis is due to steapsin escaping from the pancreas into the surrounding fat. Evidence of its occurrence may be obtained from the presence in the urine of a ferment

capable of decomposing ethyl butyrate. It may be recognized at an exploratory laparotomy in the fat of the abdominal cavity as a number of small opaque white areas sometimes surrounded by a narrow hæmorrhagic zone, establishing thereby the diagnosis of a pancreatic lesion.

Other manifestations of pancreatic disease are—

4. *Nervous Symptoms*—

(a) In very acute pancreatic lesions the disturbance of the solar plexus causes terrible pain, usually referred to the epigastrium or umbilicus, but sometimes to the vertebral column. The patient may feel as if he were fixed in a vice. Then vomiting begins, which soon becomes bilious. Meteorism and collapse follow.

(b) In subacute cases the nervous manifestations closely resemble those of hepatic colic.

(c) In chronic cases there may be paroxysms like the gastric crises of tabes. Bronzing may occur from irritation of the sympathetic.

5. *Symptoms of Compression.* Jaundice from occlusion of the bile duct is common in chronic lesions of the head of the pancreas. In new growth the occlusion is usually more complete than with gallstones, so that bile pigment is completely absent from the stools in the former condition, while it may be found by extraction in the latter. Symptoms of obstruction of the portal vein, such as hæmorrhoids and ascites, are much less common.

6. *Dyspeptic Symptoms.* For reasons already given these may not be obvious. Usually there is anorexia, with especial distaste for fats. Occasionally boulimia occurs. Nausea, colic, much intestinal flatulence and diarrhœa are often present.

We may deduce the following general conclusions as to the medical treatment of pancreatic lesions.

(a) As the acid of the gastric juice is the great stimulant to pancreatic secretion, any deficiency in this should be remedied by the administration of dilute hydrochloric acid or, better, freshly dissolved fifteen-grain tablets of acidol (betain chloride), after food. On the other hand, hyperchlorhydria exhausts the pancreas, and helps to set up chronic pancreatitis. If present, it should be corrected by alkalis, including magnesia after meals.

(b) Pancreatic extract may be given in keratin-coated capsules, to avoid the destructive action of the gastric juice. In complete absence of pancreatic juice the capsules will, however, remain undissolved.

(c) The interference with fat absorption allows undue putrefactive changes to occur, for which intestinal antiseptics should be

employed. Of these naphthalene tetrachloride, in five to ten grain doses, has the advantage that, not being absorbed, it can be given freely without causing toxic symptoms.

(d) The intestinal ferment erepsin has the power of digesting casein and, to a limited extent, fibrin, but not other native proteins. Thus plasmon and protene can be digested when egg proteins cannot. Starch should not be given in a soft form, *e.g.* ground rice, which would escape digestion by the saliva, but dry, like rusk or biscuit, which, requiring mastication and insalivation, reaches the duodenum already largely digested. Sugar is readily assimilated, but if glycosuria exists would naturally be restricted to the amount tolerated. Fat is the least well digested of the three foodstuffs. It is best given as milk, predigested by liquor pancreaticus for not more than twenty minutes, to avoid the bitter flavour produced by longer action.

From these general considerations we can pass to the several diseases of the pancreas.

Pancreatic Infantilism.—Inadequate pancreatic secretion has a marked effect on bodily growth. A patient of sixteen does not look more than eight or ten. There are no signs of puberty, and the epiphyses of the bones do not unite at their proper time. There is chronic fatty diarrhoea and a swollen tympanitic abdomen. Glycosuria does not occur, as it is only the external secretion which is at fault. Administration of pancreatic extract produces a marked improvement. It is difficult, however, to distinguish this condition from the infantilism described by Herter as due to chronic intestinal infection and characterized by an overgrowth and persistence of the flora of the nursing period.

Acute Pancreatitis—

1. **Hæmorrhagic.**—No real distinction can be drawn between hæmorrhagic pancreatitis and pancreatic hæmorrhage. The subjects are usually middle-aged stout men. In forty-two per cent. of the cases there is a history of gallstones. A stone blocking the diverticulum of Vater would permit a reflux of bile into the pancreatic duct, which is known to be capable of producing such a hæmorrhage. But gallstones are commoner in women, and it is suggested that the greater liability of men to pancreatic hæmorrhage is due to the greater muscularity of the gall bladder enabling it to drive bile into the pancreatic ducts during the passage of a gallstone from the ampulla into the duodenum. Sometimes an ascending infection of the pancreatic duct without gallstones and occasionally traumatism may be responsible.

The patient is suddenly seized with intense pain in the upper abdomen, nausea, vomiting and obstinate constipation. There may be

an indefinite, tender, epigastric swelling, not moving with respiration. The temperature is usually normal or subnormal, the pulse small and rapid. The patient acquires the abdominal facies and speedily becomes collapsed. Death usually occurs from the second to the fourth day.

The diagnosis is made from hepatic colic, if jaundice be present, by the diffuse epigastric swelling and the much graver constitutional symptoms. If jaundice be absent the case may resemble one of acute intestinal obstruction, from which it may be distinguished by the absence of fecal vomiting and of visible peristalsis, which is accompanied by increase and diffusion of the pain. The obstruction is not so absolute and flatus may be passed. Perforated duodenal ulcer can generally be distinguished by the history of gastro-intestinal symptoms and the presence of free gas in the peritoneal cavity.

Treatment is of little avail, and is chiefly directed to the severe collapse. Morphia is often inadequate to relieve the pain. Operation may increase the shock and should be delayed in the hope of the patient surviving till the more amenable stage of gangrene is reached.

2. **Gangrenous.**—This is the sequel of pancreatic hæmorrhage. Men are more likely to die in the earlier stages, while women may live till the stage of gangrene is reached. The symptoms of pancreatic hæmorrhage persist, but become less violent. In addition, rigors ensue and the temperature becomes hectic. An ill-defined tumour appears in the epigastrium, due to the accumulation of blood or pus in the lesser sac. Leucocytosis is the rule. Glycosuria and fatty stools are rarely found. Operation by drainage now offers some chance of recovery.

3. **Suppurative.**—This may occur without preceding hæmorrhage, but the present state of our knowledge does not permit of its diagnosis from gangrenous pancreatitis.

4. **"Pancreatic Mumps."**—Pancreatitis is a rare complication of mumps, but is more frequent in some epidemics than in others. It usually appears between the third and sixth days of the disease, but may be earlier or later. There is no relationship between the severity of the parotitis and the frequency of the pancreatic complication. Exceptionally the pancreatitis may precede the parotitis, as may be the case with another metastasis in mumps, namely orchitis. The symptoms resemble those of other forms of acute pancreatitis, but are not so severe. The pulse tends to be slow. Glycosuria is very rare. The existence of parotitis will suggest the correct diagnosis. The duration is short, four to five days, and the prognosis is good.

Chronic Pancreatitis occurs in two forms—

1. **Interlobular**—the result of obstruction to the outflow of pancreatic juice or of acute

pancreatitis—in which glycosuria is usually absent.

2. **Interacinar**—associated with cirrhosis of the liver or arterio-sclerosis, in which glycosuria is present.

All other causes are extremely rare. Two-thirds of the cases occur between forty and sixty. There may be a history of alcoholism or of prolonged intestinal or biliary disturbances. The symptoms are those of pancreatic insufficiency already described. Emaciation is rapid. The condition may become stationary, or may prove fatal through glycosuria, cachexia or secondary infections. The general dietetic treatment of pancreatic diseases should be adopted, and urotropine and salicylates, five to ten grains of each three times a day, should be given, as these drugs have been shown to be excreted by the pancreatic ducts. If improvement does not occur in about four weeks the operation of drainage of the gall bladder or of cholecystenterostomy should be performed. The former procedure deprives the alimentary canal of bile, but is indicated, at any rate as a temporary procedure, if there is any evidence of an ascending infection. The sclerosed condition of the head of the pancreas may be mistaken for new growth at the time of operation.

Hæmochromatosis (Bronzed Diabetes) is the name given to the combination of—

1. Cirrhosis of the liver—usually hypertrophic—with some pericellular change also;
2. Interstitial pancreatitis;
3. Bronzing of the skin and internal organs by deposit of an iron-containing pigment;
4. Progressive diabetes.

It occurs in men between forty and sixty; only one case has been recorded in a female. The patient may die of an intercurrent disease before glycosuria appears; more commonly death results from diabetes.

Pancreatic Calculi, composed of calcium carbonate or phosphate, are generally small and multiple. They are commoner in males than in females, and they occur at an earlier age (thirty to forty) than chronic pancreatitis or pancreatic cysts, to which they often give rise. Like gallstones, they are probably caused by the combination of an obstruction to the outflow with an ascending infection.

The symptoms resemble those of hepatic colic, but jaundice only occurs if the stone becomes impacted at the ampulla. Glycosuria may ensue from the resulting pancreatitis. Steatorrhœa is a valuable sign if present; and even if there is no increase in the total fat the proportion of neutral fat to fatty acids and soaps is unduly high.

The diagnosis can only be made when a patient who has had an attack of colic passes calculi of calcium salts without bile pigment. They may

occasionally be detected by X-rays, as they are more opaque than gallstones.

Treatment. The flow of pancreatic juice may be increased by drinking freely of water acidified by CO_2 or a weak acid, which stimulates the formation of secretin, the hormone to pancreatic secretion. Injections of pilocarpin are risky. Pancreatic calculi have been successfully removed by operation.

Pancreatic Cysts produce—

1. **Symptoms.** Pain is generally felt in the left lumbar region. Digestive disturbances and diarrhoea are common. Pigmentation of the skin may occur; rapid emaciation is the rule. Pancreatic insufficiency is not generally noted, as the cysts are usually in the tail of the gland.

2. **Physical Signs.** A smooth, rounded, elastic, sometimes fluctuating swelling is found in the neighbourhood of the umbilicus, more generally to the left of the middle line, which is in sharp contrast to the emaciation of the patient. The swelling is not dull at first, because it lies behind the stomach and the transverse colon. As it grows forward it becomes dull, the dullness being clearly differentiated from surrounding resonance. If the stomach be inflated the dull area diminishes. There may be transmitted pulsation from the aorta, but this ceases in the knee-elbow position.

The course is slow and progressive. There may be compression of the portal vein, causing ascites, of the bile duct, causing jaundice, or the formation of adhesions, causing intestinal obstruction. The cyst may rupture into the peritoneal cavity, with disappearance of the swelling and the signs of acute peritonitis.

Diagnosis. Hydatid of the liver is distinguished by the absence of general symptoms, while the dullness is blended with that of the liver. The blood shows eosinophilia. A distended gall-bladder lies in the right hypochondrium, with its axis in the longitudinal direction. An accumulation in the lesser sac from rupture of a gastric ulcer is accompanied by more or less fever. If the swelling is not already resonant it becomes so on inflation of the stomach, when the liver may also become depressed into the abdomen. The history would point to a pre-existing ulcer. A pancreatic cyst may simulate an ovarian cyst by dropping down into the peritoneal cavity, but if the patient raises herself from the recumbent to a half-sitting posture it is pulled up and can be separated from the pelvis. The diagnosis from mesenteric cysts may be impossible, but these are usually mobile and do not produce any digestive disturbances or emaciation. A left hydronephrosis may present difficulties in diagnosis, but it is usually more lateral, covered by resonant colon and gives ballottement. The history will help, and the diminution of the swelling coincidently with the discharge of a large quantity of urine may clear up the difficulty.

Treatment. Exploratory puncture is to be condemned. Operation by drainage as soon as the diagnosis is made is the only treatment. This avoids the formation of troublesome adhesions, intracystic hæmorrhage and secondary suppuration. Slow healing is the rule and a chronic fistula may result. Diabetes may be a sequel.

Tubercle and Syphilis of the pancreas are very rare. Congenital syphilis occasionally causes interstitial pancreatitis.

New Growth.—Innocent tumours are merely pathological curiosities. Sarcoma is also very rare. Seventy-five per cent. of the cases of primary carcinoma affect the head of the gland. It is twice as common in men as in women. Its maximum incidence is between fifty and sixty. The first symptom is usually continuous and progressive jaundice, due to complete obstruction of the bile duct. Less commonly the onset is with the dyspeptic symptoms typical of pancreatic lesions. The liver enlarges slightly at first from biliary obstruction, and then tends to shrink again. Gross enlargement would suggest secondary growths in the liver, which, however, are not a characteristic feature. The gall bladder follows Courvoisier's rule and is usually distinctly enlarged. In about twenty per cent. a small, scarcely movable tumour may be detected. Examination of the fæces gives the signs of pancreatic inadequacy. Glycosuria is usually absent, and if it occurs is usually due to a secondary pancreatitis. Emaciation becomes profound. The duration seldom exceeds six months, death occurring from exhaustion, extension of the growth, or less commonly from perforation of an important vessel.

Diagnosis. The discovery of enlarged glands above the left clavicle is of great importance in any case of suspected abdominal malignant disease. If jaundice is absent the diagnosis is seldom arrived at. If it is present the diagnosis has to be made from (a) gallstones, where there will be a history of colic preceding the jaundice, emaciation is not the rule, and the gall bladder will not be enlarged. (b) Chronic pancreatitis—glycosuria is more common. Cammidge's reaction should be positive. The condition will be improved by drainage of the gall bladder. (c) Malignant disease elsewhere, involving the biliary passages. If it starts in the common duct it would produce the same biliary symptoms, but there would not be failure to digest muscle fibres and starch grains. Cancer of the gall bladder only causes jaundice if fragments of growth pass down the duct, and dilatation of the gall bladder would precede the jaundice. In malignant disease of the liver itself the gall bladder is not enlarged. Nodules would be felt in the liver, which is usually enormously enlarged.

Treatment can only be palliative. The usual

dietetic regimen for pancreatic diseases should be followed. Anodynes may be required internally and externally. For the pruritus, due to bile salts entering the circulation, thyroid extract is the best remedy, as this diminishes their production.

W. L. B.

DISEASES OF THE LIVER AND BILE DUCTS

Jaundice.—The staining due to bile pigment can be recognized by a greenish-yellow discoloration of all parts of the skin and of the visible mucous membranes, and by the presence of the pigment in the urine. Jaundice occurs (1) when an obstruction opposes the normal outflow of bile from the hepatic duct or common duct; (2) when the main ducts are patent and the liver itself is the seat of a toxic inflammatory or nervous process. The cerebral symptoms, irritability, depression of spirits, and even melancholia—are partly attributable to the depressant action of bile salts on the circulation. Much more severe symptoms, acute delirium, convulsions, coma and even death may ensue. Not infrequently there are chills and fever, especially in gallstones due to infections of the bile passages. Permanent occlusion of the duct is always fatal, though cicatricial occlusion may last for years.

Obstructive Jaundice is due to (1) foreign bodies, such as stones or parasites within the ducts; (2) inflammation and swelling of the duct wall or its opening into the duodenum; (3) tumours growing in or from the walls; (4) cicatricial stricture; (5) obliteration of the lumen from without by pressure, as by tumours of the liver, pancreas, stomach, kidney, omentum; by pressure from enlarged glands in one of the fissures of the liver; by other tumours such as aneurysm, fæcal accumulation, the pregnant uterus; and finally by kinking or torsion of a duct consequent upon displacement of the liver or one of the neighbouring organs.

Symptoms. All the organs which are penetrated by the bile are tinted with it, and the depth of tint largely depends on the length of time the jaundice has existed. Many of the secretions are coloured, especially the urine, the sweat more rarely, the tears, saliva and milk.

Symptoms due to the circulation of bile salts affect the skin, the circulatory system and the central nervous system. Marked pruritus may cause great distress in prolonged obstruction. Sweating (which may be localised), produces lichen, urticaria and xanthelasma. Telangiectases may appear in the later stages. Bile salts cause a slowing and weakening of the pulse, a lowered blood pressure, slower respirations and a tendency to hæmorrhage.

Intra-Hepatic Jaundice is produced by toxins such as phosphorus, arsenic, snake-venom,

toluylendiamine, etc.; it is seen in many specific fevers—malaria, pyæmia, scarlatina, enteric, typhus, yellow and relapsing fevers. Certain cases of jaundice of obscure but probably infective origin, known as epidemic, infectious and febrile jaundice, may occur, as well as the severer forms, called malignant jaundice, icterus gravis, Weil's disease, and acute yellow atrophy.

The symptoms of this form of jaundice are usually much less intense than those of obstructive jaundice, though severer forms, such as acute yellow atrophy, produce grave toxic symptoms, but not necessarily intense jaundice.

Hereditary Icterus may attack several members of the same family. The jaundice present at birth may disappear late or be present for years. The liver and spleen may show some enlargement. Hypertrophic cirrhosis of the biliary type may be the cause in some cases, in others congenital obstruction of the bile passages, in others it may be a primary disease of the blood.

Icterus Neonatorum is dependent on the alterations in the circulation in the liver associated with the changes at birth.

Severer forms, often with a fatal issue, are due to absence of the bile ducts, congenital syphilitic hepatitis, sepsis of the umbilical vein from the navel. The only treatment is prophylactic.

Fatty Degeneration is seen in (1) anæmias and cachectic states, such as chronic tuberculosis, chronic staphylococcal and other infectious and malignant disease; (2) passive congestion, in which deficient oxidation plays an important part; (3) as the effects of many poisons, such as phosphorus, arsenic, antimony, mineral acids, chloroform, carbolic acid, certain fungi; but the most important of these is alcohol; (4) infections of the alimentary tract, especially dysentery and the gastro-intestinal affections of children.

Gastro-intestinal symptoms, dyspepsia, and deficient assimilation indicate a deficient activity of the liver. Clinically it is smooth, often tender, with a well-defined clean edge. It may be distinguished from amyloid liver by the absence of a rounded edge, leukæmic enlargement by absence of blood changes, and from Hanot's cirrhosis by absence of enlargement of the spleen. A displaced liver need not cause trouble if there is careful examination, which should also exclude irregularities in the shape of the organ.

Inflammations—

Acute Yellow Atrophy is a rare disease, almost always fatal, in which jaundice and severe toxic symptoms form the main picture. Women are more affected than men, and the commonest age is between twenty and thirty

years. The causes are: secondary syphilis, pyæmia, pregnancy, alcoholic excess, fright and pre-existing hepatic disease, especially cirrhoses.

Symptoms. Disordered digestion and gastro-intestinal catarrh first, then after a few days jaundice, apparently simple. Later come the severe toxic symptoms: vomiting, headache, delirium, trembling and sometimes convulsions. Hæmorrhages may be present in the skin and internal membranes. Death is preceded by coma. The temperature may be raised, though throughout the disease may be afebrile. The pulse is rapid, the tongue dry and foul. It may be possible to detect a diminution of liver dullness. The urine is lessened in amount, bile-stained and contains albumin, albumose, leucin and tyrosin. The ammonia is increased and the urea decreased. The stools are clay-coloured, but hæmorrhages may darken them. Seldom only has recovery been noted, though the fact that subacute varieties are known anatomically confirms the reputed recoveries.

Diagnosis. Catarrhal jaundice can only be excluded by the course, though pregnancy and syphilis would raise suspicions of the severer disease. The presence of leucin and tyrosin in the urine, with vomiting and the nervous symptoms, are important, though any severe jaundice and the second stage of cirrhosis may cause confusion. Atrophic cirrhosis may be distinguished by the history and possibly by the small, hard liver. Hypertrophic cirrhosis, in which attacks of this nature are recognized, should cause no difficulty if the greatly enlarged liver and spleen be examined from day to day. In phosphorus poisoning the gastro-intestinal symptoms are more severe at the beginning, and jaundice comes on later than in acute yellow atrophy. The liver in phosphorus poisoning is not decreased in size.

The *prognosis* is exceedingly grave. The *treatment* is to give minute doses of calomel, abundance of fluids, diuretics and saline transfusion.

The Cirrhoses of the Liver.—We recognize the following varieties:—(1) Alcoholic cirrhosis, Lannec's cirrhosis, and the large fatty cirrhotic liver which may precede the onset of the variety more commonly seen. (2) Hypertrophic cirrhosis (Hanot's cirrhosis). (3) Chronic peri-hepatitis or capsular cirrhosis. (4) Syphilitic cirrhosis.

Alcoholic Cirrhosis occurs more frequently in men. Spirits are much more potent to cause it than wine or malted liquors.

Symptoms. Extreme cirrhosis may be present without any symptoms. In the early stages the patients are often abnormally fat, later, however, they usually exhibit the features common to habitual alcoholics.

Symptoms of Portal Obstruction. The blood-vessels of the whole portal area are overfilled and the circulation is sluggish. The chronic catarrh of the stomach and small intestines thus caused gives a furred tongue, nausea and vomiting, particularly in the morning, irregular action of the bowels, and pain or discomfort in the right hypochondrium. Hæmorrhage from the lower end of the œsophagus, from the stomach or intestine is frequent, and may be fatal. Epistaxis is common. Hæmorrhoids, enlarged epigastric and mammary and umbilical veins; and ascites which may appear quickly are all the result of portal obstruction. Œdema of the feet may be seen before or after the development of ascites.

The skin usually is sallow, often with a muddy appearance in the face. The urine is reduced in amount, concentrated and contains albumin, urates and sometimes tube casts. Slight fever may be present.

In the early stage the liver is enlarged and tender; in some cases the organ remains large throughout. Examination may be impossible till the ascites has been removed. The lessened size of the liver may be ascertained by percussion, or palpation on deep inspiration. The spleen is enlarged and can usually be felt. The ascitic fluid has a specific gravity usually below 1015, and the amount of albumin is from three to six per cent. Lymphocytes are the chief cells.

Toxic symptoms appear at any stage. Delirium, convulsions, stupor or coma may develop very quickly and the patient usually dies.

Diagnosis is seldom difficult, though rare conditions may cause error. It is likely to be confused with syphilitic cirrhosis, which may be distinguished by a history of infection, signs of other syphilitic lesions or great irregularity of the liver surface. Hanot's cirrhosis may be distinguished by the persistent jaundice and the absence of an alcoholic history, or evidence of portal obstruction.

The *prognosis* is bad. If alcohol can be banished the patient may live in comfort for a considerable period. The patient is more prone to intercurrent disease, *e.g.* tuberculosis, and the danger of one of the complications is always present, such as toxæmia, jaundice, ascites, hæmorrhage.

Hypertrophic or Hanot's Cirrhosis occurs in young subjects, occasionally in children. It affects chiefly the male sex, and often follows infectious diseases.

The symptoms are as follows:—(1) Ill-health, weakness, malaise and loss of flesh may be present at the onset for a long period. (2) Jaundice, usually slight, is present throughout, but severe jaundice with high fever and delirium

may develop at any stage. (3) A dull weight in the right hypochondrium or well-marked attacks of pain, with nausea and vomiting. (4) A fullness of the abdomen, which is due to an enlargement of the liver; the edge is well below the costal margin, hard, regular, and its surface smooth; the left lobe is often very prominent. (5) The spleen is enlarged, hard and easily palpable. (6) There is usually no ascites and no evidence of portal obstruction. (7) Hæmorrhages, purpura, various skin troubles, fever and diarrhoea are sometimes present. The disease is very chronic, the cause of death being severe jaundice, an intercurrent disease or cachexia. Periods of remission are common. Treatment consists in attention to general health and a careful diet; improvement may follow antiseptics which are excreted by the bile, such as urotropin.

Perihepatitis may be a local condition from inflammation of one of the neighbouring organs or of the liver itself, or, secondly, it may be general, with extreme general thickening of the capsule, forming a distinct disease. It is met with under two forms, the one indistinguishable from cirrhosis, the other associated with a chronic mediastinitis and adherent pericardium. In the first type there is always a chronic interstitial nephritis.

Syphilitic cirrhosis is mentioned under *Syphilis of the Liver*.

Treatment of Cirrhosis. On a bland diet with no alcohol the disease may remain quiescent. Milk should be the basis of all diets. As the patient is able to bear them, cereals, butter, eggs and fish may be cautiously added; meat, soups and highly-spiced food should be avoided. Tea, coffee and cocoa may be taken in moderation. Potassium iodide should always be tried, on the possibility of the syphilitic element. The bowels should be kept open by saline purges and disinfected by very small doses of calomel. A course at one of the spas is beneficial in the early stages, but should be mild in hypertrophic cirrhosis. Other medicinal treatment is symptomatic. When the patient becomes delirious or comatose, saline transfusion into muscles or veins should be performed and repeated after twenty-four hours. Tapping should be done early and repeated frequently if necessary. Collapse during the operation can be mitigated by putting on a binder, which can be tightened during the operation. Laparotomy and the rubbing of peritoneal surfaces so as to stimulate adhesions, or omentopexy—the stitching of a portion of omentum to the abdominal wall near the liver, may relieve the portal circulation.

Syphilis of the Liver.—See *Syphilis*.

Abscess of the Liver occurs (1) in the amœbic dysentery of India, Egypt and else-

where, as the large solitary abscess; (2) following trauma; (3) from embolism and pyæmia, most frequently following suppuration in the portal area, though sometimes reaching the liver through the hepatic artery or even the inferior vena cava and hepatic veins—these abscesses are as a rule multiple, the whole liver or a large portion of it being affected; (4) inflammation of the bile passages from gallstones, parasites or in suppurative cholangitis; (5) from the penetration into the liver of foreign bodies, *e. g.* a needle or fish-bone from the œsophagus, the suppuration of echinococcus cysts, from round-worms, or flukes; (6) in typhoid fever; (7) from the extension of the inflammation from elsewhere, *e. g.* perforation of a simple or malignant ulcer of the stomach, etc.

Symptoms. The large solitary abscess may be latent and rupture may cause death suddenly. The onset is gradual, with malaise, general debility and discomfort in the liver. Fever of the intermittent type, sometimes with rigors, is present, though afebrile cases have been described. Pain and a sense of fullness in the hepatic region is constant or sharp and stabbing; this may actually be due to pleurisy or simulate it. Pain referred to the right shoulder is very common. Cough, vomiting and digestive disturbances make up the main picture, but arthritis from the absorption of toxic products and nervous irritability or depression are occasionally seen.

There is wasting, a muddy subicteric tint of the skin, and an anxious expression. The abdomen is full, right hypochondrium may bulge and localised redness or œdema may be present over the abscess. The liver dullness is increased both upwards and downwards, and on palpation a sensation as of a thick-walled bag filled with air may be felt. Fluctuation and friction may be present. The respiration is shallow and thoracic, compression of the right lung may simulate pneumonia, especially if from extension upwards there is pleuritic friction. The possibility of an empyema or a cavity in the lung from this cause must be borne in mind. A reddish-brown expectoration, compared to anchovy sauce, containing amœbæ, would settle the diagnosis in the latter case.

If not opened by surgical measures it may remain latent or rupture into the lung, pleura, pericardium, stomach, intestines, gall bladder or ducts, kidney, a blood-vessel or externally.

Diagnosis. (1) The fever resists quinine and malarial organisms are absent in stained blood films. (2) From primary empyema or inflammations of the lung: the liver presents unusual symptoms as regards pain, size and shape, while the colour of, and the presence of amœbæ in the sputum in perforation of the lung cannot be mistaken. (3) From the intermittent

fever associated with gallstones: there is no fever in the intervals and the jaundice deepens after each attack.

In all suspected cases the liver should be punctured, some caution being necessary against tapping a hydatid cyst. The X-rays and a blood examination (for leucocytosis) may assist the diagnosis.

Treatment. Many cases recover spontaneously if the abscess is evacuated into the lung. Incision and free drainage by operation is advisable if the abscess follows dysentery, in which case it is usually single, or if it points exteriorly. Pyæmic abscesses and suppurative pyelophlebitis so seldom recover that the value of operation is doubtful.

New Growths of the Liver.—Both carcinoma and sarcoma are seen either as primary or secondary growths. Secondary carcinoma is the common form, the primary disease being in the stomach, gall bladder, large intestine or pancreas.

Symptoms. When the condition is secondary to disease in other organs the symptoms will be those of the primary organ, dyspepsia and pain, etc., in the case of the stomach, intestinal irregularities or obstruction in the case of the colon. When the liver is invaded the stage has been reached when nutritional troubles are marked, there is progressive loss of flesh and strength; jaundice is often present, but of a mild degree. Pain in the liver may be present, but the organ may be much enlarged without any pain. Ascites is rare.

The abdomen is distended and the walls thin; the veins are usually prominent. The liver is large, with an irregular nodular surface and an uneven margin. In one form, however, cancer with cirrhosis, the liver is not enlarged. Percussion will give a more accurate delimitation of the size and shape of the organ. Fever and even rigors may be present. Anæmia in the later stages is marked, and with it œdema of the feet.

Diagnosis is only difficult when the surface of the liver is smooth, as in primary carcinoma. The presence of jaundice, the rapid enlargement and the cachexia will distinguish it from fatty or amyloid liver. In echinococcus disease the projections are softer than in carcinoma and the blood may show eosinophilia. In hypertrophic cirrhosis the jaundice is deeper and there is no marked wasting or cachexia.

Diseases of the Bile Passages and Gall Bladder

Acute Catarrh of the Bile Ducts (catarrhal jaundice) results from (1) an attack of acute indigestion from errors in diet, exposure to cold, malaria and portal obstruction as in heart disease; one form of this, simple or catarrhal jaundice, occurs in epidemic form;

(2) in infectious fevers, such as pneumonia and typhoid; and from (3) emotional disturbance.

Symptoms. The onset is gradual, either with slight malaise, indigestion, vomiting and diarrhoea and slight fever, or without any symptoms whatever until the jaundice is obvious. There may be fever and pains in the hepatic region, back and limbs. For the rest the signs are those of obstructive jaundice already described. The liver is enlarged, occasionally, too, the spleen; the gall bladder is seldom palpable. The duration of the disease is from two weeks to three months, though ordinary cases seldom last longer than six weeks.

Diagnosis. The difficulties lie in separating it from cirrhosis, cancer and sometimes from gallstones. Catarrhal jaundice attacks young persons; there is no great enlargement of the liver, the jaundice is never very intense, there is no cachexia, it is not recurrent, and there is only slight pain. Duration of the jaundice for longer than six weeks should be the sign for a thorough review in the diagnosis.

The prognosis is good and the after-effects negligible, yet the possibility of mistaking it for malignant disease or acute yellow atrophy in the early stages makes it necessary to give a guarded prognosis at first.

Treatment. For some days water, lemonade or soda-water may be all that the patient can take. The bowels should be kept loose by a mild purgative. Sodium bicarbonate (gr. xxx) in warm water will allay nausea, and alkaline baths will allay any itching of the skin.

Chronic Catarrhal Angiocholitis is associated with the presence of gallstones in one of the ducts, or depends on a chronic gastro-duodenal catarrh set up by chronic alcoholism, the acute fevers, such as typhoid, or acute catarrhal jaundice.

The presence of slight chronic obstruction in the ducts should always arouse the suspicion of gallstones or malignant disease. The jaundice varies in intensity, and its chronicity often leads to some wasting. It is liable to be confused with hypertrophic cirrhosis, from which it can be separated by the absence of marked enlargement of the liver and spleen. When gallstones are present intermittent fever may be more marked and colicky pain may be or have been present.

The treatment requires a bland diet, no alcohol, calomel in small doses and saline purges.

Suppurative Angiocholitis follows gallstones, carcinoma, parasites in the duct, and the acute fevers.

Symptoms. There is fever, sometimes rigors, digestive disturbances, prostration and wasting. The liver is enlarged, smooth and tender; the

spleen is large. Jaundice is always present but varies in intensity. Pain may be due to peritonitis over the gall bladder, or if colicky to obstruction in the ducts. Local or general peritonitis, pyæmia or infective endocarditis may ensue.

The treatment is surgical, to allow of free drainage by the bile passages; when this has been done urotropin may assist in producing a general disinfection.

A type that is occasionally met with is a very acute form which clinically would be termed an "acute abdomen." All forms of suppuration, gangrene and ulceration of the gall bladder may be met with. The treatment is operation.

Cancer of the Bile Passages.—Females suffer more than males. Gallstones are found in over ninety per cent. of cases. It may begin in the gall bladder or ducts, or be affected secondarily to the stomach, pancreas, intestine, etc. The symptoms are jaundice, constant and progressive; digestive disturbances, pain, sometimes paroxysmal and often severe; cachexia, and, when the disease is established, a tumour in the region of the gall bladder extending downwards and inwards towards the navel. The gall bladder may be distended, and if the growth has invaded the liver this may be enlarged and irregular, or the liver may be enlarged uniformly from distension with bile. Ascites may follow pressure on the portal vein. The disease seldom lasts longer than six months.

The diagnosis has to be made from gallstones, malignant disease of the liver, hypertrophic cirrhosis and catarrhal jaundice.

Cholelithiasis.—Gallstones are rare before the age of twenty-five, and three-fourths of the cases are in women. All conditions which favour the stagnation of bile predispose towards gallstones, *e.g.* sedentary occupations, tight corsets, enteroptosis, constipation and depressing mental emotion. They are formed anywhere that bile is found, but mostly in the gall bladder.

Symptoms. One or more gallstones may exist in the gall bladder for years without causing any symptoms.

1. Biliary colic is due to the passage of a gallstone down the cystic or common duct. The attack sets in without warning, there is a gripping, piercing pain in the right side of the upper abdomen; it radiates from that spot all over the abdomen, but specially towards the right shoulder. The pain may be ushered in by a rigor and a rise of temperature to 102° or 103° F. The patient rolls about on the floor, leans over a chair or crouches in a sitting posture in the endeavour to find relief. There are pallor, sweating or feeble pulse and vomiting. On palpation the recti may be so rigid

that nothing can be felt, in any case there is great tenderness over the gall bladder, which may be enlarged and tender. The skin over the gall bladder may be acutely sensitive. If the stone blocks the common duct jaundice appears. The attack may be over in a few hours or may last longer than a week, with a dull, continuous ache, interrupted by acute attacks of pain. The diagnosis is not as a rule difficult. The seat of the pain is usually so definite as to direct attention to the liver. Acute inflammation of the gall bladder may be mistaken for biliary colic and can only be distinguished by the onset of peritonitis with a definite febrile condition. Pseudo-biliary colic, a nervous hepatic colic seen in women, sometimes gives difficulty; the pain may be radiating, as in biliary colic, but it is always associated with emotion, fatigue or other nervous conditions; the liver may be tender, but jaundice is absent.

2. Obstruction of the cystic duct. There is a tense cystic swelling below the edge of the liver. The gall bladder is distended with fluid, which fluid may be bile and mucus if the obstruction has been of short duration, or thin, clear and only slightly mucoid if the obstruction has lasted some time. The size of the swelling may be as large as a normal kidney or even larger, and moves with the liver on respiration. A gall bladder undistended cannot as a rule be felt. Jaundice is not necessarily present.

3. Obstruction of the common duct. A single stone or a series of stones may be present; a stone may lodge in the ampulla of Vater. The obstruction may be complete or partial.

(a) Complete obstruction causes deep and continuous jaundice, with no septic features or special wasting in the early stages. Previous attacks of colic and the absence of an enlarged gall bladder may help to distinguish it from malignant disease.

(b) Incomplete obstruction, with infective cholangitis. The symptoms are: variability in the intensity of jaundice and the amount of bile in the fæces, no distension of the gall bladder, enlargement of the spleen and prolonged duration of the jaundice. A stone lodged in the diverticulum of Vater acts as a ball valve, producing partial obstruction. The symptoms of this are ague-like paroxysms which, from the

temperature chart, are indistinguishable from tertian or quartan malaria. These may last for longer than a year, each paroxysm being followed by a deepening of the jaundice and tenderness of the liver. As in malaria, between the attacks the health may be normal. There is no dilatation of the gall bladder in obstruction from stone (Courvoisier's rule).

(c) Incomplete obstruction with suppurative cholangitis. Fever is the most marked symptom, usually intermittent, sometimes with rigors. Jaundice is not intense, the liver is enlarged and tender and the signs are more markedly those of septicæmia. Recovery does not take place.

Treatment. For the acute attack nothing serves but quarter-grain doses of morphia, given hypodermically, or chloroform. Heat applied to the liver gives some relief, as does drinking very hot water. Drugs for the solution of gallstones are probably useless. Urotropin in ten-grain doses may be given with benefit. A plain diet with the avoidance of much carbonaceous food is best. Long intervals between food is inadvisable. Regular exercise and breathing exercises prevent stagnation of the bile, and the clothes should not be worn tight round the waist so as to impede the action of the diaphragm. The bowels should be regulated and a saline purge taken once or twice a week. For itching use alkaline baths, McCall Anderson's dusting powder (starch, 1 oz.; oxide of zinc, $\frac{1}{2}$ oz.; camphor, $1\frac{1}{2}$ dr.), or a solution of anæsthesin (ethyl ester of para-amido-benzoic acid) in olive oil.

Operation should be advised (1) if repeated attacks and gallstone colic render the patient an invalid—a second or third operation may be required; (2) if the gall bladder is distended and there are attacks of pain or fever; (3) if intermittent hepatic fever points to the presence of a ball-valve stone; (4) if there is acute inflammation over the gall bladder, with signs of severe localised peritonitis; (5) if chronic jaundice supervenes in a patient with a history of gallstones, and finally, (6) if any of the accidents attendant upon gallstones, such as perforation of the gall bladder, intestinal obstruction, etc., can be diagnosed.

W. O.
A. G. G.

DISEASES OF THE URINARY SYSTEM

EXAMINATION IN DISEASES OF THE KIDNEY

SOME patients who suffer from renal disease complain of symptoms that at once suggest it. Such are swelling of the face and legs, a change

in the quantity or quality of the urine and pain in the loins. None, even of these, are certain indications. The greater number of patients relate histories that are still more vague. It follows that in renal cases the scent, to borrow

a sporting phrase, is often very bad, and the physician will only get on the line by making careful casts.

At the first sight many a patient will betray his complaint by a certain waxy pallor and fullness in the eyelids which, however slight in degree, should be noticed at once. Myxœdema produces the same appearance, and the complexion of hepatic cirrhosis, of which Sir Joshua Reynolds's portrait of himself in the National Gallery is a fine representation, is like it, but is rather more yellow. In severe cases the breath sometimes has a urinous smell. There is nothing peculiar about the tongue, but its condition sometimes reflects that of the stomach, and the gums should be examined carefully, by squeezing, for suppuration round the sockets of the teeth. In examining the lungs, evidence of consolidation or of pleural effusion, are of special importance. Each of these conditions is due to an infection, which is apt to be the beginning of the end. Bronchitis is not of such bad omen. Special care must be given to the state of the circulation. The exact boundaries of the heart must first be established.

In primary interstitial nephritis the heart, though much hypertrophied, is often but little enlarged. A displacement of the apex beat outwards to the nipple line is in such cases all that is observed. An extension beyond that implies dilatation. Dilatation of the right side is uncommon. The impulse should next be observed. It is often increased in cases of simple hypertrophy, and of a "thudding" character, if it be allowed to apply an epithet of sound to touch. By auscultation a systolic murmur is often heard at the apex when there is dilatation. But it is at the base that the sounds are most characteristic. Over the aortic valve the second sound is generally louder, sharper and more ringing than in health. This arises from the high blood pressure common in chronic nephritis, which closes the aortic valves with great force immediately systole ceases. The displacement of the apex may be much greater than that above mentioned. This occurs in the later stages of the disease in some old persons, and still more commonly in those under forty. In these younger cases the heart reaches, under alternate dilatation and hypertrophy, a greater size than in the old.

The next point is the condition of the arteries. The radial, the brachial, the temporal, the facial, are open to examination by the finger, and the retinal branches of the ophthalmic can be seen with the ophthalmoscope. Thickening of the walls and dilatation, shown by increased width in the transverse diameter, and in the longitudinal by tortuosity, can be seen and felt in the external arteries. In the retina the wiry character described by Gunn, and eventually

the thick white walls outside the blood column can be seen. The blood pressure should be estimated, if possible with a good sphygmomanometer.

At the same time the other signs of albuminuric retinitis should be sought. It is not enough to examine the region round the disc. The macular area should also be included, as many cases show the small spots of degeneration there which do not at the time present the acuter changes round the disc.

In the examination of the abdomen nothing abnormal will be found except in cases of polycystic disease or of renal tumour. Polycystic disease is so commonly, and other tumours rarely bilateral, that the existence of a renal tumour on each side is strong evidence of the former. In some cases the lumpy character of the polycystic kidney can be clearly distinguished. For the diagnosis of other renal tumours the articles on those subjects should be consulted.

In the legs the principal symptom to be searched for is œdema. Some cases only show this on careful examination. Pressure should be kept up for a minute. If the finger is then passed up and down over the part, a slight dent which would escape the eye is easily detected.

The last step is the examination of the renal functions by chemical analysis, by cryoscopy, and by the artificial excretion of dyes such as methylene blue, or of chemical bodies such as salt. The procedures for this purpose will be found under the analysis of excreta.

In certain cases these examinations should be carried out for each kidney separately by means either of the separator or of the ureteral catheter.

It has already been stated that the patient's history will in some cases at once suggest the presence of renal disease. There are, however, other symptoms than those above mentioned, which are significant. Chronic disorders of the stomach or of the intestinal tract are common. In some cases there is flatulent indigestion, in others continual nausea and recurrent vomiting, in others obstinate diarrhœa. Shortness of breath and palpitation are often due to the failing of an hypertrophied heart. Frequent micturition is a symptom of the polyuria common with granular kidneys. It is no doubt partly due to increased blood-pressure. But it may also depend upon a deficient power to excrete solids unless in great dilution. Nervous disturbances are various. Headache, dizziness, failure of sight, may all of them be due to nephritis. It is hardly necessary to add that coma or convulsions should at once arouse the same suspicion. Questions should therefore be asked on all these points.

In some cases a history of attacks like ague,

may, as I have occasion to know, be the only evidence attainable of pyo-nephrosis. Pyuria may not appear till afterwards. W. P. H.

MALFORMATIONS OF THE KIDNEY

Many kidneys retain the lobulated shape proper to foetal life. Occasionally kidneys are found which are distorted, or lie with what is usually the outer border to the front. It is not uncommon to find two ureters to a single kidney, or an extra renal artery. The latter may be above or below the main artery, and may spring from the aorta itself or from one of its branches, such as the phrenic or internal spermatic artery. It is of pathological importance, since it often crosses the ureter and by pressure thereupon produces hydronephrosis. In rarer instances the two kidneys are joined across the spine, usually at about the fourth or fifth lumbar vertebra, to form a single "horse-shoe" kidney. In such cases there are usually two ureters and two renal arteries. One kidney may be completely absent, in which case the ureter, and even the vesicula seminalis, may be absent too. Or the ureter may be present, but may end blindly above in a small patch of fibrous tissue situated in the renal region, or even in the connective tissue to the side of the spinal column. Usually the suprarenal gland remains, but occasionally this also is absent. In one patient of mine the right kidney was absent, and the left lay in the right renal fossa, while its ureter crossed the spine obliquely to open into the left side of the bladder. In other cases one kidney may be represented by two or three small cysts, or by a mere fragment of renal tissue. Congenital cystic disease of the kidneys will be considered under the heading *Polycystic Disease*.

The ureters are sometimes locally constricted. This is most common at two points, the exit from the kidney and the entrance into the bladder. In either case hydronephrosis is the consequence. Occasionally a ureter is found to be impervious for the whole or for a part of its course.

Abnormal mobility will be considered under *Movable Kidney*.

Disturbances of Circulation. Passive congestion is produced by any condition which interferes with the action of the right side of the heart. Chronic bronchitis with emphysema, and stenosis or incompetence of the mitral valve are common causes. More rarely congestion is produced by a tumour obstructing or invading the renal vein or the vena cava. The kidney in such cases is large and hard. Its capsule is not adherent. The surface is dark and the stellate veins are engorged. When cut open

both cortex and medulla are purple in colour. There appears to be some connection between mitral stenosis and fibrosis of the kidney, and it is by some supposed that the fibrosis is produced by chronic congestion. Others, however, believe the mitral stenosis in those cases to be part of a general cardio-vascular sclerosis, which affects the kidney by a fibrosis spreading from the arteries. The point has not yet been sufficiently worked out. In such cases albuminuria is of frequent occurrence in congestion of the kidney, and the urine is scanty and concentrated.

The anuria and polyuria which occasionally occur in hysterical patients have been referred, but without any evidence, to stimulation or paralysis of the vasomotor nerves.

Infarcts of the kidney occur in cases of septic endocarditis. They take the usual conical form, with the base on the surface, and follow the changes generally found in this condition. Their occurrence is usually marked by hæmaturia, due to hæmorrhage into the parenchyma from the intense congestion of the part. Eventually the parenchyma is destroyed and a scar of fibrous tissue remains which produces a depression on the surface of the organ.

Microscopic infarcts occur in septicæmic conditions and are due to blocking of minute vessels by septic organisms.

Thrombosis of the renal vein may occur as part of a thrombosis of the inferior cava, or may be due to a new growth invading the renal vein itself.

W. P. H.

ANOMALIES OF URINARY SECRETION

These may be divided into—

1. Deficient excretion of normal constituents.
2. Excessive secretion of normal constituents.
3. Excretion of abnormal substances due to disease.
4. Excretion of abnormal substances due to individual variation in metabolism.

1. *Oliguria*.—Whenever the flow of blood through the kidneys is hindered, as in cardiac failure, the amount of water decreases and the urine becomes scanty and concentrated. The acidity is then high, the colour deep, and urates are deposited.

Deficiency of Solids.—The chlorides are often greatly diminished, or even absent, in fevers, especially in pneumonia. They are also greatly diminished in some cases of dropsy. In the later stages of nephritis all the solids may be diminished.

2. *Polyuria*.—(a) *Diabetes Insipidus*. This is a condition, sometimes hereditary, sometimes acquired, in which enormous quantities of water are passed, and the patient, if water be withheld, exhibits serious symptoms. The latter part

of the definition distinguishes it from polydipsia. There is some evidence that the cause is incompetence of the kidney to excrete solids except in high dilution.

(b) The same cause perhaps accounts partly for the polyuria of granular kidney. But another cause may also be found in the blood-pressure, which is commonly very high.

Phosphaturia and Oxaluria.—In former times an excess of phosphate or oxalate of calcium in the urine was thought to be a cause of neurasthenia. Neurasthenic cases often excrete less acid, and therefore the phosphates are readily precipitated, though they are not present in excess. An excess of oxalic acid may be due to eating rhubarb, spinach and some other vegetables. In both conditions the deposit may be due rather to an excessive secretion of calcium, of which the cause is unknown, than to variation in the acids.

3. *Abnormal Substances due to Disease.*

Albumin.—In the healthy kidney this is held back. In disease of the kidney it escapes. The point of escape is probably chiefly in the glomeruli. Albumin in urine is a mixture of serum-albumin and serum-globulin, but in a proportion which varies, and is not the same as that in the blood. It may be that one or other alone is present. The best tests are—

(a) Boiling. In acid urines a precipitate appears. If it does not, a drop of dilute acetic acid should be added. In alkaline urines a spontaneous precipitate shows phosphates. It disappears on the addition of acid. An alkaline urine should be acidulated before boiling. Resins in the urine such as copaiba will give a precipitate.

(b) Nitric acid. To nitric acid in a test tube add by trickling gently down the side a supernatant layer of urine. At the level of junction a white layer of coagulated albumin forms. Albumose reacts in the same way.

A precipitate, some distance above the line of junction, is formed of urates.

(c) Salicyl-sulphonic acid, either in crystals or saturated solution, is a delicate test, precipitating nothing but albumin and albumose. The latter clears on boiling.

(d) After acidulating with acetic acid add a drop or two of potassium ferrocyanide; a precipitate forms.

(e) Picric acid or Esbach's fluid (picric acid 1, citric acid 2, water 100) is used for a rough quantitative test. Into an Esbach's tube pour urine up to the mark U, and the reagent up to the mark R, stopper, and invert gently. Read off the level of the precipitate after standing for twenty-four hours. The numbers are grammes per litre. Above four per thousand the result is untrustworthy.

A third kind of albumin reacts to the above

test, but is also deposited in the cold after the addition of dilute acetic acid. It has been called nucleo-albumin, but its exact constitution is still a matter of doubt. It is probably, like the others, derived from the blood.

Physiological Albuminuria.—In many young persons albuminuria appears without any other symptoms of nephritis. The subsequent history shows that the kidneys are not diseased. This occurs in various forms.

(a) Orthostatic albuminuria is the commonest. The urine during the night is normal. A short while after getting up albumin begins to appear, rises to a maximum, and often disappears again by the end of the day. All other influences but that of posture can be excluded. These patients, children or young adults, are usually weak and languid. The albuminuria probably depends in some way upon a low arterial pressure.

(b) Albuminuria after exertion. Collier found it in almost every individual of five "eights" after the Oxford races. Armstrong and others found it in boys after running. It has been found in soldiers after marching.

(c) Fear, as in boys going to be whipped or examined, cold bathing and sexual initiation are other known causes. (*Cp.* Paroxysmal Hæmoglobinuria.) The albumin appears often to be of the form of "nucleo-albumin"; Collier found casts.

Albumose.—This proteid is precipitated by the reagents which precipitate albumin, but is characterized by its solubility at boiling-point. On heating urine containing it a precipitate appears at about 56° C., but disappears again gradually as the temperature is raised, to reappear on cooling. It occurs in certain diseases of bones, especially in diffuse or multiple myeloma, and has been found in a few other conditions.

Hæmaturia is distinguished by the presence of blood cells in the urine from *hæmoglobinuria*, in which the colouring matter alone is present. The test for the latter are—

(a) The guaiacum test. To the urine add a few drops of fresh tincture of guaiacum, shake, and to the emulsion add ozonic ether. A blue ring forms at the junction. Iodide of potassium in the urine gives a rather similar colour, but it is deeper and appears more slowly.

(b) The spectroscope shows the bands of hæmoglobin, or more commonly of methæmoglobin.

(c) The colour of such urines varies from dark blood-colour to a mere smokiness. A deposit of the same colour quickly settles.

(d) The microscope alone can show if blood cells are present.

In hæmaturia the blood may come from the urethra, from the bladder and ureters, or

from the kidney. In the first case it drips from the meatus spontaneously, and on micturition the first part of the urine is bloody, the last clear. Hæmaturia from this source is usually due to injury, sometimes to urethritis. When it comes from the bladder or ureters it usually collects at the base of the bladder, and is passed chiefly at the end of micturition. It is due to injury, inflammation, ulcer, new growth, or varicose veins. It is not uncommon in cases of prostatic enlargement. When bleeding takes place in the kidneys the blood is intimately mixed with the urine, and the colour is often brown from the presence of methæmoglobin, due to intimate contact with an acid urine. Such cases arise from disease of the pelvis, such as stone and new growth, or most commonly from some form of nephritis. Profuse hæmorrhage sometimes occurs in cases of granular kidney.

Hæmaturia without nephritis has been reported as a family complaint. Some cases of hæmaturia, recurrent and often profuse, are known to occur without any recognizable disease of the kidney, or with alterations so slight that they can hardly be considered as the cause. These cases are usually from one kidney alone, and are called essential hæmaturia.

Hæmoglobinuria occurs as a result of transfusion with the blood of another species, in some cases of acute disease, especially pneumonia and rheumatic fever or after acute nephritis, in an epidemic form among new-born children (Winckel), and after certain poisons. It also occurs in hæmoglobinuric (black-water) fever, and in animals from piro-plasmosis. In man it is most common as a paroxysmal disease produced by cold, exercise and mental excitement. It may be an exaggeration of the albuminuria produced by these causes. In this disease it is the result of a hæmoglobinæmia produced by an intermediary body present in the blood which cold certainly, and probably the other antecedents mentioned also, can render actively hæmolytic. A majority of such patients are syphilitic.

Chyluria.—In certain cases the urine is opaque and white, yellowish-white, or pink from admixture with blood. It sets into a solid jelly, or deposits jelly-like clots. If the urine is left to stand the opaque part collects at the top. On shaking with ether the opacity disappears, and the ether when evaporated leaves an oily residue. The urine remains clear but is albuminous. The coagulum gives the reactions of fibrin.

This condition is in most cases due to an infection with the *filaria Bancrofti*. The worms block the thoracic duct and rupture of the lymphatics occurs in the renal pelvis. The embryos are found in the blood during sleep.

This infection is endemic in China and other subtropical countries.

Sporadic cases occur in which the thoracic duct is blocked by inflammatory tissue or other causes.

The symptoms are in some cases very irregular.

No treatment has been found effective.

Lymphuria.—In a few cases albumin and fibrin have been found alone, without any fat. The urine sets into a colourless jelly, and there is no opacity. The pathology of these cases is unknown.

Pyuria.—When pus occurs in any quantity in the urine it forms a yellowish-white deposit. The microscope at once shows its nature. Chemical tests are of less value. The following are employed—

(a) To the urine add an equal part of caustic alkali. The mixture becomes ropy and adhesive strings are formed in it.

(b) To the urine add an equal part of ozonic ether. Bubbles of gas escape.

Leucocytes are found with the microscope in many inflammatory conditions. Pus in quantity occurs in urethritis, cystitis, pyelitis and pyonephrosis due to calculus or tubercle. In every case bacteriological investigation should at once be carried out.

Abnormal Pigments.—Urobilin in excess gives a *warm orange* colour. It occurs in hepatic disease, in cases of hæmolysis, where large hæmorrhages are being absorbed, and in other conditions.

A *red, claret or purple* colour, without the presence of blood, is usually seen in urines which contain an excess of hæmato-porphyrin. The colour is not, however, due to hæmato-porphyrin, but to another unknown body. Most of these cases are due to poisoning by sulphonal or trional, and they commonly end in death. The condition usually occurs in women.

Rhubarb and senna sometimes produce a *reddish-brown* colour.

A *green* colour is usually caused by bile pigment. Sometimes it is nearly black. When diluted the characteristic green produced by the addition of nitric acid or by tincture of iodine is the best test. When such urines are shaken the foam is coloured green. Another cause of a green colour is carboluria, and it is worth mentioning that this may be produced by a single injection of a serum (*e.g.* anti-streptococcic) which has had a small amount of carbolic acid added for preservation. Such a case in my wards was too dilute to give the purple colour with ferric chloride, but gave the yellowish precipitate with bromine water.

A *red, green or blue* colour may be given by aniline dyes; methylene blue is sometimes

given medicinally and sweets are often coloured by these dyes.

Indican gives urine a dark colour which turns black when warmed with nitric acid, but not in the cold. Boil the urine with hydrochloric acid, and a trace of nitric acid, cool, and shake up with chloroform. The latter absorbs a blue colour. Indicanuria occurs in cases of bacterial decomposition of the fæces, and in cases of fetid empyema and similar conditions.

Melanuria occurs in cases of melanotic sarcoma of the viscera. The urine is normal in colour, or brown, when passed. Nitric acid in the cold turns it black.

Hale White described blackening of urines from phthisical patients, and the same occurs in ochrenosis, and some other rare conditions.

4. Abnormal Substances due to an Idiosyncrasy of Metabolism.

Alkaptonuria.—The urine when passed is natural in colour, but turns brown or black on exposure to air. On adding alkalies the colour is made darker still. The urine reduces Fehling's solution, but does not give the other reactions of sugar. In most cases the condition, which is rare, is congenital, and the colour is noticed on the baby's napkins. It is usually lifelong. It is produced by the presence of homogentisic acid, which is due to a failure to decompose completely the aromatic constituents of the proteid molecule.

Cystinuria, which is shown by the presence in the urine of colourless hexagon crystals soluble in ammonia, is also usually a lifelong condition. It is due, like alkaptonuria, to a defect in proteid metabolism, but its exact nature is uncertain. It is of importance in that it often leads to the formation of calculi.

H. P. H.

URÆMIA

The term uræmia is applied to that form of blood poisoning with urinary products which is manifested by a well-known series of symptoms. It arises in the course of all forms of nephritis, in acute and passive congestion and in waxy, cystic and tuberculous diseases of the kidneys, and also as a result of complete obstructive suppression of urine.

Clinically three forms of uræmia may be recognized, namely, (1) acute, (2) chronic, and (3) latent. While acute uræmia may develop in any form of nephritis, it is most common in the post-febrile variety. It is sudden in its onset and rapid in its course. Chronic uræmia is most common in chronic interstitial nephritis. It is gradual in its onset and slow in its course. The two forms merge, however.

The symptoms of **Acute Uræmia** are epilepti-

form convulsions, coma, mania and amaurosis. The convulsions may come on suddenly or they may be preceded by headache, giddiness or nausea. They may be general and identical with those of ordinary epilepsy—excepting that the initial cry is usually absent. During the convulsions the temperature is variable; it may be elevated, even to 104° F. or higher, or, as is more commonly the case, it may be depressed. The convulsions last for some minutes. Rarely there is a single fit, followed by stupor; usually there is a series of fits. In the majority of cases the attacks succeed each other at short intervals, and it may be even before the patient recovers from the preceding seizure. In the intervals the patient is usually unconscious. Occasionally, however, between the attacks there is maniacal excitement. Convulsions, coma and mania may occur quite independently of each other. Coma is the commonest cerebral manifestation of uræmia. As already indicated, it may accompany the general convulsions, or it may develop gradually and independently of convulsive seizures. It may be preceded by headache, partial or complete loss of vision, gastro-intestinal symptoms, cramps and twitchings. The last-named, especially of the face and forearms, usually occur during the coma.

The maniacal form of uræmia is not common. It may be the first indication of renal disease. It may follow the fits or be independent of them.

By amaurosis is meant sudden and complete blindness, which usually subsides as suddenly as it comes on, and is independent of changes in the fundus. It may precede the fits or occur without them. Much more frequently it follows them. Sight is perfectly recovered in a few hours or days.

The commonest symptoms of **Chronic Uræmia** are gastro-intestinal. They are nausea, vomiting of a severe and persistent kind, hiccough, and sometimes diarrhœa. Others are persistent headache, which is most commonly occipital, cramps in the legs, twitching of the muscles apart from loss of consciousness, occasional delirium, contraction of the pupils, giddiness, recurrent attacks of dyspnœa, itching of the skin, and increasing drowsiness which may pass on to coma. The attacks of dyspnœa are generally nocturnal, and they sometimes resemble those of spasmodic asthma. Occasionally spaced breathing of the Cheyne-Stokes occurs.

Rarer symptoms of uræmia are deafness, either following the convulsions or apart from them, hemiplegia or monoplegia suddenly occurring and with no gross lesion found after death to account for the paralysis, numbness and tingling in the fingers, cramps in the

muscles, persistent insomnia and symptoms of stomatitis.

In **Latent Uræmia** either no urine is voided at all or small quantities may be passed at long intervals, the urine being clear, watery, having a specific gravity of about 1006, and containing a very small quantity of urea or other solids. Here the clinical picture is quite different from that of ordinary uræmia. Convulsions, coma and mania are absent. The symptoms are slight in intensity, and for the first five or six days after the onset of obstruction these may be merely lassitude, weakness and sleeplessness. Then nausea, occasional vomiting, fairly commonly obstinate constipation and meteorism, rarely diarrhoea, contraction of the pupils, and exaggeration of knee-jerks may supervene. Later on there may be slight twitchings of the muscles of the arms, legs and trunk, subnormal temperature, slowness of the pulse, epistaxis, œdema, venous stasis, thirst and slowness of breathing. Death may not occur for a week or ten days or even twelve days after the onset of the anuria. It generally occurs very suddenly, the patient remaining conscious to within a few hours or even half an hour of the fatal termination. The patient occasionally dies in a convulsive seizure or in coma.

The *diagnosis* of uræmia is much easier when it occurs during an attack of acute nephritis than when it occurs during the course of chronic parenchymatous nephritis or granular kidney, since in the last two, and particularly in granular kidney, uræmic symptoms may develop in the midst of apparent health and without any warning. In these cases it is highly important that the urine should be examined. If the patient is first seen in the comatose state, it should be drawn off by means of a catheter. The urine is frequently found to contain a large amount of albumin. The amount of urea is of very little diagnostic importance. The pulse should be examined for evidences of arterio-sclerosis, and the heart for hypertrophy of the left ventricle. It should be remembered, however, that cerebral hæmorrhage is by no means an infrequent terminal event in granular kidney and arterio-sclerosis. If a patient is first seen in the comatose state, other causes of coma besides uræmia, such as cerebral hæmorrhage (especially pontine), meningitis (here there may be only slight fever and no localising symptoms), cerebral tumour, alcoholic poisoning, opium poisoning, injury diabetes, epilepsy, pyæmia, sunstroke, typhoid fever, miliary tuberculosis and hysteria should be excluded. Uræmic convulsions should be differentiated from convulsions due to other causes, such as epilepsy, hysteria, strychnine poisoning, tetanus and hydrophobia. As

already noted, hemiplegia or monoplegia may occur suddenly in uræmia, and with no gross lesion to account for the paralysis. It is extremely difficult to diagnose these cases from those of hemiplegia or monoplegia of organic origin. And, lastly, cases of headache, with giddiness and vomiting, especially when associated with optic neuritis, closely simulate the symptoms of cerebral tumour.

In regard to the *prognosis* of uræmia, about half of the cases recover in acute nephritis, about fifty per cent. recur in chronic parenchymatous nephritis, while the condition is almost invariably fatal in cases of granular kidney.

In regard to *treatment*, in both forms of uræmia the diet should be that which is suitable for acute nephritis. Threatened or already developed acute uræmia requires prompt and active treatment. Since the function of the kidneys is largely in abeyance, the cardinal indications are to get the bowels and skin to act as quickly as possible. The former may be started by an enema. Of purgatives, those which act rapidly are naturally the most desirable. Of these elaterium and croton oil, on account of their concentration, are the best. Elaterium may be given in doses of $\frac{1}{4}$ gr. in the form of a small pill or dissolved in a teaspoonful of water; or $\frac{1}{20}$ to $\frac{1}{10}$ gr. of the active principle (elaterin); or 1 to 4 gr. of pulv. elaterini co. One or two minims of croton oil may be mixed in a little olive oil. These remedies should be placed well back in the throat, so that they may be swallowed by a reflex act.

In order to act on the skin the patient, if not too ill, may be placed in a hot bath. Otherwise a hot-air or vapour bath or a hot pack for twenty minutes may be used. Jaborandi was formerly used as a sudorific much more than it is at present. Undoubtedly the cause of this diminution in the extent of its employment is the fear of it causing serious œdema of the lungs. This is greater in water-logged patients. The writer has never seen this follow the administration of one or two drachms of the tincture every four hours. If it threatens, it may be cut short or controlled by a hypodermic injection of $\frac{1}{100}$ to $\frac{1}{50}$ gr. of atropine. If the symptoms are very urgent, $\frac{1}{10}$ to $\frac{1}{6}$ gr. of nitrate of pilocarpine may be administered by subcutaneous injection, to be repeated if required at intervals of an hour. Venesection from the arm, in amount from twelve to twenty ounces, may advantageously be employed in a robust and full-blooded person with high blood tension. When there is little or no œdema it may be combined with the injection of one or two pints of warm water or weak saline solution into the rectum, under the skin, or into a vein. The writer has seen one case in which, appar-

ently, a fatal termination was prevented by lumbar puncture. Continuous inhalation of oxygen has also been tried in acute uræmia.

If convulsions set in, the patient's tongue should be protected, and besides the measures already enumerated, chloral and bromides in the form of an enema, or the inhalation of chloroform in sufficient amount just to control the fits are useful. Should these fail, morphia should be resorted to.

The *treatment* of chronic uræmia lies in treating the cause, as for example by saline purges and hot baths. So long as the vomiting is only occasional, beyond acting on the bowels and skin no treatment is required. When vomiting is frequent and persistent, bismuth and dilute hydrocyanic acid may be tried. If these fail, small doses of opium are indicated. It is best also not to try stop diarrhoea, unless it is severe. When it is so, tannalbin in ten-grain doses or small doses of opium may be given. For the headache a sharp purge and hot tea may be tried. Citrate of caffeine, in five-grain doses, is sometimes successful. Most frequently, however, nitroglycerine is the most serviceable drug; $\frac{1}{100}$ gr. or one minim of the liquor trinitrini may be administered three times a day, the dose to be increased if required. Some writers have claimed very good results to follow the administration of pilocarpine. Leeches to the mastoid process also are sometimes useful. The restlessness and sleeplessness or delirium should be treated by chloral and bromides, and if necessary by morphine. For the dyspnoea, the inhalation of five minims of amyl nitrite or the internal administration of nitroglycerine is indicated. Morphia may be necessary.

The *treatment* of latent uræmia is that of the cause.

F. W. P.

ACUTE NEPHRITIS (ACUTE BRIGHT'S DISEASE)

Definition. An acute illness characterized by dropsy, scanty urine containing blood, albumin and renal casts, and toxic symptoms pointing to serious disturbance of the functions of the kidney.

Conception of the Disease. Attempts have been made, but not with much practical success, to differentiate cases of acute nephritis according as one of the three histological elements composing the kidney is chiefly affected—glomeruli, tubules and interstitial tissue. In the majority of cases all the elements suffer, whatever the cause of the inflammation. The term "acute nephritis" must be taken to express a clinical condition, and not a pathological state of the kidney, seeing that there is great variation in the post-mortem findings in the disease, in some

cases the changes being considerable and easily apparent to the naked eye, in others very slight, even with critical microscopical examination. The conclusion must be accepted that very grave disturbance of the kidney functions may coexist with the slight "organic" changes in the organ.

Relation to Chronic Nephritis. This is very close. Indeed, primary acute nephritis is a comparatively uncommon disease—especially if children be excepted—in the wards of a general hospital. The majority of the cases in adults are instances of acute nephritis complicating chronic, a fact that is abundantly confirmed in the post-mortem room.

Causes. 1. *Essential Causes.* Acute nephritis is probably always due to the irritation of the kidney during its efforts at elimination of some poison, of microbic or other origin. The poisons of the *acute specific fevers* are the most important, especially of *scarlet fever*, to a less extent of *diphtheria*, *typhoid fever*, *pneumonia* and *erysipelas*. *Acute sore throat* (e.g. acute tonsillitis) is sometimes followed by acute nephritis, quite apart from scarlet fever. Any form of *septicæmia* may lead to the disease; it is quite a frequent terminal event in ulcerating endocarditis. The poisons associated with *pregnancy* not uncommonly set up acute nephritis—the nephritis of pregnancy is more likely to be due to such irritant than to pressure of the pregnant uterus. Poisons of a more simple sort likely to cause the disease are *carbolic acid* and its derivatives, *turpentine* and *cantharides*. Outward application of these and allied substances is as likely to inflame the kidney as taking them internally. In spite of this category of known causes of the disease it must be confessed that in perhaps the majority of cases the origin is quite obscure. This is usually ascribed to "chill," and certainly exposure to cold or damp or both is a striking predisposing cause of the disease. That there is a more essential cause underlying the condition seems very likely, but whether microbic or not is unknown.

2. *Associated Causes.* As already stated the disease is commonest in children, whether due to scarlet fever or to "chill." Sex has no influence except in the adult cases, when the more frequent exposure entailed by male *occupations* makes the disease commoner in men.

Symptoms. 1. *Mode of Onset.* Three groups of cases occur. (i) In the commonest type of case the onset is that of a mild infective illness. There is general malaise, pains in the back and limbs, headache, a rise of temperature to 100° to 101°, with anorexia, nausea or, not infrequently, vomiting. It is soon noticed that the urine is very dark-coloured and scanty, and by the end

of forty-eight hours the face is puffy. The œdema increases and spreads all over the body; the urine remains very scanty and may become suppressed; the patient becomes rapidly anæmic, the temperature remains irregularly raised for about a week; constipation is the rule; the tongue is heavily furred.

(ii) The disease is not uncommonly much more latent. Tiredness on exertion, aching of the legs, headache, listlessness—these may be the only features present until the dropsy, or the state of the urine, or one or other of the nervous symptoms grouped under the term uræmia (*e.g.* convulsions, amaurosis, etc.) calls attention to the real state of affairs.

(iii) In a few instances the disease takes on a more fulminating character, beginning with high fever, persistent vomiting, anuria and rapid development of uræmia symptoms.

2. *The Urine.* The amount is scanty, up to actual suppression. The specific gravity is high, the reaction acid. The colour is usually dark brown, due to altered blood. There is a heavy deposit, consisting of blood cells and casts (chiefly blood and epithelial casts). The output of urea and uric acid, as also of chlorides and pigments, is diminished. In a few cases blood may be absent, at least when the patient comes under observation. Albumin, however, is constant, and is usually present in large amount.

3. *The Œdema.* The face, and especially the tissues around the eyes, is usually first affected. The dropsy is, however, sometimes first noticed in the legs. The œdema is soft; when it extends and becomes marked in degree it follows the distribution of gravity and is easily affected by pressure. In severe cases it may be so marked as to render the patient scarcely recognizable. It may affect the lungs and the serous sacs, and at times the larynx, requiring tracheotomy. If it passes off the patient is left in a state of comparative emaciation that is very striking.

4. *Crises.* In the course of an ordinary attack, it is not uncommon to see periodic crises occurring. They can sometimes be attributed to injudicious haste in increasing the diet, etc. During one of these crises the fever increases, the urine becomes more scanty, there is increased malaise and œdema, and there may be vomiting or other toxic symptoms.

Course. One of three things may happen to a patient suffering from acute Bright's disease. (i) He may get well. This will usually take at least six weeks. The event is to be known by the absence of albuminuria after the patient is up and on a full diet. (ii) He may drift into a condition of chronic nephritis, usually taking the form of chronic parenchymatous nephritis, less often of chronic mixed nephritis. If the albuminuria persists after three months' careful

treatment it is probable that this event is happening. (iii) He may die. Death is due either to acute uræmia, or to pericarditis, or to an acute pulmonary or peritoneal infection, or (rarely) to acute œdema of the larynx.

Complications—

1. *Acute Uræmia.* Any of the symptoms of this serious condition may ensue in a severe case.

2. *Anæmia.* Constant in all cases, but it may become a marked feature.

3. *Eye Changes.* Papillitis is not uncommon, a diffuse neuro-retinitis less so. Hæmorrhages may occur into the retina.

4. *Cardio-vascular Changes.* All forms of Nephritis lead to hypertrophy of the heart and to a high blood pressure, acute nephritis not excepted. These phenomena may, therefore, be regarded as symptoms rather than complications of acute Bright's disease. Endocarditis does not seem to occur, or but rarely.

5. *Pericarditis* is by no means uncommon. There is a special tendency for nephritic patients to develop this complication. It is an exceedingly grave event and mostly fatal. It usually goes on to liquid effusion.

6. *Pleurisy.* The same remarks apply. The prognosis, however, is by no means so serious.

7. *Pneumococcal infections* are rather common, indeed five and six may be of this nature. A specially interesting form of this infection is *pneumococcal peritonitis*.

Diagnosis. The question of the occurrence of acute nephritis hardly admits of doubt in the presence of urine containing blood and tube-casts with dropsy of recent onset. The only difficulty that may, and often does, arise, is whether or not there is also present one or other form of chronic nephritis also. This is to be determined by the state of the heart and blood-vessels of the retina and the general features of the case as the acute symptoms subside.

Prognosis. This is extremely difficult at the outset. It may better be expressed in terms of probability than in terms of the particular patients' condition at the time. About sixty per cent. of the cases get quite well. Recovery may follow a very severe onset, and a mild and latent case may proceed to chronic mischief. As the disease progresses a better guide is given to prognosis, and especially does the response to treatment enable the practitioner to decide the probable course of events. If chronic disease is present complete recovery is, of course, out of the question. Acute uræmic symptoms are not necessarily very grave in acute nephritis without chronic disease. Pericarditis and pneumococcal infection are probably more serious.

Treatment. Despite the fact that we can do so little to check the inflammatory process, and practically nothing to abate the albuminuria,

it is a fact that the skilful negotiation of a case of acute nephritis often repays the practitioner's efforts as noticeably as anything in medical therapeutics. The *indications* in treatment are as follows: To remove any source of poisoning that may be present; to give as complete rest to the inflamed kidney as is compatible with its functions being necessary to preserve the nutrition of the body; to secure the "vicarious action of the bowels and of the skin in the elimination of waste products; to correct the resulting anæmia." To these ends the following *scheme of treatment* should be adopted.

1. *General.* The patient is kept in bed and very strictly in the recumbent position, but is frequently moved on to the side and occasionally on to the chest. He is clothed in a warm and long flannel nightdress, which is frequently changed. He lies between blankets. The temperature of the room is kept at sixty-five to seventy degrees, and it is well ventilated.

2. *Diet.* In the treatment of uræmia the French have a dictum *lait ou la mort*, and this may well be applied to cases of acute nephritis. Not only is the diet confined for a time to milk, but the amount should be restricted. For an adult two pints in the day are ample, and for a child half this amount suffices. It is usually taught that water should be given freely "to flush out the kidneys." But the benefit of this procedure may be doubted; even the excretion of water entails work upon the inflamed organ, for the elimination of water by the kidney is not a mere filtration process. Moreover, until the kidney begins of itself to increase the flow of urine it is useless to attempt to force a diuresis. Once the diuresis begins, however, it is important to assist it by copious drinks of soft water. At the outset, then, the total quantity of fluid should be restricted to three pints for an adult and half this quantity for a child. Nothing whatever should be added for the first week, or even longer if the condition shows no improvement. Gradually, small amounts of starchy foods and fats may be added (bread and butter, porridge, potatoes, cream). Later, cereals in the form of soups—of course without meat or "stock"—rice, tapioca, macaroni. White fish is to be reserved until quite late in convalescence, and chicken until later still. Coloured vegetables, eggs, meat extracts, beef-teas and butcher's meat are to be postponed indefinitely. At any point, should a "crisis" ensue, or, indeed, any retrogression, a return must be made to a purely milk diet for a while. It will often be necessary to explain this rigidity of diet to the relatives, whose fears of starvation need allaying; and temptations to vary the régime on account of pressure brought to bear upon the practitioner must be studiously resisted.

3. *The Skin.* In mild cases a hot bath (T. = 110°) should be given daily, followed by plenty of friction to the skin by warm dry towels. In more severe cases the patient is sponged down with hot water, or better, is given a hot-air bath daily, for fifteen to twenty minutes, at a temperature just sufficient to induce sweating. Care must be taken to avoid cardiac depression during the bath. Continuous insensible perspiration is aimed at by means of the flannel dress, the blankets and the temperature of the room.

4. *The Bowels.* These should be got to act with as much daily regularity as possible. Few aperients are better than the time-honoured pulv. jalapæ co. in doses of one to four drachms, assisted by sulphate of soda in a little hot water (one to two drachms). In urgent cases, when uræmic symptoms are present, it is advisable to give one or two minims of croton oil on a little sugar.

5. *Drugs.* Diuretic drugs are best avoided altogether. A diaphoretic mixture may be prescribed after the first few days, such as the following—

Liq. Ammon. Acet. ʒ ss
Sp. Ætheris Co. ℥ xx
Aquam Camphoræ ad ʒ i ss
S. sextis horis

If the heart flags tinc. strophanthi ℥ v with liq. strychninæ hydrochlor. ℥ ii may be added to this mixture. When the more acute symptoms are over, and the anæmia becomes marked, a very useful preparation is liq. ferri acetatis in doses of ℥ x-xx.

6. *Duration of Treatment in Bed.* A patient suffering from acute nephritis should be treated in the recumbent position for—if necessary—as long a period as three months before it is decided that the disease has become chronic.

T. J. H.

CHRONIC NEPHRITIS (CHRONIC BRIGHT'S DISEASE)

A good deal of confusion exists in the current nomenclature relative to the different forms of chronic nephritis. Confining our attention to a study of actual cases coming under observation, three main types deserve description, according as the chronic inflammation affects chiefly the tubules of the kidney; or more especially the glomeruli, blood-vessels and interstitial tissue; or all parts of the kidney alike. The first type is usually denoted *chronic parenchymatous nephritis*, the second *chronic interstitial nephritis*. Various synonyms are in use, as will be indicated later. It must be borne in mind that these descriptions apply to *types* of chronic nephritis only, not to definite diseases. Many individual

cases are met with which are better not grouped at all, but simply termed *chronic nephritis*.

Chronic Parenchymatous Nephritis Chronic Tubal Nephritis (Large White Kidney)

Causes. The disease may arise from defective resolution in acute nephritis (*q. v. Course*); or it may arise *de novo* as an insidious process. It is often brought to light by an acute exacerbation supervening upon the chronic condition (*vide Acute Nephritis: Relation to Chronic Nephritis*).

Any of the causes of acute nephritis, then, may lead to the chronic disease. Other causes are *tuberculosis* of some part of the body, such as *phthisis*, *syphilis*, *malaria* and *chronic alcoholism*. In not a few cases, as in acute nephritis, no very adequate cause can be established. The disease is most common in young adults, and is quite common in children. *Males* suffer more than females, probably on account of the more common incidence of the above causes in males and because male occupations lead to greater exposure.

Symptoms. These are the same as seen in the acute disease, but certain of them call for special mention.

1. *The Œdema.* This is usually the first objective sign of the malady. The face often attains a characteristic appearance of puffiness combined with pallor. The puffiness may at first only appear in the early morning and later becomes more marked at that time. Involvement of serous sacs is common, or of the lungs; looseness of the cellular tissues chiefly determines the distribution of the dropsy, gravity less so.

2. *Chronic Uræmia.* A convenient term covering many of the "toxic" symptoms seen in the disease: anorexia, headache (most often vertical, and dull in character), insomnia, irritation of skin, nausea, coated tongue. *Acute uræmic symptoms* may arise at any time.

3. *The anæmia* is a constant feature and not seldom leads to the discovery of the disease.

4. *Cardio-vascular Signs.* These are more marked than in acute nephritis. The pulse tension is considerably raised (170–200 mm. Hg). The left ventricle is hypertrophied, showing a heaving impulse and an accentuated aortic second sound. The arteries may sometimes be felt to be thickened.

5. *The urine* is usually diminished in amount (800–1200 c.c.), has a high specific gravity, is deficient in pigments, contains much albumin and gives a sediment on standing which consists of granular, fatty and hyaline casts, leucocytes and a few red blood corpuscles. Obvious blood is not usually present unless there is a super-added acute attack. But the guaiacum test is often positive, or red cells are seen under the microscope, in specimens which have no appear-

ance of blood to the naked eye. The amount of urea and uric acid is often considerably diminished.

6. *Loss of Flesh.* A constant feature, allowance being made for the dropsy. T. J. H.

CHRONIC INTERSTITIAL NEPHRITIS

Synonyms. Granular kidney, gouty kidney, small red kidney, arterio-sclerotic kidney, contracted kidney.

Definition. A slowly progressive, and often latent, degeneration of the functional elements of the kidney, invariably associated with arterial and cardiac changes, and characterized by symptoms in which these latter changes occupy a prominent place.

General. Granular kidney overlaps considerably with arterio-sclerosis, and in some instances either name may be given to the disease with equal propriety. Many of the cases are latent until some accident attributable to the vascular degeneration calls attention to the condition. This is specially noticeable in cerebral hæmorrhage. In this account of the disease that clinical entity in which the symptoms are largely referable to the impairment of kidney function will be described.

Causes. There is an *hereditary* factor observed in quite a large number of the patients. Certain *toxic* agencies are of great importance, the main ones being *syphilis*, *alcohol*, *lead* and the poison of *gout*—whatever that may be. The almost constant occurrence of uratic deposits in or about the joints of patients dying with granular kidney proves the intimate association of gout and chronic interstitial nephritis. (But it is, of course, quite likely that in some of the cases the uratoses is the result of the renal degeneration rather than the cause of it.) In women, *mitral stenosis* is very frequently found to be complicated by contracted kidney post-mortem. *Men* are much more often affected than women. The *commonest* age at which the disease is recognized is that called middle life—from thirty-five to fifty-five. It occurs in children, and is certainly not always then due to congenital syphilis.

Symptoms—

1. *Polyuria, and other Urinary Changes.* A fairly constant symptom. The amount of urine passed daily may be as great as in many cases of diabetes. The *urine* is pale, of low specific gravity (1005 to 1015), contains a little albumin and yields a few casts, chiefly hyaline, on centrifugalization. The amount of urea is absolutely, as well as relatively, reduced. In some cases the albumin is merely a trace, and in a few it is quite absent, a fact which must be carefully noted lest it be concluded that in such a patient the kidneys are healthy.

2. *Symptoms referable to High Blood Pressure.* The blood pressure is constantly raised in granular kidney: if one can ever say "always" in medicine one can say it here. Pressures of 175 to 200 mm. Hg. are not uncommon, and of 200 to 250 by no means rare. *Headaches, giddiness, depression or restlessness, and palpitation* are common effects. *Hæmorrhages* occur not infrequently, especially *epistaxis*, the presence of which in men of forty to fifty should always raise suspicions of granular kidney. Less frequent hæmorrhages are *hæmoptysis, hæmaturia* and, of course, *cerebral hæmorrhage*.

3. *Symptoms referable to Arterial Degeneration.* The symptoms grouped under (2) probably own this cause as well as high blood pressure, inasmuch as the damaged vessel wall is a necessary factor in the process—witness the great frequency of "miliary aneurysms" in the brains of persons dying of cerebral hæmorrhage. Other symptoms, however, appear to be due chiefly to the thickened arteries, such as *aphasia, mono- and hemi-pareses and plegias*, often temporary in duration. *Epileptiform seizures* are sometimes seen, but not so commonly as in syphilitic arterites. *Numbness or pains in the legs*, less often in the arms, suggest a similar cause.

4. *Symptoms due to the Hypertrophied Heart.* These are chiefly *shortness of breath, palpitation and angina* of varying degree. The heart is very prone to dilatation, and this is shown by an increase of the shortness of breath and by œdema of the ankles, etc. Some patients alternate between high pressure with good ventricular systole and lower pressure with œdema.

5. *Uræmia.* Uræmic symptoms are less common in this than in the other forms of nephritis. But they sometimes occur and constitute one of the modes of termination of the disease. Not only so, they sometimes present themselves in a chronic form and of a less serious nature. There is nothing in them peculiar to this as against the other forms of nephritis (*q.v.*).

6. *Eye Symptoms.* The commonest are *retinal hæmorrhages* and patches of "*albuminuric retinitis*." Either of these may lead to temporary or permanent blindness, usually partial. Amblyopia without retinal changes is usually regarded as uræmic in character.

Course. This is very variable. A mild grade of the disease may be present for several years, especially if it be recognized early and the causes of the degenerative changes be removed. Some cases, on the contrary, advance rapidly; these are usually seen in patients who are comparatively young. The latency of the disease has already been referred to, and the discovery of it only when some very serious or even fatal complication arises: *e.g.* cerebral hæmorrhage.

Terminations. (1) By dilatation of the hypertrophied left ventricle and the production of dropsy of the "cardiac" type. (2) By the rupture of a diseased blood-vessel, especially a branch of one of the "perforating" arteries of the middle cerebral. (3) By uræmia (coma). (4) By an acute infective process such as pneumonia.

Diagnosis. This rarely presents difficulty when once attention is called to the possibility of the disease. The combination of cardiac hypertrophy and thickening of arteries with high blood pressure, polyuria and slight albuminuria can mean nothing else.

Prognosis. This is always bad in children and young adults, in whom, as already mentioned, the disease usually advances rapidly. When the principles of treatment cannot well be carried out, as in the working classes, the outlook is again ominous. The occurrence of wasting, of recurring hæmorrhages, of cardiac dilatation, or of uræmic symptoms, points to serious trouble in the near future. On the other hand, if the response to treatment be good, as is more often the case than generally supposed in those patients whose circumstances admit of proper negotiation, the outlook is more favourable, and life may be prolonged many years.

Treatment. 1. The principles laid down under *chronic parenchymatous nephritis* must be carried out here also for the purpose of sparing the kidney tissue as far as possible. But it is equally important to spare the heart and arterial system both from physical stress and from toxic irritation. To this end the following points must be attended to:—

2. *Rest.* Both physical and mental. The recumbent posture is again advisable for a portion of the day. And most patients require reorganization of their daily routine in respect of nerve strain. Prolonged, or exciting, or stressful occupations are to be avoided, and a shorter working day is indicated for a large proportion of the cases.

3. *The reduction of blood pressure*, other than by (2) may call for the indirect action of aperients or the direct action of "vascular depressants." The indirect lowering of pressure is best brought about by administering one or two grains of blue pill once or twice a week at bedtime, followed by a saline in the early morning. For direct action one of the following prescriptions may be used—

- R Sodii Nitritis gr. $\frac{1}{4}$ to $\frac{1}{2}$
In tablet form.
S. Twice daily, after food.
- R Nitroglycerini gr. $\frac{1}{200}$ to $\frac{1}{100}$
In tablet form.
S. Twice daily, after food.

Small doses ($\frac{1}{4}$ to $\frac{1}{2}$ gr.) of thyroid extract may be tried as another alternative, or a later

introduction to the vascular depressant group, gypsine (active principle of mistletoe), in doses as advertised by the chemists supplying this preparation.

4. Because they raise blood pressure and stimulate the heart unnecessarily, alcohol, tea, coffee and tobacco should be avoided.

Complications. Similar complications occur to those seen in acute Bright's disease (*q. v.*). The tendency to acute infective processes is even greater than in acute nephritis, that is, if we assume that the *pleurisy* and *pericarditis* so often seen in the subjects of chronic nephritis are due to microbic infection—a view justified by pathological observations. In addition to *papillitis* and *retinal hæmorrhage* seen as complications of acute nephritis, the condition of fatty degeneration known as "*albuminuric retinitis*" occurs in chronic nephritis, causing at times very serious defects in vision. *Phthisis* co-exists not infrequently, and when this is the case the infective process in the lung may be latent for some time.

Diagnosis. Dropsy with albuminuria occurs in that stage of *valvular disease of the heart* termed "failure of compensation," and this condition needs at times to be distinguished from chronic nephritis. So far as the dropsy is concerned, in heart disease its distribution is determined chiefly by gravity; the ankles and feet are affected first. In nephritis the dropsy is determined chiefly by looseness of cellular tissues; the eyes and face are affected first. So far as the albuminuria is concerned, in heart disease there are no associated casts, and the urine is highly pigmented, throwing down abundant urates. In nephritis casts occur and, although the urine may be scanty (as in heart disease), pigmentation is low and urates do not usually appear on standing. The two diseases may, of course, concur. From "*functional albuminuria*" chronic parenchymatous nephritis is distinguished by (1) the amount of albumin, which is more considerable—it rarely, if ever, exceeds 0.1 per cent. in postural albuminuria; (2) the occurrence of casts, and (3) the coexistence of cardio-vascular signs. Dropsy, of course, at once marks off any case from the functional group.

Prognosis. Once established chronic nephritis is an incurable disease. The variety termed "parenchymatous" admits of more palliation than the type here called "mixed," and is not so subject to accidents as the "interstitial" form. But it is a serious disease, and the patients live often on the verge of one or other of the uræmic manifestations described elsewhere. It was formerly said that the existence of neuro-retinitis in a case of chronic nephritis condemned the patient to death within two years, but such rigid statements

are not always verified. Bad points in prognosis are: oedema, which has come to stay despite treatment, serous effusions, extensive retinal changes, one or other of the nervous signs of uræmia (dyspnœa, convulsions, drowsiness, aphasia, hemiplegia, etc.). Pericarditis is almost always fatal, and usually rapidly so.

Treatment. Both in general and particular points the treatment is on the lines laid down in the article on acute nephritis. It is advisable to say this because it is of the utmost importance to decide definitely that every case is really chronic before assuming it to be so. In any case of doubt the precautions discussed on p. 249 should be adopted. Assuming the question to be answered the following points of difference in the treatment of chronic nephritic patients as against acute ones may be noted:—

1. *General.* Rest is important, but bed is not necessary; the patient should be careful to spend a portion of the day, preferably about the middle of it, in the recumbent or semi-recumbent posture. The *warm bath* need not be so frequent, but the treatment of the skin by friction should not be neglected. *Climate.* Choice of climate is of great importance if it can be attained. The requisites are: dryness, warmth and shelter. Egypt, Northern Africa, some parts of Spain, Madeira and California are good spots. The British Isles are ill-favoured as a whole, especially during the winter and spring. The south coast, from Bournemouth westwards, is the best part.

2. *Diet.* A little butcher's meat once a day, or once in two days, may be allowed; indeed, the patients do better on a fairly liberal diet than upon one that is too restricted. Although spirits and wines are best avoided, a little light lager beer may be permitted or mild cider.

3. *Drugs.* There is not the same contra-indication for diuretics as in treating acute nephritic patients. The presence of oedema with scanty urine may be met by one or other of the following prescriptions—

- R Liq. Ammon. Acet. ʒ ss
Tinct. Juniperi ℥ x
Tinct. Etheris Nitrosi ℥ x
Decoct. Scoparii Co. ad ʒ i.
S. Three times in the 24 hours.
- R Tinct. Digitalis ℥ iii
Potass. Citratis gr. x
Potass. Nitratis gr. iii
Caffein Citratis gr. ii
Aquam Chloroformi ad ʒ i.
S. Three times in the 24 hours.
- R Diuretin gr. v.
S. To be dissolved in a small tumbler of Contréxeville water and taken four times in the 24 hours.

In some obstinate cases of dropsy a trial may be made of the following—

R Ol. Cubebæ ℥ v.

S. A capsule to be taken half an hour after food three or four times a day.

And, if there is no success with these measures, though many physicians consider the remedy somewhat dangerous on account of a tendency to cause œdema of the lung, the following may be resorted to—

R Pilocarpini Nitratis gr. ½.

S. To be given as a hypodermic injection.

The patient must be carefully watched after giving the injection. He should be between blankets, and the nurse must be ready to rub the body with warm towels. Stimulants should be in readiness for any collapse.

4. *Tapping the œdema fluid* may be necessary. This should be postponed as long as possible. When decided upon the best method is by the use of Southey's tubes, one being inserted into the subcutaneous tissues about the ankle on each side. All aseptic precautions are essential.

Treatment of Exacerbations. This is to be carried out strictly according to the lines laid down in acute nephritis.

T. J. H.

LARDACEOUS DISEASE

Lardaceous Kidneys are large, hard, smooth and pale. On section the structure is obliterated. Iodine poured over the surface produces a series of dark-brown spots. In microscopic sections stained with methyl-violet the arterioles, the capillaries, and the glomerular tufts become pink, the rest of the tissue blue. These reactions are due to the presence of lardacein, which is a transformation, akin to hyalin, of the natural albumin.

Lardacein, or something like it, occurs spontaneously, and can be produced experimentally, in animals. In man its chief causes are pulmonary phthisis, prolonged suppuration, and syphilis. The second often accompanies one of the other two. It is also known to occur in rheumatism with heart disease, in rheumatoid arthritis, in malignant disease, and occasionally without any traceable cause.

It is not known whether there is a local transformation, or an infiltration from the blood; lardacein has not been found in the blood itself.

The symptoms of lardaceous disease of the kidneys are albuminuria and dropsy. The urine is at first copious and of low specific gravity. Later it becomes scantier. It often contains casts, but though after death plugs

may be found in the tubes which give the reaction with iodine, it is rarely that the casts passed during life respond to the test. The heart does not hypertrophy, the blood pressure does not rise, the artery does not thicken, and albuminuric retinitis does not appear. The dropsy is great and general. The case resembles that of a patient with a large white kidney. At the same time there is usually enlargement of the liver and spleen. In any case of phthisis, of prolonged suppuration, or of chronic syphilis, a watch should be kept for albuminuria. Its appearance usually implies lardaceous disease.

It seems certain that lardaceous disease may be cured. At any rate in children with hip-disease the liver may be greatly enlarged and the urine highly charged with albumin, and yet when the original disease subsides the former may return to its normal size and the albuminuria may diminish to a trace that is barely perceptible. It is only, however, in such diseases as are curable that this takes place. In phthisis and chronic syphilis recovery is not to be expected.

The treatment is that which is best for the original disease, and consists in good food, fresh air, sunlight, tonics and, in syphilitic cases, iodide of potassium.

W. P. H.

PYOGENIC INFECTIONS OF THE KIDNEY AND URETER

The only bacteria commonly found attacking the kidney are the tubercle bacillus and bacilli of the colon group; but other bacteria met with include the staphylococci, streptococci, proteus, and rarely the gonococcus. The proteus and some of the staphylococci can split urea into ammonia and render the urine alkaline, but the others, being unable to do so, are found in acid urines.

It is now well proved that from time to time bacteria are absorbed into the blood from the throat and bowel, and are excreted, amongst other channels, by the kidneys. Bacteria in the process of being filtered through the kidney may infect it. They may do so because they are in a state of exalted virulence; or because the general resistance of the host is lowered; or because the local resistance of the kidney is diminished by back-pressure from ureteric or urethral obstruction, or by mechanical injury such as that caused by stone or blows on the loins. It is impossible to bring forward the proofs for these statements here, as space will not permit, but they are well founded and will be more widely admitted as time goes on. At present the idea of ascending infection holds the field. Ascending infection does occur, but only when there is incompetence of the ureter from urethral obstruction or disease

of the ureteric mouth. Infections of the kidney and bladder arising without previous symptoms of any kind are nearly always "hæmatogenous" and descend from the kidney to the bladder.

Pyelonephritis due to Bacteria other than the Tubercle Bacillus

The onset is sudden, with high fever, rigors, headache, vomiting, and constipation or diarrhoea.

The complaint is that there is *greatly increased frequency of micturition*, with pain in the urethra or neck of the bladder just at the finish of the act.

There may be an intense continuous aching pain in the back and front of one or both loins, *but this is often absent altogether*, and *profuse hæmaturia* lasting one or two days is by no means uncommon.

The temperature may be as high as 105° F., the pulse-rate being increased in proportion to the temperature, whereas the respiration rate is not much increased.

The urgent and painful micturition should at once suggest an *examination of the urine*. The urine may contain a large amount of diffused blood, but more often presents simply a haze due to contained pus and bacteria—a haze which does not disappear on the addition of acetic acid and forms a ropy jelly with potassium hydrate. In the average case not more than a trace of albumin will be found, and no casts; the reaction will be acid and the amount passed in the twenty-four hours will be considerably increased. If a drop of urine be placed on a slide, dried, stained and washed, dried again, and mounted in a drop of cedar oil, pus cells and bacteria can be readily detected with the microscope.

Bacteriological examination will determine the nature of the bacteria present, whether a bacillus coli, streptococcus, staphylococcus, proteus or some rarer organism.

Abdominal examination in the first few days may reveal a large and tender kidney on one side or the other, but more often the muscles around the affected kidney are rigid and on guard, and there is so much tenderness in the loin that the kidney cannot be felt. In other cases the kidneys are neither enlarged nor tender. The disease is more often encountered in women than in men, and on the right side rather than the left side, though not infrequently it is bilateral. Only one kidney may be painful and tender though both are infected.

The complaint is perhaps more often met with in women during the fourth or fifth month of pregnancy, in which case the pressure of the uterus on the right ureter is supposed to be a predisposing cause, but it is often seen in cases

of movable kidney and renal or ureteric calculus, in pelvic prolapse, in children suffering from diarrhoea, and sometimes after a blow in the loin. In many cases, however, it comes on spontaneously and no predisposing cause of any kind can be detected.

Clinical Types. By far the commonest type is a fairly acute case (see chart) that clears up completely in a few days by a process of natural immunity, whatever treatment be adopted.

A fair number of *acute cases become chronic*, that is to say they cease to have fever except for a day or two at a time at long intervals, but they continue to pass pus and bacteria in the urine, which causes increased frequency of micturition and discomfort at the end of the act. Occasionally for weeks together the urine becomes clear to the naked eye, but if plate cultures are made it can be shown that bacteria are still present in great numbers, and eventually pyuria appears again. This is another important fact to bear in mind in attempting to estimate the results of treatment. At any time, however, spontaneous cure may occur quite suddenly. The chronic cases go on for many years, and eventually may perish of uræmia. Very rarely indeed *fulminating cases* are met with, the temperature being 107° F. to 108° F. Signs of profuse and increasing toxæmia appear and the patient will die unless nephrectomy is performed. Some brilliant cures have been obtained in this connection, but the need for nephrectomy is very rare indeed.

The Hæmaturia Type. Profuse hæmaturia at the onset is quite common.

Diagnosis. The sudden onset of fever with increased frequency of micturition are the outstanding signs. The condition is usually mistaken for cystitis or a deep urethritis.

From Cystitis. Guyon taught that "cystitis never gives rise to fever." The reason is clear if it is remembered that the bladder is a reservoir, whose walls must needs be slow to absorb water and soluble toxins. If, therefore, in the absence of a deep urethritis symptoms of cystitis arise accompanied by fever, it may be taken for granted that pyelitis is the true diagnosis. The absolute diagnosis can only be made when the fever has subsided, by means of the cystoscope and ureteric catheters.

From Deep Urethritis. The deep urethra is a most delicate absorbing surface; witness the rigors seen after catheterization and urethrotomy, and the high fever seen in gonorrhœal "posterior" urethritis. If pus is coming from the deep urethra there may be fever, pyuria and increased frequency of micturition.

Two points are diagnostic:—(1) The patient will usually have noticed urethral discharge previously. (2) There is burning pain in the

urethra from the start to the finish of micturition, whereas in pyelitis the pain comes just at the finish of micturition, when the bladder wall collapses down on to the inflamed ureters and trigone.

From Tuberculosis of the Kidney the diagnosis is made by the more gradual onset without fever, by the finding of the tubercle bacillus in the urine, and by the cystoscope. But before being content with his diagnosis the practitioner must endeavour to elucidate two further points.

1. *Can any predisposing cause be detected*, such as the obstruction to or pressure upon the ureter by pelvic tumour, movable kidney or calculus, or obstruction to the urethra by stricture or enlarged prostate? If these can be removed the prognosis is greatly improved.

2. *What is the infecting bacterium?* This must be determined by drawing off a catheter specimen of urine into a sterile flask and sending it for cultural examination to a bacteriologist.

Prognosis. If the patients thus afflicted be simply *put to bed and given plenty of water to drink* more than half of them lose all signs of fever in two to three days and their water becomes clear. This fact cannot be too strongly emphasized, as it is often forgotten when attempts are made to estimate the result of treatment.

A few of the cases persist for some weeks, with intermittent attacks of fever, and then clear up completely. Of the remainder a few more will clear up after a few bladder washes. In these cases the kidney has cleared up but the bladder has remained infected. Lastly, a few remain in which the fever disappears but the pyuria persists most obstinately, accompanied by slightly increased frequency and discomfort at the end of micturition. This group of cases defies most forms of treatment, though some of them yield in time. In a small number the pyuria persists for years, and eventually the kidneys are so far destroyed that uræmia sets in and ends the chapter.

Treatment. So long as the symptoms remain acute and the fever unabated Nature should be left very much to herself. Put the patient to bed and insist that she drinks at least six pints of fluid in the twenty-four hours. If she can be persuaded to drink more, so much the better. A tumbler of Contréxeville water should be drunk three times a day on an empty stomach, and the rest should be made up with barley water, lemonade, weak tea, milk and soda water.

Diuresis is encouraged and the urine rendered less irritating if it be made alkaline.

Potassium citrate can be used alone in doses of fifteen to thirty grains, or it can be prescribed with twenty minims of the tincture of hyoscy-

mus and made up with infusion of buchu to the ounce.

Another excellent mixture is—

Sod. Bicarb. gr. xxx

Pot. Cit. gr. xxx

Pot. Acet. gr. xxx

Mag. Carb. gr. iii

Calc. Carb. gr. iii

Aq. Camph. ad $\frac{3}{4}$ i.

S. To be taken every four hours till the urine is alkaline.

It is permissible and advisable to pass a catheter once only and obtain a specimen of urine for bacteriological purposes.

On the simple treatment outlined above more than half the cases get quite well in a few days to a few weeks, and have no further trouble. (See chart.)

Urotropin may be used instead of alkalis, but it often irritates the stomach and bladder during the acute stage. It is best prescribed in five-grain tabloids, one to be crushed up in a tumbler of water and taken after a meal three or four times a day.

Unless the urine is acid urotropin is not excreted in the urine as formic acid and has no inhibitory action on bacterial growth. It is therefore necessary to give a drug that will render the urine strongly acid. Use either acid sodium phosphate in doses of thirty to sixty grains, or boric acid in doses of ten to fifteen grains. If urotropin is mixed with acid sodium phosphate in a medicine bottle, decomposition soon takes place and the desired effects are not obtained.

If after three weeks of such treatment the fever has abated but the pyuria is persisting, a course of *bladder lavage* should be instituted. In many of my cases a single cystoscopic examination with its thorough lavage of the bladder has been sufficient to lead to a complete and instantaneous cure. For lavage the best antiseptic is oxyceyanide of mercury, 1 in 4000 of water. Silver nitrate in strengths of 1 in 10,000 to 1 in 1000 is sometimes effective where the first fails.

No instrumentation or lavage of the bladder should be carried out during the acute stage, apart from the single catheterization performed in order to obtain the specimen for bacteriological purposes. Nor should any vaccine treatment be employed during this stage, as a prolonged "negative phase" may be induced and the bacteria be enabled to extend their ravages.

The fever is a sign that the body is being sufficiently stimulated by autogenous bacterial toxins.

If daily lavage fails to cure after a fortnight's use it should be given up, as by this time it is

clear that one or both of the kidneys are still infected. The case may now be said to have entered upon the chronic stage, and such cases are very obstinate of cure.

The treatment that holds out the best prospect of complete cure is *lavage of the renal pelvis*. This is performed by means of the ureteric catheter once or twice a week. The whole performance can be carried out in ten minutes, without an anæsthetic and without any pain whatever. The cures now being obtained by this method are most striking.

Vaccine treatment has been extensively carried out, but has proved disappointing so far as absolute cure is concerned. In some cases it does seem to relieve the pain and increased frequency of micturition, but the bacteria do not disappear from the urine. If it be employed it should only be in the chronic stage. Start with injections of 50 millions of dead bacteria every ten days or a fortnight, and work up by 50 millions at a time to 1000 or even 1500 millions.

Another line of treatment that may meet with success is to send the patient for a drink cure to one of the foreign spas, such as Vichy, Contréxeville or Evian.

If the patient cannot go abroad a drink cure may be instituted at home. A tumbler of Contréxeville water is to be drunk thrice a day on an empty stomach, as well as six pints of fluid. Urotropin and acid sodium phosphate should be exhibited for months at a time so long as they do not cause irritation of the alimentary canal. The changes can be rung on other urinary antiseptics, such as helmitol, boric acid, benzoic acid and sodium benzoate. Sandalwood oil and its derivatives are always worth a trial, especially in staphylococcal cases.

If the patient is pregnant ("pyelitis of pregnancy") rest in bed in any position will usually lead to subsidence of the fever. There is seldom any need either to induce labour or to drain the kidney through the loin, as has been widely advocated, as the patient can usually be steered through to full term by judicious use of rest in bed and urinary antiseptics. After childbirth the condition is likely to improve, and may clear up altogether.

Operation is hardly ever required. Drainage of the kidney in the loin and pelvic lavage is seldom needed, as the same results can be obtained by the ureteric catheter.

Nephrectomy is required in a few rare cases of a fulminating type when the fever is extreme (107° F. to 108° F.) and does not subside in spite of treatment and the patient seems likely to succumb. In such cases it yields brilliant results and may pluck a woman from the brink of the grave and lead to immediate and complete cure.

F. K.

TUBERCULOSIS OF THE KIDNEY AND URETER

The tubercle bacillus is absorbed into the blood through the alimentary canal, being taken in with the milk or the food. In certain individuals whose resistance to the bacillus is low groups of bacilli may become impacted in the cortical blood-vessels of the kidney. Tuberculous infarcts are formed, the centre of which caseate and become surrounded with granulation tissue. In time the caseous material bursts into the pelvis of the kidney and pus appears in the urine, and with it the first symptoms of the disease, the bladder being irritated by the pus. As the infected kidney is destroyed the opposite kidney grows large from hypertrophy, and, the capsule being stretched, it aches. A large aching kidney may therefore be the healthy kidney.

If the disease be left to take its course it spreads along the ureter to the walls of the bladder, which become ulcerated and thickened. It also spreads in time to the vesicles, prostate and opposite kidney.

Death is the invariable rule in from one to eight years from uræmia, secondary infections or intercurrent disease elsewhere.

Clinical States. The sudden onset of pyuria, with mild irritation of the neck of the bladder, but without fever, is absolutely characteristic of the majority of cases. The attack may last a few weeks and then intermit, to be repeated weeks or months later, but more often the symptoms are continuous and progressive from the first. *Pain* is felt at the end of micturition in the end of the penis or deep in the perineum. *The frequency of micturition* is increased both by night and day and the symptoms progress till water has to be passed every few minutes. There is no fever, no wasting, no uræmia, and the patient appears plump and perfectly well—his appearance utterly belying the seriousness of the disease. The next most common symptom is an *aching kidney*.

The ache is felt in the back of the loin, beneath the twelfth rib, and at times also in the front or side of the loin.

The aching kidney is likely to be the healthy hypertrophied kidney.

Profuse hæmaturia, with or without pain, is not at all uncommon at the onset, and in rare cases it is repeated again and again and dominates the picture. Later on in the disease a little blood clot is often seen in the urine, and it is a sign of ulceration of the bladder.

Renal colic is rare, and is seen in those cases where the ureter is partially blocked by the disease.

In the late stages of the disease there is wasting and fever, and signs of uræmia are

not wanting to point to the short approach of death.

Physical Examination. In the early and operable stages palpation may reveal nothing, but later on one or both kidneys may be felt enlarged and tender, and rectal examination may reveal a thickened ureter and nodules in the vasa vesiculæ, prostate and base of the bladder. A nodule in the globus major of the testicle is of great aid in diagnosis.

Examination of the Urine. With rare exceptions the urine is acid and contains a haze which does not disappear on the addition of acetic acid, and gives a ropy deposit with potassium hydrate. Pyuria is a most serious symptom and demands an immediate and complete investigation of the genito-urinary tract. Purulent urine should always be drawn off by a catheter for full bacteriological examination; or a complete twenty-four hours' specimen may be collected in a bottle for this purpose. The tubercle bacillus may be found in many cases, but in a minority of the cases repeated examinations fail to reveal it, and nothing but the injection of the urine into a guinea-pig may suffice to prove its presence. Fortunately this is not often required, as the cystoscopic picture is usually characteristic and diagnostic, even though the bacilli cannot be found. The urine of tuberculous kidneys is never alkaline, unless secondary bacteria are present.

Cystoscopy and ureteric catheterization are the key to diagnosis and successful treatment, as not only can the nature and extent of the disease be thereby determined, but also the functional value of each kidney. Employing these methods routinely Albarran performed one hundred and eight consecutive nephrectomies for tuberculosis of the kidneys with three deaths and eighty per cent. of cures.

Diagnosis. Pyuria is easy to detect and is of serious import. When detected the practitioner should at once say to himself: What is the primary focus of disease, and what is the infecting bacterium? Urethral pus is easily excluded if the pus be seen issuing from the meatus, or, if not, by making the patient pass water into two glasses, for if the last is clear the pus must be urethral. If it is hazy it may be renal or vesical. To distinguish between renal and vesical pus cystoscopy is necessary. Pus in the acid urine may be due to the tubercle bacillus or the bacillus coli and other pyogenic bacteria.

Differential Diagnosis. 1. *From bacillus coli and other infections* the absence of fever and the mildness of onset should suffice in most cases, but the absolute diagnosis can only be made by bacteriological examination and cystoscopy.

2. *From cystitis* due to stone, stricture or

tabes the diagnosis is made by excluding these three conditions, as the symptoms may be equivocal in such cases. Stone is excluded by the X-rays or cystoscopy, stricture by the urethroscope, tabes by examination of the nervous system.

3. *From posterior urethritis* the diagnosis can be made at once if the patient is asked to pass water into two glasses. Clear urine in the last glass excludes tuberculous kidney. Bacteriological examination and the history should also lead to a correct diagnosis.

Prognosis. Tuberculosis of the kidney is invariably fatal, if left to itself, in from five to eight years. Nephrectomy in the early stages yields brilliant results. For instance, Albarran was able to follow up seventy-seven of his cases, and found that fifty were completely cured and seventeen still had signs of vesical tuberculosis but were healing up gradually.

Treatment. Modern treatment is based on the following principles—

1. Tuberculosis of the urinary tract in the majority of the cases starts as a descending infection from one kidney.

2. Spontaneous cure of a tuberculous kidney is unknown.

3. The finding of pus and tubercle bacilli in the urine is specific.

4. By means of the cystoscope, ureteric catheters, and functional tests it can be determined that one kidney is diseased and the other healthy and of full functional value.

5. If the disease is unilateral nephrectomy means a cure.

6. If the bladder is already infected it will heal up after nephrectomy if tuberculin be exhibited for one to two years afterwards.

7. Tuberculin cannot cure renal tuberculosis, in fact it makes it worse; it can only cure vesical tuberculosis after the primary renal focus has been removed.

The practitioner faced with a case of pyuria suspects tuberculosis and his suspicions are confirmed by the bacteriologist, who reports that the tubercle bacillus is present. What, then, is to be done? Since nothing short of early surgical treatment can hold out hope of cure, a complete cystoscopic examination should be emphatically recommended. In favourable and early cases the disease can then be traced to one kidney or ureter, which should be removed without delay. If the bladder is clear the pus disappears at once from the urine, and with it disappears all the symptoms and the patient is cured. If the bladder is infected the symptoms are greatly relieved forthwith, but tuberculin treatment must be persevered with for at least a year or eighteen months till the cystoscopist is able to report that the vesical lesions are healed. Under this treatment one

has been able to watch the ulcers heal, the sub-mucous tubercles melt away, and the bladder resume once more an appearance of health. Tuberculin can now be obtained in tabloid form and is to be administered once a fortnight in doses of 1 in 100,000, rising gradually to doses of 1 in 10,000 or even 1 in 5000. "Koch's New T.R." gives the best results.

At the same time it is most important to adopt such measures as will raise the general resistance of the patient to tuberculosis and will prevent fresh infections. I am accustomed to order these patients to boil their milk for the rest of their lives, as they have had their warning, to avoid close contact with phthisical patients, to live with windows open day and night, to take regular daily open-air exercise, and to feed up as much as they can.

In other cases the cystoscope shows that both kidneys are infected, and in these cases it is useless to carry out any form of operation. Death is inevitable within seven or eight years in chronic cases and within a few months in acute cases. Measures can, however, be adopted which will bring relief to the symptoms.

Sandal-wood oil in doses of five to fifteen minims three times a day will often relieve the bladder irritation and should always be tried first. If it fails resource must be had to bladder sedatives, belladonna being the most useful, and such drugs as aspirin, antipyrin and pyramidon should be given a trial. Drugs often act best when given in rectal suppositories. In the last resort opium must be exhibited if the pain becomes unbearable.

Summing up, we may state that the fate of these cases lies largely in the hands of those to whom they first apply for treatment. If all cases of obscure pyuria were at once referred for cystoscopic examination most cases of renal tuberculosis could be permanently cured. Until this becomes the rule cases will still be seen that have been allowed to drag on until both kidneys are diseased, when the chance has been lost for any hope of cure. F. K.

RENAL TUMOURS

A Renal Tumour may be an enlargement of the kidney itself, or of some part of it; such are polycystic kidneys and hydronephrosis. Simple cysts or hydatid cysts occasionally form renal tumours. The remainder are solid growths, and it is these alone which will now be considered. They are of great variety, and their classification is admitted to be still unsettled. Many kinds of structure and many kinds of tissue are found in them. True lipoma has been found; small fatty tumours, which have been ascribed by Grawitz to the inclusion of islets of adrenal tissue in the kidney, are not uncommon.

The adenomas vary from encapsuled and innocent-looking growths reproducing the kidney structure, to others which invade the gland and contain sarcomatous and even carcinomatous tissue. Other growths are undoubtedly sarcomatous, spindle-celled, round-celled or alveolar, and others again have been described as carcinoma. Even in the same tumour such different structures may be found that sarcomatous carcinomas of the kidney have been reported. In addition, especially in the tumours of childhood, cartilage, muscle and fat have been found, and such tumours are labelled chondro-sarcoma, rhabdo-myoma, lipo-myoma and the like. Allen and Cherry have maintained that, since the kidney is of mesoblastic origin, all these forms, even when most resembling carcinoma, are really sarcomatous, and that the great variety which characterizes them depends upon their origin from the somites which form the surrounding muscles, bones and connective tissue. It is also acknowledged on all hands that it is impossible in renal tumours to form a prognosis from histological structure. Some which appear innocent recur rapidly and form metastases, others which appear malignant do not.

Renal tumours are particularly common in early childhood. The following age-table is taken from Morris.

From birth to	5 years of age	39 cases
" 5	" 10	" 2
" 10	" 20	" 6
" 20	" 30	" 14
" 30	" 40	" 20
" 40	" 50	" 30
" 50	" 60	" 22
" 60	" 70	" 11
" 70 years upwards		4

Carcinomas, or what are so described, occur almost entirely after the age of forty.

All tumours are more common in males. They are very rarely bilateral. Metastases are common in the glands, the lungs, and the liver, rare in the genito-urinary tract itself.

A renal tumour grows forwards, and can be easily pushed back into, or forward from, the loin. It usually moves with respiration. If on the right it pushes the colon to its inner side. If on the left the last part of the transverse colon passes upwards in front of it; the descending may be on its outer side or in front. The fingers can usually, when the muscles are relaxed, be pushed up between the tumour and the ribs, and resonance may be found above it. These tumours may grow to enormous size. Then all landmarks fail. Occasionally they pulsate.

The chief symptoms of renal tumour are pain and hæmaturia. Pain is variable in

degree and in character. It sometimes radiates along the course of the contiguous dorsal and lumbar nerves. Hæmaturia has these peculiarities: it is copious, is recurrent, and not dependent on muscular exertion, nor stopped by rest. In about half the adult cases, and in nearly all the infantile, the tumour is discovered before either of these symptoms appear. Albuminuria is usually present.

The chief difficulty in diagnosis is to distinguish renal from adrenal or ovarian tumours, and from new growths in the colon.

The duration of renal new growth is longer than that of new growth in other viscera. On the average such a case lasts four or five years.

Nephrectomy is the only possible treatment, but it is an operation with a mortality of about twenty-five per cent., and recurrence is frequent and early.

W. P. H.

NEPHROLITHIASIS (URINARY GRAVEL AND CALCULUS)

Definition: The precipitation of certain organic or inorganic salts in the kidney, with consequent damage to the tissues of this organ or of the urinary tract. If the salts thrown out of solution remain to accumulate into masses, *calculi* are formed; if the salts are excreted as crystals or as small fragments the condition is spoken of as *gravel*. "Calculus" may occur without gravel, and "gravel" may occur without calculus; or both may occur together, or may alternate, in the same patient.

Nature of the Deposits. Most crystalline deposits in the kidney consist of a mixture of *urates* and *oxalate of calcium*, arranged in concentric layers. Less frequently the calculus is composed chiefly of *phosphate* and *carbonate of calcium*. A much less common form of calculus is composed of *cystin*. A *nucleus* of some organic substance is not uncommon. The *size* of the deposit varies from the common "cayenne pepper" uric acid crystals up to stones so large as to require considerable expansion of the urinary apparatus to contain them.

Causes of Urinary Lithiasis. 1. *Age.* The condition is quite common in infants, whose diapers may frequently be found to contain good-sized crystals of uric acid immediately after micturition, and in whose kidneys, post-mortem, deposits of the same nature are by no means rare, sometimes as large as peas. In old people, on the other hand, urinary lithiasis is distinctly uncommon.

2. *Heredity.* A family disposition to lithiasis seems definite, and the popular association of the condition with gout in this respect is probably justified by facts, though patients may be very gouty without developing lithiasis,

and may be the subjects of well-marked renal calculus without ever suffering from gout.

3. *Habits.* Lack of exercise and fresh air probably tend to induce lithiasis, as do alcohol and rich living. Obesity appears to overlap with lithiasis as with gout, and the factors producing these conditions seem to overlap also. In diet some authorities attribute importance to hard drinking waters as a causal factor, and the frequency of stone in Norfolk has been thus accounted for.

4. *Associated Diseases.* The influence of gout and obesity has been referred to. Plumbism probably acts as an inducing cause through gout. Anæmia and leukæmia cause gravel by insufficient oxidation. Dyspepsia is commonly associated with oxaluria. A nucleus in the kidney may be caused by trauma or by purpura. The condition wrongly termed "phosphaturia," in which there is diminution in the acidity of the urine and easy deposit of phosphates in the urinary tract, is a precursor of lithiasis. It is found in neurasthenics, in vegetarians and in association with chronic gastric disturbances.

Symptoms. In both gravel and calculus the disease may be quite latent, no symptoms at all being present. That is to say, uric acid sand and fragments of oxalate or phosphatic sand may be passed without other manifestations of the diathesis to bother the patient; and one or more calculi of some size may be present in the kidney without giving rise to symptoms. If, however, symptoms are present they are as follows—

1. *Gravel.* More or less irritation of the urinary passages—ureter, bladder or urethra. Some discomfort or pain in the loins. Recurring hæmaturia of a slight degree, often only found in microscopic examination of the urine, revealing the presence of red blood cells. For the more generalized and constitutional symptoms present in this condition, reference should be made to the sections on *Gout*, *Oxaluria* and *Phosphaturia*.

2. *Calculus.* The symptoms of stone in the kidney may be discussed under the headings *pain*, *hæmaturia*, *anuria* and *changes due to infection of the urinary passages*.

(a) *Pain.* This is of two kinds, (i.) *renal colic* and (ii.) *non-colic renal pain*.

(i.) *Renal colic* occurs in a large number of the cases, usually in attacks having some considerable interval of time between them. During these intervals the patient may be quite free from pain, or he may suffer from troublesome pain of the second kind. An attack of colic often follows quickly upon some exceptional form of exercise, a railway or motor journey, a long walk or, in women, a confinement. It may be ushered in by a rigor, with a high temperature and sweating, or by a form of

epileptiform seizure. The pain is sudden, very intense, and may lead to vomiting or syncope. It begins in the loin of the affected side, spreads to the front of the belly and down to the groin and genital organs. Sometimes it is felt in the centre of the back, and occasionally in the loin of the unaffected as well as that of the affected side. Frequent desire to micturate may be present, and a sympathetic flatulent distension of the colon. The intensity of the pain leads to pallor, an anxious facies, frequent pulse and collapse. The attack, if not quickly relieved by opium, lasts for some hours, up to a day or two.

(ii.) *Non-colic renal pain* is probably more common than colic. This is situated in the small of the back, chiefly on the affected side, and is quite often mistaken for lumbago. It may last in a more or less continuous fashion for several years, leading to loss of weight and nutrition, inability to take exercise without producing exacerbations, and marked mental and physical depression. Occasionally the patient refers it to the right or left hypochondrium, high up under the costal arch (see paragraph on *Diagnosis*).

(b) *Hæmaturia*. This may be of the frank variety, quite obvious by naked-eye examination of the urine, and the loss of blood may then be considerable. This form almost always follows immediately upon an attack of renal colic. Quite as often the bleeding from the damaged kidney or urinary passage is masked, producing urine that is merely "smoky" or revealing the presence of blood only when this is specially tested for. In this form of hæmaturia the bleeding may follow, and be only present after, extra exertion, with great constancy, the urine becoming quite natural at other times (see *Diagnosis*).

(c) *Anuria*. This is the one most serious symptom of renal calculus, and, apart from the risks attendant upon surgical treatment and the results of infection of the urinary passages, is the only fatal event in the disease. It is not, however, very common. When it occurs it indicates either the occlusion of one ureter with reflex suppression of urine from the kidney of the other side, or the simultaneous occlusion of both ureters, or the occlusion of the ureter of an only kidney, or of a single ureter from both kidneys.

(d) *Infection of the Urinary Passages*. Sooner or later, in a large number of cases of renal calculus, the urinary tract becomes the seat of pyogenic infection, especially by *B. coli*. This incident leads to an additional chain of symptoms, such as pyuria, "chills," anæmia, loss of flesh and other evidences of a chronic infection. The reader is referred to the special chapter upon urinary infections for an account of this condition.

Unusual Positions of the Calculus. The stone may be passed outside the body, with cessation of the symptoms. Or it may lodge somewhere between the kidney and the exterior of the body. The common situations are: (a) at the orifice of the ureter, as this enters the bladder, (b) at the beginning of the ureter, (c) at the point where the ureter crosses the iliac vessels, (d) in the bladder and (e) in the urethra. When a stone lodges at one or other of these points the symptoms show variations from those above described, chiefly in the way of distribution of pain and other discomfort. Thus, at the vesical orifice of the ureter, a rather common point of lodgment of the calculus, the pain is apt to spread to the penis, scrotum, rectum and seminal vesicles, and frequent desire to micturate is often present.

Diagnosis. 1. *The colic* has to be distinguished from gallstone colic, from ordinary colic and especially from appendicular colic. The characters of the pain, its distribution, careful examination of the urine for blood and radiography are the best means of establishing a diagnosis.

2. *The non-colic pain* has to be distinguished from lumbago, from Pott's disease, from sacroiliac disease and from gallstones. The same points must be investigated. The treatment of renal calculus as lumbago, because no colic occurs, has been referred to already. If the physician remembers to exclude calculus in all cases of continued and obscure backache, mistakes are not likely to arise. The writer has seen a patient in whom pains in the back were treated as recurring lumbago and as myalgia for over ten years, in whom a radiogram showed the presence of five stones in the left kidney.

3. Renal colic may be due to other diseases of the kidney than calculus—tuberculosis, movable kidney, or renal growth—but either of these is rare as a cause of renal colic. The *hæmaturia*, however, must be distinguished from these and some other conditions, but especially from tuberculosis. Here, as in stone, physical exertion causes exacerbations of the pain and of the bleeding, sometimes in the most striking manner.

Treatment. 1. *Gravel*, and calculus giving rise to no pain, or only trivial pain, and to no hæmaturia, is to be treated on "medical" lines—by the free ingestion of soft drinking water, or perhaps still better by Contrexeville, Vichy or Evian water, by increase of exercise and fresh air, and by a plain and simple diet from which "rich" things, spices, condiments and alcohol, are excluded. To these injunctions may be added a prolonged course of such drugs as citrate of potassium, urotropin or helmitol, piperazin or sodium benzoate.

2. *Calculus* giving rise to bad pain, either of the nature of colic or of the continued sort, with or without hæmaturia, is to be met by surgical procedures. The surgical treatment of renal calculus in the hands of a careful operator is highly successful. In most cases simple nephrotomy is sufficient, but in cases where the hæmorrhage is difficult to control on account of the stone being deeply embedded in the kidney substance, and where it is found that extensive destruction of the kidney has taken place, the organ may call for removal. Despite assertions to the contrary, no surgeon can properly tell beforehand in which case nephrectomy will be required; a free hand should therefore be given for dealing with the condition as indicated at the time of the operation. If infection of the urinary passages has occurred surgical procedures should not be delayed. *In all cases it is essential that evidence be forthcoming as to the proper functioning of the kidney on the other side before operation be decided upon.* This evidence can be elicited by careful examina-

tion of the urine as a whole and of that from one or both ureters, obtained by catheterization of these ducts. Inadequate secretion by the "sound" organ is a definite contra-indication to operative treatment. So also is an active condition of urinary infection until this has received appropriate treatment. The presence of more than one stone, and the presence of stones in both kidneys, do not contra-indicate operation. In cases of bilateral calculus careful consideration must be given to the question of which kidney is explored first, after a study of the radiograms and of the urine secreted by either kidney separately.

3. The *anuria* complicating some cases of calculus must receive energetic treatment, on the lines laid down in the article on *Uremia* (q.v.). Should it exist for longer than forty-eight hours it is by most authorities regarded as an indication for immediate exploration, but merely for incising the kidney and draining the pelvis—leaving further procedure until such time as the anuria has passed off. T. J. H.

DISEASES OF THE DUCTLESS GLANDS

DISORDERS AND DISEASES OF THE SUPRARENAL GLANDS

THE suprarenal glands constitute the most important part of what is known as the chromaffin system. This system, also called the hypertensive or adrenal system, comprises in addition to the two suprarenal glands, small glands resembling the medulla of the suprarenals which are scattered about in various parts of the body, chiefly in connection with the sympathetic nervous system. There are groups of these chromaffin glands or accessory adrenals connected with the solar plexus and the semilunar ganglia. The intercarotid glands and the coccygeal glands also belong to the system. The suprarenal glands consist of cortex and medulla, but the other members of the chromaffin system consist of medullary substance only. The functions of the cortical part are distinct from those of the medulla, so that the so-called accessory adrenals are able to reinforce or act in substitution for, a portion only of the full activities of the complete suprarenal glands. The functions of the cortex are probably related to the growth and development of the sexual organs and to the neutralization of toxins, but whether directly or by stimulating some of the other internal secretory glands it is not yet possible to say.

The cells of the medulla and of the accessory adrenals readily stain a brown colour with chromic acid, hence the name chromaffin system.

The chief, if not the only function of these cells is to secrete a substance which raises the blood pressure by contracting the peripheral arterioles, presumably through the terminals of the sympathetic. The relations of the suprarenals with the other internal secretory glands are apparently very intimate and important. Reference has already been made to their influence upon the development of the sexual organs. This influence is shared by the pituitary gland, which also secretes a substance which raises blood pressure. It would therefore seem that the adrenals and the pituitary act in the same direction. There is every reason to believe that the suprarenals and the pancreas are mutually antagonistic. There can, at any rate, be no doubt that glycosuria can be produced by the subcutaneous injection of an excess of adrenalin, and that the glycosuria is due to pancreatic inhibition. It is probable that small doses of adrenalin stimulate pancreatic activity. The thyroid appears to behave in the same way to the pancreas, *i. e.* first stimulating, and in larger doses inhibiting it, so that the thyroid in this matter acts in the same sense as the suprarenals, though in other ways it certainly does not. It is a curious and interesting fact that in thyroidectomized animals the injection of an excess of adrenalin fails to produce glycosuria; which suggests that the glycosuric effect of the injection is obtained by stimulation of the thyroid. The most conspicuous toxic effect of adrenalin is that which it exercises upon the

circulatory system. Repeated injections produce hypertrophy of the left ventricle, together with sclerosis or atheroma of the arteries in both systemic and pulmonary circulations, a process which appears always to begin in the tunica media and is favoured by an excess of calcium in the blood.

From the foregoing it is evident that excessive suprarenal activity may produce excessive sexual activity, that it may provoke glycosuria and functional high blood pressure, and be the determining if not the primary factor in atheroma and arterial sclerosis. In the present state of our knowledge it is impossible to say upon what excessive suprarenal activity depends, but the most probable cause is the failure or exhaustion of one or more of the internal secretory glands which act in a contrary sense.

Suprarenal insufficiency, though such a condition almost surely exists, is so far not clinically recognizable. A condition of acute adrenal inadequacy has, it is true, been described as consisting in extremely low blood pressure and other symptoms commonly associated with shock, for which the evidence in favour of the responsibility of the chromaffin system is very inconclusive. Certain it is that the symptoms respond to treatment not by adrenalin, but by pituitary extract (see *Pituitary Gland*).

Addison's Disease is the only morbid condition which is certainly due to suprarenal inadequacy. There are no doubt various views as to its pathology, but in the majority of cases which come to autopsy, destructive lesions—generally tuberculous—of the suprarenals are demonstrable. The disease is characterized by pigmentation of the skin, gastro-intestinal disturbance, low blood pressure (70–80 mm. Hg.) and general muscular asthenia. The symptoms of these stigmata vary much in degree; the most characteristic, namely the pigmentation, may be so slight as to escape notice, or may be in reality absent until the disease is far advanced. The gastro-intestinal disturbance usually takes the form of diarrhoea, and is not infrequently labelled colitis. Anorexia is not uncommon, and vomiting, especially in the later stages, is generally a distressing symptom.

Addison's disease is a rare disease which is usually chronic in its course and very unsatisfactory to treat. If it be recognized early a considerable degree of amelioration may be effected by the administration of Burroughs & Wellcome's tabloids of suprarenal gland in combination with such other measures, medicinal and hygienic, which the individual case demands. The oral administration of the gland substance is much more efficacious than the hypodermic injection of adrenalin, which is practically useless.

L. W.

DISEASES AND DISORDERS OF THE THYROID GLAND

The diseases of the thyroid gland usually cause enlargement of the organ. An enlarged thyroid is commonly known as a goitre. The word is copied straight from the French, and is derived from the Latin "guttur," the throat. Pathologically, if we exclude malignant disease, which is rare, there are four varieties of goitre, the parenchymatous, the cystic, the adenomatous, any of which may be endemic or sporadic, and the exophthalmic, which is always sporadic. Although Captain McCarrison has shown that endemic goitres are readily cured by vaccines prepared from the faeces of the subjects of this disease, and that an amoeba is the causal factor in a great many cases, no theory yet advanced is sufficient to explain the endemicity itself. In exophthalmic goitre the thyroid enlargement is only one feature in a symptom complex, and is not always present.

The parenchymatous form is the most common, the one, that is, in which there is both an accumulation of colloid in the vesicles and an increase of the connective tissue elements. The enlargement is very generally uniform and may attain to very large dimensions. The cystic form is, as a rule, merely the parenchymatous in which a cyst or cysts have formed by distension of a vesicle or vesicles; or the cyst may be caused by the liquefaction of an adenoma. The adenomatous form is due to the presence of "definite encapsuled masses of a typical thyroid tissue imbedded in the gland" (Berry), and the gland is in this case, as in the case of cysts and malignant disease, already the seat of parenchymatous enlargement.

Simple parenchymatous goitres will very often yield to judicious thyroid medication, more especially when this is reinforced by the local application of ung. potass. iodid. A compress of adrenalin applied over the gland at night is also useful. If such measures fail and the goitre is a large one, it may be necessary to have recourse to surgical interference.

Atrophy and Thyroid Insufficiency.—The normal thyroid gland is very difficult to palpate. It is therefore never safe to conclude from a physical examination of the neck that the functions of the gland are not being properly performed. We are unfortunately not yet in a position to define these functions. We know that they are very important, that their inadequate performance gives rise to a very large variety of unpleasant symptoms, and that their complete cessation produces in the young the condition known as cretinism, and in the adult the malady called myxedema. These two have been proved post-mortem to be associated either with a simple atrophy of the gland or with such

profound changes in its structure as to render impossible the discharge of its ordinary duties. Recent investigations have further brought to light the fact that most, if not all, the internal secretory glands, the thyroid, the pituitary, the adrenals, the pancreas and the ovary and testes are very closely inter-related; and that the smooth and orderly working of this hierarchy is essential not only to the growth and development, but also to the maintenance, of the bodily health and mental efficiency of the human organism. It seems at present that the most important place in this hierarchy is occupied by the thyroid gland. It is well, however, to remember that this may be due to the fact that the thyroid is, of all of them, the one best situated for clinical and experimental investigation. It should thus be borne in mind that the functional insufficiency of the gland, and still more its atrophy and complete absence of function, denotes not only that the requisite amount of thyroid essence is on the minus side, but it connotes that some of the other internal glandular essences are on the plus side, so that in the present state of nescience concerning the hierarchy, which of its members are antagonistic and which sympathetic, it is not open to us to apportion the responsibility for the clinical symptoms which arise. All that is possible to do is to discuss those diseases which have been shown to be cured or conspicuously benefited by the exhibition of thyroid extract. I shall conclude this section with some considerations on the very important question of thyroid medication in general, erroneous views upon which have in the past frequently led not only to failure, but to disaster.

Cretinism.—In paraphrase of Brissaud's saying about acromegaly and gigantism (see *Pituitary*), cretinism may be described as the myxœdema of infancy and childhood, myxœdema as the cretinism of adult life. In the one there is absence of development, physical and mental; in the other there is mental and physical degeneration. No one who has seen a pronounced case of either is ever likely to be in doubt about the diagnosis; it is the lesser degrees which escape recognition. In the case of cretinism a doubt may arise from the fact that many cretins are goitrous. Some writers have sought to draw a distinction between goitrous and non-goitrous cretins, and between cretinism which is endemic and cretinism which is sporadic. Such distinctions are, however, purely fanciful. Endemic cretinism occurs in the districts in which adult goitre is endemic, districts, that is, which conceal some factor which is specially inimical to the thyroid gland. Nor is there any essential difference between a cretin who displays a goitre and one who does not. In the latter case the goitre represents an early attempt

on the part of the gland to respond to what is expected of it by a process of hypertrophy; a laudable effort which is rendered futile by exhaustion and fibrous degeneration.

A typical cretin is a revolting sight. Seldom more than three feet in height, it exhibits a strange and ungainly disproportion between the various parts of its person. A large head, flat-topped and low-browed, is crowned with hair so coarse and scurfy as to resemble that of an ungroomed horse's mane. The expressionless eyes regard you from beneath lids so puffy as to seem œdematous, and the habitually open mouth, with its thick everted lips and protruding tongue, is in a chronic state of salivary dribble. The skin is dry and harsh, and its subicteric colour is usually relieved by pigmented warts or moles dotted irregularly over the surface. The relatively enormous abdomen is further emphasized by a pronounced lordosis, and is very frequently embellished by an umbilical hernia. The bones are soft, and the teeth, which appear late, rapidly become carious. The pulse is very slow and the temperature persistently subnormal. Whereas the ordinary child very seldom complains of the cold, the cretin always makes straight for a fire, and seems really content only when in bed or in a hot bath. Yet, in spite of its unattractive appearance, the cretin is an amiable creature. It is usually very affectionate, slow to anger, as indeed to everything else, for slowness and intense deliberation characterize it in every direction, and in its ponderous way it is genial and easily pleased.

The untreated cretin seldom lives long. The absence of the thyroid gland, which is one of the normal defences against microbial invasion, renders such invasion easy. The acute specifics, especially pneumonia, account for a large number of deaths. There seems to be a great predisposition to cardio-vascular complications. When suitably treated by thyroid extract the prognosis as to life is very good. Whether any remarkable results are to be expected in the matter of bodily development depends upon the age of the cretin when the diagnosis is first made. The earlier the age at which treatment is begun, the better the results to be expected. And if this is true of the bodily development, it is even more conspicuous in the case of the mental improvement. The later the date at which the thyroid extract is first exhibited, the less the prospect of the degree of intelligence attaining to the normal.

Myxœdema.—Complete loss of thyroidal function is much more common in women than in men. Prof. George Murray places the disproportion at fifty-five men out of 370 cases. The same authority places the age at which the malady is most likely to occur as between thirty-five and forty-five women, and thirty-five and

fifty men. It may, however, occur at any time from the age of fifteen to the age of seventy. The disease is usually very slow in its onset, and patients will bear with the earlier symptoms with surprising patience before seeking advice. Even when advice is sought in an early stage the condition is all too frequently overlooked, and the rather vague subjective troubles attributed to anything and everything but the right cause. The thyroid gland, like the liver, is very much less vigorous in some people than in others, and tends to become depressed and exhausted by efforts which leave the more robust unharmed. In the battles which the gland wages against the infectious diseases, in the calls which are made upon it at puberty, at the menstrual periods, during pregnancy, during lactation, and in the internal secretory chaos which is liable to occur at the menopause, we may often find the cause of that exhaustion of the thyroid which is the first step in the evolution of complete myxœdema. Of the acute diseases which serve as starting-points, rheumatic fever, mumps, measles and influenza have seemed to me to be the most potent.

There is something very pathetic about a myxœdematous person, especially a woman. She realizes all too clearly the physical and mental disabilities which fate has imposed upon her, and yet, though frequently garrulous in a high degree, she does not complain; or, if she does, she complains in a deprecating manner. Mentally she is amiable, negative and obstinate. Physically she is usually weary and unwieldy; she is spoken of and treated as if she were obese. Yet the observant eye will notice that the deposits of "fat" do not follow the normal curves; that they have special places of predilection which imparts an element of the grotesque to the outward seeming. A myxœdematous person is not so much obese as a caricature of obesity. There is usually a well-defined hump over the seventh cervical and first dorsal spines, and the deltoids seem exaggerated in size. The breasts themselves are not enlarged, but there are wads of flesh immediately below them. The hips and gluteal regions are thickly overlaid, in exaggeration of the "middle-aged spread." The muscles appear to be of a stony hardness, and the skin and subcutaneous tissues, instead of moving freely over them, seem as if they were adherent thereto. The skin is dry and scaly, with patches of eczema and psoriasis scattered over its surface. It usually has the subicteric tint suggestive of a severe anæmia. The hair falls in great quantities, and what remains is dry and lustreless. It often becomes grey very prematurely. The face is expressionless, with heavy translucent eyelids, everted lips, and a characteristic malar flush. The voice is often deepened by a whole tone and gives a raucous

note, a combination which, together with the extreme deliberation of utterance, is very suggestive to the experienced ear.

Although unwieldiness of outline and a general appearance of undignified obesity is a striking feature in most of these patients, such is not always the case. In two of my patients, one a man and the other a woman, this feature was entirely absent. Both had been the round of the hospitals, and their apparently hopeless cases had been carefully investigated by very competent physicians. Blood counts had even been made, and the aid of the X-rays invoked, without any diagnostic result; whereas in both the employment of thyroid extract very soon restored them to complete health. The fact is, in a case of myxœdema the ordinary methods of examining patients, anamnesis, inspection, palpation, percussion and auscultation, even when the investigation of the urine and the blood are superadded, are very liable to yield negative results unless the two first, the history and the inspection, are conducted with more than ordinary care. The only symptom which has seemed to me to be constant among the many which may appear is a persistently sub-normal temperature. This may be as low as 96° F. and is invariably associated with a very marked degree of hypersensitiveness to cold. Although the pulse is as a general rule unusually slow, sixty per minute or less, even in uncomplicated cases it may be as rapid as ninety. The deposit of mucin, from which the disease takes its name, is evidently not confined to the skin and subcutaneous tissues, as was at one time thought to be the case. The skeletal muscles are certainly invaded. Nothing else would explain their extraordinary board-like hardness and the terrible fatigue to which their exercise gives rise. That the heart may also become the seat of a similar mucoid infiltration is rendered probable by the grave cardiac asthenia which some patients develop. Of the complications which are liable to occur, there is one, namely hæmorrhage from mucous surfaces, which, from the fact that it is never referred to, deserves special mention here. Such hæmorrhage may in a general way be said to be due to (a) blood states, or (b) conditions involving high blood pressure, or (c) local ulcerations. In myxœdema the blood state is substantially normal, the blood pressure usually on the low side, and local ulcerations do not come into the clinical picture of the disease. If, therefore, these common factors can be excluded, the possibility of myxœdema being the cause of the hæmorrhage should be remembered. The complication is rare, but it has occurred sufficiently often in my experience to impress itself on my memory.

Minor Thyroid Insufficiency.—Complete cretinism and complete myxœdema are easily

recognizable, but there are minor degrees of thyroid insufficiency which are at first very difficult of recognition. There are also some well-known clinical conditions which experience has proved, if not to be caused by, at any rate to be very closely associated with, deficient activity of the thyroid gland. It is some of these which I now propose to discuss.

That the thyroid secretion is essential to the development of the fœtus is shown by several facts. Myxœdematous women seldom become pregnant, and when they do, in the absence of thyroid medication they invariably abort. It is normal for women during pregnancy to develop an enlargement of the thyroid gland, which subsides to some extent after the child is born, but is continued during lactation. By no means the least important function of the thyroid gland is that of fixing the calcium salts in the body. In order to permit of bone formation in the fœtus the mother is obliged to provide more secretion than under normal circumstances she requires, and the gland consequently hypertrophies. After the birth of the child, the same degree of this increment being no longer necessary, the gland tends to resume its normal proportions. In some women this prolonged call of pregnancy has the effect of unduly exhausting the gland, and they are unable in consequence to suckle the child, for lactation is dependent upon a due supply of thyroid secretion.¹ Such women generally become obese and lethargic, and remain so for varying periods until the thyroid has had time to recover itself. Judicious thyroid medication will frequently not only enable a mother to suckle her infant, but will materially shorten the period of her post-partum difficulties.

But to return to the child. Unsatisfactory babies are almost invariably the subjects of thyroid deficiency. Other dyscrasias may of course act as contributory causes, more especially the syphilitic and the tuberculous; but even of these it may be said that some, at any rate, of their effects are due to their depressing action on the thyroid. It has more than once occurred to me to succeed in transforming an unsatisfactory child into a satisfactory one by a combination of grey powder and thyroid extract, after having tried both separately with very partial success.

When we pass from the region of general unsatisfactoriness to demonstrable clinical entities, we are, at this period of life, immediately brought face to face with rickets. Now, with regard to rickets, I feel in a position positively to affirm that if all the symptoms of the disease are not due to thyroid insufficiency, then certainly its

most salient features are. Especially does this apply to the bony phenomena which are the most obvious signs of the disease. These phenomena are obviously due to inadequate osseous development, and, as in the fœtus, so in the growing infant, thyroid secretion is essential to the full utilization of the calcium salts. It is known that the bony phenomena are due to a relative absence of calcium salts, and it is also known that these salts, given in large excess though they be, have no influence in arresting the disease. This is because the all-essential link is missing, the thyroid secretion, by whose means alone the ingested calcium can be so assimilated as to be incorporated in the osseous tissues. No originality is claimed for this view as to the essential factor in rickets. It was first advanced by Prof. Marfan in 1907,² and upheld in an interesting paper which does not appear to have attracted the attention which it deserves. My own experiences have convinced me that the view is correct. If it be true anywhere, as the adage has it, that *naturam morborum curationes ostendunt*, it is pre-eminently true in the sphere of opotherapy, and every case of rickets in which I have employed thyroid extract has shown such decided improvement as to leave no doubt in my mind that thyroid insufficiency is the main causative factor in the disease.

As a child progresses in years, deficiency in thyroid secretion may reveal itself in various ways. I have already shown that nocturnal enuresis,³ though it may own other causes, such as phimosis or intestinal worms, is in the vast majority of cases caused by thyroid inadequacy and is readily curable by the administration of thyroid extract. In the same connection I discussed the question of adenoids and made so bold as to suggest concerning them that they constituted one of the stigmata of thyroid insufficiency. The views expressed may be briefly summarized as follows:—Adenoids and enlarged tonsils occur in children who have an inadequate supply of thyroid secretion. The hypertrophic condition in each case is apparently the result of an endeavour on the part of the organism to supply an internal secretion as nearly allied as possible to the one which is lacking. If the hypertrophy is not very pronounced, and if it has not been very long in existence—great enough and protracted enough, that is, to produce complications, such as disease in the tonsils themselves or in the ears—then the exhibition of thyroid extract will cause their regression. It is only when medicinal

² "Le Rachitisme dans ses rapports avec la déformation ogivale de la voûte palatine," etc., *La Semaine médicale*, September 16, 1907.

³ *Adenoids, Nocturnal Enuresis and the Thyroid Gland* (Bale, Sons and Danielsson, Ltd., 1909).

¹ Hertoghe, "Nouvelles Recherches sur les insuffisances thyroïdiennes," *Bulletin de l'Académie Royale de Médecine de Belgique*, IV Série, Tome XXI, No. 4.

means have failed that operative interference becomes justifiable.

Enlarged lymphatic glands, so often observed in the necks of weakly children, are not infrequently due to thyroid inadequacy. Whatever their position and accompaniments, they are usually quite confidently attributed to tubercle, and are treated as such with more or less indifferent success. Latham has recently pointed out that even where their origin is undoubtedly tuberculous there is no justification for removing them until other means have failed. But these glandular enlargements are less often due to tubercle than is commonly supposed. I have seen a good many children thus afflicted to whom I was emboldened to administer thyroid extract by the presence of some unmistakable coexisting sign of thyroid insufficiency. The enlarged glands in these cases have always been situated at the angle of the jaw, they have been hard and not tender, and have shown no tendency to suppurate. In this matter it is necessary to be quite sure of our ground before administering thyroid extract, because if the case be really tubercular, the extract, so far from doing good, will do very definite harm. For some reason which is so far unexplained, tuberculous people bear thyroid very badly. In connection with this matter of enlarged lymphatic glands it is interesting to note that Dr. John Orr, of Edinburgh, has had good results with thyroid extract in Hodgkin's disease.¹

In tracing up to this point in its development the difficulties which may beset a child with an inadequate thyroid gland, it has not been necessary to draw any distinction between the sexes. They appear to be equally affected. When we reach the age of puberty, however, we find that the boys have practically disappeared. There are, it is true, some few cases of delayed puberty—infantilism—most of which yield readily to thyroid extract; but in the vast majority of boys the changes which occur at this period appear to evoke such an activity of the thyroid gland as to protect them during the immediately ensuing decade from any evidences of thyroid inadequacy, always excepting those bony deformities which a previous insufficiency has stamped upon them. In the case of girls it is far otherwise; for with them it is at puberty that the worst of their troubles begin. But before separating the sexes I must make a generalization which refers equally to both. I stated at the outset that the prolonged call which pregnancy makes upon the thyroid gland frequently resulted in its exhaustion. The same thing must be said of the infectious diseases generally, more especially of those which are called the infantile diseases—mumps,

measles, German measles, and scarlatina. It is evident that the internal secretion of the thyroid constitutes one of the defences of the organism against microbic invasion, for not only are sub-thyroidic children more liable to such invasion, but the occurrence of one of these diseases in a previously healthy child very often proves the starting-point of troubles due to thyroid inadequacy. The resistance to the effects of the poison makes a heavy demand upon the activity of the gland, and when the demand is over the gland becomes exhausted and its function depressed. A very large percentage of cases of rickets, adenoids and nocturnal enuresis will be found on inquiry to date from one of the infantile febrile diseases. In connection with this aspect of the matter it is convenient to call attention to the markedly depressing effect which real influenza at all ages is liable to exercise upon the functions of the thyroid. I say real influenza in contradistinction to the transitory febrile attacks which are diplomatically so labelled to satisfy importunate relatives. Real influenza, as is well known, produces a degree of subsequent mental and physical asthenia which is out of all proportion to the severity of the attack itself, an asthenia which defies the ordinary tonics and remains obdurate to everything except time. Such, at any rate, was my experience until, on the theory of thyroid exhaustion, I began treating these cases with thyroid extract. The results of this treatment have always been gratifying, and I have no hesitation in affirming that if we were to realize more fully the exhausting effects upon the thyroid of all acute specifics, we should be much more successful in dealing with the period of convalescence, which to some natures is even more trying than the disease itself.

This defensive power of the thyroid secretion is one which deserves to be emphasized. When it has attracted the general attention which it certainly merits, we may look for good results from the exhibition of thyroid extract during the course of all acute specific diseases. It should be remembered that, if it be sought for, an enlargement with tenderness of the thyroid will be found to be present in a large number of febrile diseases, notably in acute rheumatism.

Let us now return to our chronological order and proceed to consider the troubles imposed by thyroid inadequacy as the years advance. We had arrived at the age of puberty, at and after which boys may be dismissed as affording an interest which is but occasional and fortuitous. Of girls it is a truism to say that the establishment of the menstrual function constitutes a crisis no less critical than that which occurs at the menopause, but it is insufficiently realized that at both periods the pivot round which the critical phenomena revolve is the behaviour

¹ *Folia Therapeutica*, July 1909.

of the thyroid gland. That there is a physiological antagonism between the internal secretion of the ovary and that of the thyroid is well established,¹ and the observed facts go far to prove that the activity of the ovary normally provokes a corresponding activity on the part of the thyroid. The clinical evidence of this is provided by the enlargement of the thyroid, which is to be observed in the majority of women at each menstrual period. It is obvious, then, that, given a girl with a congenitally inadequate thyroid, the advent of menstruation will serve to emphasize that inadequacy and thus bring into view various symptoms which up to that time had lain dormant. One of my cases of nocturnal enuresis² was certainly due to this cause. Without going much more fully into the matter than my present purpose permits, it would be impossible to offer an explanation of the clinical fact, of which any one may easily convince himself—namely, that both dysmenorrhœa and menorrhagia are more frequently than not due to an insufficiency of thyroid secretion.

That simple enlargements of the thyroid are due to an insufficiency of the internal secretion of the gland is now generally admitted.³ That migrainous attacks, more especially such as affect by preference the menstrual period, are due to the same underlying cause is a proposition which originated with Leopold Levi and H. de Rothschild,⁴ and has been supported by numerous observations by them and by others. Of dysmenorrhœa and menorrhagia enough has already been said. To this list of the disabilities which an inadequate thyroid may impose upon the female sex I would add one more—namely, sterility. From the fact that the thyroid enlarges during pregnancy, it may be taken as certain that the maternal economy requires an additional amount of the internal secretion during that period, and it is evident that if this additional quantity be not forthcoming the pregnancy will be brought to an abrupt termination. In the case of women whose thyroid activities are markedly inadequate, this unhappy result will occur as soon as the first strain is put upon the gland—that is, when the next menstrual period is due. Many women who are labelled as hopelessly sterile are so only because of the general failure to recognize the paramount importance of the thyroid gland in the function of reproduction. I have known at least one case in which the repeated abortions were

confidently attributed to syphilis, in which, nevertheless, the administration of thyroid extract brought a pregnancy to a most satisfactory conclusion.

So fascinating and, in a sense, so facile, is the diagnosis of thyroid insufficiency that it threatens soon to supplant gout in the position so long held by the latter as the last resort of the perplexed practitioner. When one has been fortunate enough to produce really strikingly good results by prescribing thyroid extract one is tempted to attribute a great many ills to thyroid insufficiency which have no necessary connection therewith. To this mental attitude must be attributed the tendency of the moment, which is most apparent in France, towards blaming the inadequate thyroid for many mutually exclusive diseases. From the already formidable list of maladies for which the responsibility has been cast upon the thyroid, two seem to deserve more than a passing notice; one of these is rheumatoid arthritis, the other is chorea. Now, neither rheumatoid arthritis nor chorea is, to coin an expression, a self-contained disease; each of them represents a group of symptoms which may be produced by several different causes. In both, thyroid inadequacy may occasionally play a leading part, but either may occur in patients who do not show, nor ever have shown, the slightest sign of insufficient action of the gland. It has fallen to my lot to produce very brilliant results with thyroid medication in both these conditions, but in the majority of the cases so treated the results have been negative. In these diseases and many others it is to be presumed that an insufficiency of thyroid secretion provides a soil which is favourable to the unhindered action of the toxins, and that consequently the rectifying of the inadequacy will do much to protect the individual against invasion, though it can seldom ameliorate matters quickly enough and profoundly enough to influence the results of an invasion which has already succeeded. Chorea is often very favourably influenced by thyroid extract, but only in those who are definitely subthyroidic. In those who present none of the ordinary stigmata of thyroid inadequacy the extract does not succeed. Rheumatoid arthritis may be due to many causes, of which pyorrhœa, tubercle and thyroid or other internal glandular inadequacy are only some. If the stigmata of thyroid insufficiency are apparent in any individual case, thyroid extract will probably give good results, but even then probably only when combined with other accredited measures.

Women who have been perfectly healthy all their lives very often display a marked tendency to thyroid insufficiency about the time of the

¹ "Cardiopathies of the Menopause," *Clinical Journal*, March 3, 1909.

² *Adenoids, Nocturnal Enuresis and the Thyroid Gland*, p. 27.

³ H. Batty Shaw, *Organotherapy* (Cassell & Co.).

⁴ Hertoghe, *op. cit.*

menopause. It is not only the reproductive organs proper which resign their functions at this period. A great many glands which are, in a manner which is still obscure, related to these organs tend to become concomitantly deranged, and chief among them is the thyroid gland. The changes incidental to the menopause often begin much earlier than is commonly supposed to be the case. In this country we are taught to expect them about fifty years of age. In France the recognized age is forty. But the age varies not only with race and climate, but also with the individual, and it is far from unusual to find both spinsters and those married women who have begun child-bearing at a comparatively early age exhibiting very distinct evidences of the approaching climacteric as early as thirty-five years. Of such evidences a great many will be found to be very closely related to thyroid inadequacy, and a very considerable improvement, both subjective and objective, may usually be brought about by judicious thyroid medication. True myxœdema in my experience more often owns the climacteric as its cause than any other factor or combination of factors.

For reasons less obvious and in a manner less dramatic than the menopause the conditions surrounding the mere advance of years tend to produce inadequacy of the thyroid function. It is not that the thyroid gland declines more rapidly than the other internal secretory glands, for they all, even if we include the spleen, tend to diminish both in size and activity as the years advance. It is that the thyroid gland is so important to the economy that any diminution in its activities reflects itself unmistakably in a great many directions. So much is this the case that one foreign writer contends that if the activities of the thyroid could be maintained unimpaired the condition of old age could never arise. It is not necessary to subscribe to such an extreme view in order to appreciate the value of suitable doses of thyroid extract in most of the troubles which are liable to beset the senile period. There are very few of these troubles whose treatment by the recognized means is not rendered more rapidly successful by the addition of thyroid extract.

I now pass to the consideration of some of the signs and symptoms from which we obtain confirmatory evidence when the existence of thyroid inadequacy is in question. Some of these I have already noticed in considerable detail,¹ and I need not therefore do more than enumerate them. Among the most important is the subnormal temperature, which is usually a marked feature, and is not only revealed by the thermometer, but is also complained of

by the patient, who protests that she never feels warm. The eyebrow sign (*signe de sourcil*) to which Leopold Levi and H. de Rothschild attach considerable importance, consists in a rarefaction, amounting sometimes to complete absence, of the hair on the outer third of the eyebrow. This sign, when present, is certainly very suggestive, but in my own experience very perfect eyebrows are compatible with a marked degree of thyroid inadequacy, more especially when this has been provoked, as by an acute specific, after the patient has attained to maturity. Carious and irregular teeth should always excite suspicion. So, likewise, should delay in the eruption of the permanent teeth.

The most important among the signs which reveal a persistent deficiency of thyroid secretion are those which refer to the skin and its appendages. Amongst these, that which is most easily observed is the eyebrow sign already described. Another, which has the same merit of easy detection, is the condition of the nails, which are thin, delicate and friable; very different from the coarse, horny, striated nail of the gouty. Of the hair of the head, it has already been noticed that in thyroid insufficiency it becomes lustreless and scanty. It does not, however, always fall out; it may retain much of its volume, but the individual hairs become finer and tend to lose their colour. Premature greyness is generally, though not always, a sign of thyroid inadequacy. The same may be said of premature baldness of a pronounced kind. Both these degenerations are so common in comparatively young people in this country that little diagnostic value is attached to them. They are nevertheless, both of them, very suggestive, and should always excite a suspicion either that the thyroid is not acting properly or that its functions have been gravely depressed in the past.

Abnormalities of cutaneous pigmentation are exceedingly common in all disturbances of the thyroid, whether such disturbances take the form of excess or perversion, as in Graves' disease, or of inadequacy, as manifested by myxœdema, rheumatoid arthritis, rickets or climacteric disorders. The abnormalities in pigmentation which accompany such disturbances are not, as a rule, very obtrusive, nor, when present, must they be regarded as pathognomonic; but they afford valuable evidence in favour of suspicions otherwise aroused. Of these abnormalities, leucoderma is by far the most common. Amongst the grosser forms of skin lesion, that which is most frequently encountered in thyroid inadequacy affecting adults is certainly psoriasis, but eczema is almost equally common. Radcliffe Crocker²

¹ *Adenoids, Nocturnal Enuresis and the Thyroid Gland.*

² Radcliffe Crocker, *Diseases of the Skin*, 1903.

found thyroid extract exceedingly useful both in lupus vulgaris and ichthyosis. Urticaria and transitory cedemas affecting the deeper structures are concomitants of thyroid insufficiency to which Levi and de Rothschild attach very considerable importance. In cases of what we may call submyxœdema in adults, there is usually a slight deposit of myxœdematous tissue under the skin, and this is more noticeable in certain parts of the body. In such cases it will be found that although the skin of the hand and forearm can be pinched up with ease, that which overlies the deltoid and the upper part of the trapezius cannot be so pinched up. In women the area immediately below the breasts often presents the same phenomenon.

Subthyroidic people, like the fully myxœdematous, though voluble about irrelevant matters, often seem curiously reticent about themselves. Their brains move slowly and they are forgetful. It is therefore necessary to interrogate them very closely on questions which are purely subjective. That they are unduly sensitive to cold, that they have considerable difficulty in concentrating the attention, that their memories are unreliable, especially in small matters, that they are very somnolent, especially at certain times of the day, are all facts which must be elicited by cross-examination. Fatigue, muscular and mental, is very characteristic of the condition. Although this element is very rarely absent from a case, the fact of its presence is never volunteered. This is due as a rule to its having been quite confidently and often brutally attributed to "nerves," "fancies," "vapours," or whatever the epithet of the moment may happen to have been, and the patient has been urged to rouse herself and take plenty of exercise. Needless to say, this is very bad advice, which not only causes a great deal of unnecessary suffering, but militates very decidedly against any tendency to improvement. Such patients demand physical and mental repose, and it should on no account be denied them.

Thyroid Medication.—Success in the treatment of disease by thyroid extract depends in the first place upon the employment of a reliable preparation, and in the second, upon a very careful supervision of the dose. In the matter of the former my own experience is not very extensive. I have tried but four preparations, with all of which I have been satisfied. One is Messrs. Burroughs, Wellcome's tabloids, another is Messrs. Oppenheimer's Palatinoids, the third is the Elixir Colloid of Messrs. Squire & Sons, of Oxford Street, and the fourth is a French preparation, the Thyra-toxin of Byla & Co. of Gentilly. The dis-

advantage of the tabloids has been that the minimum dose is half a grain which, as will appear later, I now regard as a large dose. This, however, is in process of being remedied. The palatinoids are made in doses of a quarter of a grain. The advantage of these two preparations is that they are portable and reliable. The French preparation is a solid one, in the form of "tablettes." The makers claim that they have eliminated the lipoids and leucomaines which are present in all ordinary preparations in such quantities as to give rise to symptoms which are regarded as those of physiological intolerance. It is certainly a fact that this preparation is very well borne by patients who seem unduly sensitive to those in more common use. One of the advantages of Messrs. Squire's Elixir is that the word "thyroid" does not appear on the prescription. A very large number of patients or their friends have made unpleasant and even tragic acquaintance with the drug, and are consequently apt to take fright at the mere name of it. It is, therefore, convenient to be able to prescribe it under a different name. Another advantage is that one may vary the dose to any desired extent. The strength of the elixir is one and a half grains to the fluid drachm, so that five minims represents one-eighth of a grain, a dose with which I prefer to begin the treatment, even of severe cases. As it is very frequently desirable to associate other drugs with the thyroid, it is a convenience to include them in one mixture. The elixir has no incompatibles. It is right to add that I have occasionally believed my results to be better with the solid preparation than with the liquid.

The dose of thyroid extract is quoted in most textbooks at three to ten grains, three times daily; a dose so large that it would be ludicrous were it not so dangerous. The proper dose is from one-tenth grain to one grain, three times daily. With the exception of certain types of lunatics, it is only the most robust among healthy people who can take larger doses with impunity, unless these larger doses have been arrived at progressively from very small beginnings. There is one important fact which the prescriber of thyroid extract should keep ever before him, which is, that the more a patient requires the drug, the smaller is the initial dose which he will tolerate. This is probably to be explained as follows. The want of thyroid essence has given rise to the deposit of mucin in various parts. Under the influence of thyroid medication this mucin is liberated into the circulation with a view of its excretion. If it is liberated too rapidly, as by large doses it certainly is, there ensues such a surfeit in the blood that the excretory organs are unable to deal with it, and urgent symptoms

of intolerance quickly arise. Prof. Murray warns his readers against the exhibition of large doses in advanced cases of myxœdema, lest the degenerated myocardium fail under the strain and cause sudden death. The warning is much needed. And not only in advanced cases; for there are in reality very few cases of whatever degree of inadequacy which can tolerate without very grave disturbance an initial dose of more than one quarter grain twice daily.

It is commonly stated that the symptoms of excessive dosage are tachycardia, palpitation, diarrhœa, vomiting, excitement and even maniacal symptoms. These certainly do occur, but only in the case of a dose so grossly excessive that its administration by accident would afford its only excuse. If the drug be given with circumspection, the fact that the limit has been reached will reveal itself quite unmistakably long before any of the above symptoms have time to develop. A little looseness of the bowels there may be, but there ought to be nothing to which the name diarrhœa is usually applied. A certain degree of quickening of the pulse-rate is to be expected, but if it amount to anything approaching heart-hurry, the management of the case has been very unskilful. To quicken mentality and promote alertness is one of the physiological effects of the drug, but it argues ignorance or carelessness when these results are allowed to reach the stages of excitement and restlessness. If it is intended to give thyroid extract over a period of several weeks, it is necessary to make observations upon the temperature and pulse-rate. If the drug is really required the temperature is almost without exception subnormal, especially in the evening, and the pulse-rate is as a rule slow. When the temperature rises to normal the drug should be suspended, at any rate for a time, and the pulse-rate, whatever its initial figure, should never be allowed to go above ninety-five without calling a halt. In the case of children, other than cretins, the body weight is a useful indication of the success of the treatment. So long as the weight increases the drug may be continued; as soon as the weight becomes stationary the drug should be suspended, and if the weight decreases the drug must be discontinued. Having ascertained by cautious increase from small beginnings the dose which best suits the patient, my usual practice is to continue the dose for three weeks. I then suspend it for a week and then resume it for three weeks, and so on. If the pulse-rate is not slow at first, or if there is any other factor in the case which makes me fear intolerance, I give the drug for a fortnight and suspend it for a fortnight. In the case of adult women it is well to arrange so that the menstrual

period should occur during an interval from the drug.

Given in the doses above recommended, and managed in this way, there is only one sign of commencing intolerance for which one need be on the look-out; this is coryza. A sudden and profuse nasal catarrh sometimes surprises people who are taking thyroid extract, and unless the physician realizes that such a thing is possible, he may attribute the catarrh to some ordinary cause and fail to discontinue the drug. Another signal which has occurred in some of my cases is a painless enlargement of the glands at the angle of the jaw. It has always disappeared on suspension of the drug. A slight tenderness of the parotids, one or both, sometimes occurs.

In a few instances, at the commencement of thyroid medication, patients have exhibited all the symptoms of acute pancreatitis, *i. e.* a sudden attack of violent pain in the epigastrium, with vomiting, constipation and local tenderness, which have in each case all passed off in a few hours. The close antagonistic relationship between the activities of the thyroid gland and the pancreas is my reason for regarding the latter as the seat of the pain. The sudden active stimulus of the thyroid extract upon a pancreas which for a considerable period had been free from that stimulus, would probably result in such a degree of pancreatic hyperactivity as to cause the symptoms. The few patients in which these symptoms occurred were badly in need of the drug.

Short of producing violent symptoms of this kind, it is by no means uncommon for patients taking thyroid extract in doses which appear otherwise to suit them to complain of feelings of discomfort after meals. The symptoms are usually those of the acid type, and they generally yield to alkalies and bismuth. Thyroid extract is said to be useful in the treatment of urticaria, its action presumably being that of utilizing fully the calcium salts in the diet. This may be so, but it is to my mind quite certain that thyroid medication tends to provoke urticaria, even in those who are not subject to this irritating complaint. I have frequently been obliged to suspend the drug on this account, with the invariable result that the urticaria has subsided.

Thyroid medication will occasionally, but by no means always, regulate the bowels. The stools of those taking the drug regularly generally become very light in colour. This may be due to an absence of bile pigment or to the presence of fats in excess. The latter cause is the usual one.

When it is acting satisfactorily in an ordinary case of moderate degree, thyroid medication increases very largely the urinary output.

The occasional presence of albumin in the urine need not excite alarm, but the appearance of sugar should lead at once to suspension of the drug.

If the best results are to be obtained from thyroid medication, the ordinary mixed diet of the present day requires some slight modification. Meat foods and alcoholic drinks are recognized as depressors of thyroid activity. I therefore direct those who suffer from thyroid insufficiency to be sparing in their use of them. Common salt I also endeavour to banish from the dietary. When thyroid medication is doing good it very materially increases the urinary output in quality as well as quantity.

Hypertrophy and Thyroid Excess.—The thyroid gland hypertrophies under some circumstances which may be regarded as physiological. In the female it enlarges at puberty, at the menstrual periods, under sexual excitement and notably during pregnancy and lactation. These enlargements disappear as soon as the conditions with which they are associated have passed away. It has long been held, and Major McCarrison has now placed the belief beyond dispute, that one of the functions of the thyroid gland is that of protecting the organism against bacterial and other toxic invasion. When such an invasion is threatened or has actually taken place, greater demands are made upon the thyroïdal activity, and the gland consequently hypertrophies. For this reason an enlargement, usually painful, may generally be detected in the course of most of the acute specifics, especially rheumatic fever. During convalescence there is a reaction. The exhausted gland recedes in size and its activities fall below the normal level. Thus every period of increased activity is followed by a period of diminished activity; to the temporary excess there succeeds a deficiency which may, or may not, be temporary. The most conspicuous instance of this reaction is furnished by the myxœdematous state, which is so common an aftermath of Graves' disease.

But these physiological and quasi-physiological hypertrophies do not usually exhibit the symptoms which we are accustomed to associate with an excess which is definitely pathological. These symptoms are displayed in their most pronounced form only in exophthalmic goitre. It is still very doubtful whether this disease, with its outstanding clinical features, is due to a mere excess. There is much in support of the view that some at any rate of its features are due not only to an increase, but also to a perversion of the glandular secretion. It is as if the gland, unable for some reason to supply a normal essence to the economy, hypertrophied in response to the normal demands and supplies a perverted

essence. The still unsatisfied economy increases its demands, to which the gland replies by supplying an ever-increasing quantity of the perverted secretion, with the result that the gland hypertrophies and the excessive amount of perverted secretion produces the clinical symptoms. However this may be, there can be no question that Graves' disease affords an example of thyroid hypertrophy and thyroid excess. Of excess without hypertrophy there are many degrees, the most pronounced instance being prevented by excessive thyroid medication.

Exophthalmic Goitre.—This is a disease which, ever since Graves of Dublin first brought it into general notice, has been the despair both of the pathologist and the therapist. So much is this even now the case that the victims are very liable to drift into the hands of the surgeon, not infrequently to their undoing. The name describes the two most conspicuous features of an ordinary case of the fully-developed disease. It should nevertheless be remembered that either the exophthalmos or the goitre may be absent, seldom both, from a case which is otherwise typical. In the earliest stages, though both may be present, they may be quite inconspicuous. The most invariable symptom is probably persistent tachycardia. When this is present in a patient in whom tubercle can be excluded, very careful search should be made for other evidences of the disease. Among these the most important are a slight but definite rise of temperature, fine tremors of the hands, changes in the skin and its appendages, diarrhoea, glycosuria, and symptoms referable to the higher centres of the nervous system.

In investigating the matter of temperature it is to be remembered that where a slight elevation only is suspected, it should be sought for in the afternoon between the hours of two and six. Patients with early tubercle and slight degrees of exophthalmic goitre, while revealing a slight febrile movement at this time, will often show nothing abnormal at other times. Such a finding is nevertheless by no means pathological, for most healthy women immediately before the monthly period will reveal the same phenomenon. The tremors of the hands, when present, are always very fine, so fine that when the arms are spread out and the fingers extended in the ordinary way the vibrations are sometimes more easily felt than seen. The changes in the skin and its appendages vary both in degree and in kind. The hair of the head, though generally luxuriant, is frequently the reverse. It becomes lustreless and brittle, much as it does in myxœdema, and tends to recede from the temples. The nails are nearly always thin and weak, and the skin itself is moist, or very readily becomes so,

and is not uncommonly slightly pigmented in irregular patches. The patient is unpleasantly conscious of sudden waves of suffocating heat, which are often immediately followed by profuse and generalized perspirations. Less often the perspiration may be localised to a certain area. Diarrhoea and glycosuria may both occur, but neither is common except in advanced cases. The symptoms referable to interference with higher nervous centres may be the first to excite a suspicion amongst the patient's friends that all is not well. The character changes; the diffident may become assertive, the matter-of-fact become emotional, the lethargic may display unwonted and inconvenient energy. Restlessness, either conscious or subconscious, is usually a pronounced feature. The patient feels as if she were in a chronic state of being late for an important engagement. She busies herself unnecessarily, writes urgent letters where there is no urgency, telephones insistently to her friends about unimportant trifles, purchases articles which she does not require, and becomes selfish and exacting where formerly she was affectionate and docile.

This element in a case of Graves' disease is not usually sufficiently insisted upon. Such changes may develop into a state of mental alienation so definite as to require certificates, and they do so far more often than is generally supposed. Short of this, however, it is my experience that a person who has once been definitely affected in this way, even though she recover from the disease and all its physical symptoms, is never again entirely reliable on the mental side. Chronic thyroid intoxication resembles chronic intoxication by alcohol or morphia in this, that all three, even though the recovery be otherwise perfect, leave behind them a weakening of the moral fibre, a capacity for lying and an affection for deceit which nothing can rectify (see *Thyrogenic Insanities*).

Treatment. The tachycardia of Graves' disease requires a watchful eye on the part of the physician, who should try and realize all that this interminable hurry entails. The strain which it puts upon the cardio-vascular system is necessarily very severe, and it is not by any means uncommon to find that an otherwise complete recovery has left behind it an enlarged left ventricle and a blood pressure which is persistently and definitely above the normal. The fact is, the vascular system compresses into a comparatively short period an amount of work which is intended by Nature to be spread over half a lifetime, with the result that the vessels degenerate much earlier than they should, and the heart itself becomes senile before its time. For this reason it is impossible to insist too dogmatically upon the necessity for absolute rest in bed in every case of exoph-

thalmic goitre. Unfortunately it is of all things the most difficult to ensure. The restlessness of the patient, her wilfulness, her emotional outbursts of unreasoning opposition rise up to thwart the best-laid schemes, and it is seldom indeed that one has not to content oneself with some compromise. For in this matter the ordinary drugs are of little use. Opium or bromides may help in tiding over some particularly difficult ebullition, scopolamine may occasionally do good, sleeping draughts are now and again justifiable, but inasmuch as by such measures we are merely adding one intoxication to another without doing anything to modify the original one, they are suitable for emergencies only. The object in the treatment of these cases is to check the over-exuberant activity of the thyroid gland, and unless we are able to effect this we must be content to be impotent onlookers while the disease pursues its devastating course. The only drugs which have ever seemed to me to afford any real help in this direction are belladonna and aspirin, but the degree of that help was in both cases meagre enough. Since some of the problems connected with the interrelations of the internal secretory glands have been elucidated, certain lines of treatment have suggested themselves which have had in view the lessening of the thyroid secretion by the administration of some other glandular extract. Ovarian, pituitary and parathyroid extracts have all been extensively tried, with some benefit in the case of the parathyroid and the pituitary. The only line of treatment of this kind which affords any real promise of success is the hypodermic or intramuscular injection of bile-salts. It was hoped in the first instance that the presence of these salts in the blood would bring about a slowing of the heart and a reduction of the mental excitement, effects which they are known to produce in ordinary catarrhal jaundice. In the few cases in which they have been employed these salts have not only justified the original expectation, but they have seemed to bring about a rapid amelioration in all the symptoms of the disease.¹ The preparation employed in these cases was a French one called paratoxin, of which one ampoule was injected daily. The preparation has not, however, seemed to me to be very reliable, and Messrs. Burroughs, Wellcome are now engaged in the manufacture of one which will be more uniform in its action. A useful adjuvant to this treatment is the application to the enlarged gland of a compress of a solution of adrenalin. It is right to add that many physicians of great repute speak in the highest terms of the beneficial effect of

¹ "The Therapeutic Promise of the Internal Secretions," *The Practitioner*, November 1911.

X-rays applied to the gland, not only in reducing its size, but also in ameliorating all the manifestations of the disease.

Thyroid Excess.—In the same way as there are minor degrees of myxœdema, there are minor degrees of exophthalmic goitre. These two diseases in their fully-developed forms represent the superlatives of their respective conditions, namely, thyroid insufficiency and thyroid excess. But it is only not the superlatives with which we have clinically to deal; the positive and comparative degrees are more important than the superlative, because by learning to recognize the latter we not only save our patients from the former, but we may relieve them of many of the ill-defined subjective symptoms which, while they impose a great deal of real suffering, are more often than not airily dismissed with the label "functional" or "neurotic." But it is necessary to premise what I have to say on the subject of thyroid excess by pointing out that although Graves' disease is the best recognized and most typical superlative form of such excess, it is not the only one. The other is tuberculosis. It is no doubt the case that the excess in the case of tuberculosis is a side issue; it does not constitute the disease, nor even the most important aspect of this disease. It is, nevertheless, seldom if ever absent, and may be held to account for a great many facts which we have learned to associate with tubercle, the freely acting skin, the well-nourished hirsute embellishments, hair, eyebrows, eyelashes, the excellent teeth, the keen intelligence, the slight fever, the dyspepsias, the tachycardia, the emaciation, the eager and irrational optimism. Some of these symptoms may and unquestionably do appear in people in whom the question of tuberculosis may certainly be dismissed. Nevertheless, when I find several of them combined in the same case I always regard that case as one which is, in a degree far above the average, potentially tuberculous.

Minor degrees of thyroid excess are generally spasmodic, or at least periodic, in their incidence. At the menstrual period most normal women show symptoms of this excess. The thyroid gland enlarges, there is a slight rise of temperature, the skin acts more freely and slight eruptions occur; the pulse-rate quickens, gastric disturbances are common, and there is invariably some degree of nervous disturbance involving an impairment of control in the highest centres, conscious or unconscious. Pregnant women not infrequently display similar evidences of thyroid excess. In them, too, the gland enlarges, presumably to meet the thyroidal necessities of the foetus, but the amount of secretion is usually sufficiently in excess of the demand to produce some of the nervous and

other phenomena just referred to. Girls at the age of puberty, and still more at what may be called the chlorotic age, are very liable to disturbances of the same kind, and women at the menopause, though they are far more often the subjects of thyroid insufficiency, nevertheless sometimes develop evidences of thyroid excess. Typical Graves' disease not infrequently arises at this critical period.

It is a curious and interesting fact that the subjects of definite thyroid insufficiency suffer from occasional outbursts of thyroid excess. If the patient is seen for the first time with one of these ebullitions in full swing, it is all too easy to make a mistake in diagnosis. The stigmata of chronic thyroid insufficiency are, however, usually so pronounced that the real state of affairs ought not to escape a careful and experienced investigator. The explanation of these outbursts is by no means simple. It is to be supposed that the gland, unable as it is under the ordinary conditions which govern the patient's case to respond to the energetic calls for thyroid essence made by the economy, now suddenly finds itself, possibly through the intervention of some other internal secretory gland, in a position to supply the demands, and proceeds to do so with unnecessary and embarrassing prodigality. Still more difficult of explanation are those not altogether rare cases in which the symptoms of thyroid insufficiency and the symptoms of thyroid excess both appear in a chronic form in the same patient at the same time.

A common cause of thyroid excess, often in a high degree, though it is less common to-day than it was a few years back, is injudicious thyroid medication. Some years ago the mistaken idea that thyroid extract was useful in diminishing obesity spread to the general public and many overfed women took the drug surreptitiously in large doses, with the result that they developed tachycardia, fainting fits, sudden flushes of heat, nervous irritability, diarrhoea, coryza and various other symptoms of intolerance so alarming that thyroid extract now bears a bad character with self-prescribers. For the very large measure of injudicious thyroid medication which still remains the textbooks are wholly to blame. The ordinary dose of the dried extract is quoted by most authorities as three to ten grains three times daily, a dose so excessive as to appear a ludicrous exaggeration to any one who has any real experience of the drug. I have had patients with pronounced myxœdema in whom doses of one and a half grains produced symptoms of intolerance, even when this dose was arrived at from small beginnings, and I have had at least one case of myxœdema, following after some years upon Graves' disease, in which a

dose of five grains three times daily provoked a return to most of the symptoms of the original complaint, one of which, the tachycardia, proved to be very intractable.

It is in the nervous and cardio-vascular systems that the earliest signs of thyroid excess must be sought. A pulse-rate which is over a hundred under ordinary conditions, more especially when this rate is maintained in the recumbent posture, is very suggestive of thyroid excess, whether this excess be associated with tubercle or not. In Germany they describe a "goitre heart," that is, a heart which is found in those cases of thyroid enlargement associated with superabundant excretion, and they go on to explain that the goitre heart may occur without a goitre. It is well known that Graves' disease may be present in a patient who has neither exophthalmos nor goitre, so that the "goitre heart" is obviously merely a heart which is the result of thyroid excess, a thyrotoxic heart. This is characterized by undue frequency, a diffuse apex beat, an enlarged left ventricle and a rise in blood pressure, often accompanied by some degree of pretibial oedema. The urine may contain small quantities of albumin or sugar. Such a clinical picture is very liable to invite a diagnosis of granular kidney and provoke a very gloomy prognosis, more especially if the physician fails to give due weight to the other factors in the case. Amongst such factors would almost surely be nervous and mental instability, tremors, diarrhoea, emaciation, menstrual disturbances, the age, sex and personal history of the patient.

It is still too early to speak with confidence upon any matter connected with the consequences of disturbance of the normal interrelations of the internal secretory glands, but this at any rate may be affirmed, that there is a very close connection between relative thyroid excess and the production of glycosuria. For a full discussion of the present position of this important matter the reader should consult Dr. A. E. Garrod's Lettsomian Lectures, particularly Lecture III (*Lancet*, March 9, 1912).

L. W.

DISEASES AND DISORDERS OF THE PITUITARY BODY

The pituitary body, or hypophysis cerebri, is a small rounded organ which is situated at the base of the brain, in the cavity of the sella turcica. Its position is such as to render it immune from ordinary traumatism. It is in close relation with the cavernous sinus, with the optic nerve, and with the nerves which supply the muscles of the eyeball. It is separated from the brain by a fold of the dura mater.

The organ consists of two lobes, a larger anterior and a smaller posterior united by an isthmus or hilus. The anterior lobe is vascular and consists of glandular epithelium. Developmentally, this lobe arises as an outgrowth from the primitive mouth of the embryo. Haberfeld has recently shown that a small mass of pituitary tissue, a remnant of this outgrowth, is constant in the human naso-pharynx, and is situated immediately behind the nasal septum close to the tonsil of the naso-pharynx. The isthmus or hilus contains epithelium, which secretes a colloid substance resembling that of the thyroid. The posterior lobe is very slightly vascular, consisting mainly of nerve elements. It has a prolongation, called the stalk or infundibulum, which pierces the fold of the dura mater and passes to the floor of the third ventricle. The functions of the gland, though they have been much investigated of recent years, are still very obscure, and it is not yet possible to ascribe to any particular portion of the organ the responsibility for such functions as seem so far to have been determined as attaching to the whole. Experiments up to the present seem to suggest, contrary to what histology would lead one to expect, that it is the posterior lobe which is the most active portion of the organ, but even here results have not been altogether conclusive.

It has been established experimentally that the pituitary body is essential to life; that it is very closely concerned with calcium metabolism; that growth of skeletal tissues (*i. e.* bone, cartilage and connective tissue) is very directly under its control; that it is in some way, possibly indirectly, connected with the development and deposit of fat; and that it is in very close relationship with some of the other internal secretory glands, notably the thyroid, adrenals, pancreas and sexual glands. The pituitary, like the thyroid, enlarges during pregnancy and, according to Haberfeld, it then undergoes such structural changes as to render it possible for an histologist to pronounce with certainty whether or not the subject has ever been pregnant. The maternal skeletal changes which occur during pregnancy, and the fullness of the lower lip which is not uncommon in the later months, are attributed by the same observer to hypertrophy and increased activity of the pituitary. The post-nasal pituitary remnant is not improbably connected with the development of adenoid vegetations, and may be the cause of the changes in the facial bones which have so persistently and so erroneously been attributed to interference with the nasal air-way. The connection of the infundibulum with the floor of the third ventricle, together with the now-established fact that the pituitary secretion, like the adrenal secretion, inhibits the flow of pancreatic secretion, renders it probable that

disturbances of the function of the hypophysis may have some causal relationship with the production of some kinds of glycosuria, especially as sugar is frequently present in the urine in cases of acromegaly.

The subcutaneous administration of pituitary extract causes contraction of unstriated muscle all over the body. This gives rise, among other things, to constriction of the peripheral arteries and a consequent general rise of blood pressure, and to an increased peristaltic action of the intestines, so marked as readily to overcome the intestinal paresis which is liable to supervene on abdominal operations. Its most potent effect would seem, however, to be upon the uterus, in which it produces very vigorous contractions, more especially in the pregnant, puerperal and menstruating states.

The response to the administration of pituitary extract by the mouth is considerably less in degree and rather different in kind. The difference in kind is probably accounted for by the fact that when given subcutaneously it is only possible to measure the effect of a single dose, whereas when given by the mouth the clinical results of continuous administration are open to estimation. When given by the mouth in ordinary doses of five to ten grains three times daily there is no noticeable rise in blood pressure, and even if these doses be very materially increased the rise, if any, is only slight and transient. It is therefore evident that the pressor element is either not absorbed at all, or that it is rendered nugatory by the gastro-intestinal juices. Having regard to the embryonal connection between the hypophysis and the mouth, this is contrary to what the analogy of the thyroid would lead one to expect. The effect of the extract when given by the mouth is almost equally disappointing where the intestines are concerned, for even with large doses there is no appreciable amelioration in cases of intestinal paresis. It should therefore be remembered that if an appeal to pituitary extract is to be made in a case of shock to raise the blood pressure, or in a case of intestinal paresis to overcome the distension, that appeal must be made either intravenously or subcutaneously; otherwise there will be no reply. With the effect upon the female sexual organs it is different; for here very decided results may be obtained by the oral method of administration, especially when continued over a period of months. Irregularities of menstruation are very notably improved by this means. Amenorrhœa may be cured, and reproductive power stimulated. It is useful in certain cases of Graves' disease, as it controls the tremors and induces sleep. It also subdues the tremors in Parkinson's disease. It is also a very useful general tonic in depressed and asthenic states,

more especially in women. It promotes sleep and induces a general sense of well-being.

In the present state of our knowledge it is impossible to dogmatize about the inter-relationships of the various internal secretory glands, but it is safe to assert that the pituitary may in a general way be considered to act in the same sense as the suprarenals, and in a sense contrary to the thyroid and the sexual glands; but even so vague a generalization as this is subject to several exceptions and saving clauses. An insight into this inter-relationship is obviously of the highest importance to our knowledge of the functions of any particular gland and of the indications for the therapeutic employment of its extract. The above brief sketch comprises all that can at present be stated with certainty concerning the hypophysis cerebri.

Disorders of the Pituitary may show themselves in one of two directions. The gland may be overactive—pituitary excess, or its functions may be depressed or even abolished—pituitary deficiency. Acromegaly and gigantism afford typical and pronounced instances of excess, while the lipomatosis universalis asexualis of Jonathan Hutchinson, and some forms of infantilism, notably the ateliosis of Hastings Gifford, provide examples of deficiency. It is more than likely that there exist minor degrees of both types, the symptoms and physical signs of which have so far escaped recognition.

Pituitary Excess.—Acromegaly and gigantism are the only recognized clinical representatives of this condition. Brissaud and Meige have referred to these morbid states in words which have become classical:—"Gigantism is the acromegaly of the growing period; acromegaly is the gigantism of the period of completed development; acromegalo-gigantism is the result of a process common to gigantism and acromegaly, overlapping from the period of adolescence into that of maturity." In each case the overaction of the pituitary is the cause. This overaction produces superabundant growth of bone and other skeletal tissues, giving rise to mere excess during the growing period (gigantism) and to characteristic deformities, especially of the skull and the extremities, when it supervenes in the period of completed development (acromegaly). In connection with gigantism it is unnecessary to notice anything beyond the fact that the subjects of this complaint almost invariably develop tuberculosis at a comparatively early age, and seldom survive beyond thirty years.

Acromegaly.—The pathogeny of this curious condition has given rise to much debate, but it is now very generally admitted that the disease is due to excessive action on the part of the pituitary. The excess in some cases is due to

simple over-function of the organ, accompanied by a certain measure of structural hypertrophy. In others this over-function is the result of tumour formation in the gland itself or in its immediate vicinity. This accounts for the fact that some cases present definite symptoms of intracranial tumour, whilst others do not. The simple hypertrophy in some of the cases is sufficiently decided to cause some of these symptoms, and in almost all decided cases of the disease radiograms will reveal an enlargement of the sella turcica. Inasmuch as patients do not usually come under observation until the disease is well advanced, the earliest symptoms are by no means easy of recognition. It is certainly for the most part slow and insidious in its onset and chronic in its course, though some of the cases which are due to tumour formation (sarcoma) may terminate in less than two years.

Any one who has seen a pronounced case of acromegaly is little likely to forget it. The excessive growth of the cranial bones, especially of the lower jaw, produces deformities which are positively repulsive. Saliva dribbles from the unclosed mouth and collects in the pouch of the enormously enlarged lower lip. When the patient speaks the giant tongue rolls with elephantine deliberation, producing suction sounds which punctuate the periods of the raucous voice. The lack-lustre eye and expressionless face proclaim the mental hebetude and physical lethargy which are so characteristic of the disease. The intracranial pressure may cause interference with hearing as well as with sight. The face is often bathed in perspiration, even in the coldest weather, and this may be unilateral. There are deposits of what appears to be adipose tissue in various parts of the body, resembling those which occur in myxoedema and old age. The hair in the axillæ and on the pubes is scanty or entirely wanting, and the sexual organs are atrophied.

The treatment of the condition is unsatisfactory. It was at one time believed that pituitary extract would be good. This was owing to the fact that Pierre Marie originally believed the disease to be caused by pituitary insufficiency, a pathogeny which is now known to be the reverse of the truth. It therefore follows that

if pituitary extract exercises any influence at all, that influence must be harmful. In one of my cases a combination of thyroid extract with testicular extract certainly seemed to produce very considerable amelioration of the symptoms. The hearing, which was originally very much impaired, improved very considerably; and whereas the patient was, on admission, so blind that he was unable to count fingers, he could after three months' treatment read a daily paper without the aid of glasses. The main features of the disease, however, remained unaffected.

Pituitary Deficiency may be congenital, or it may supervene either in the adolescent period or when growth is complete. When it occurs before puberty the sexual organs always retain the infantile type and the ossification of the bones of the extremities is much delayed. These phenomena are not by any means characteristic of pituitary deficiency, for they are present in many forms of infantilism. All that it is possible to say is that when the hypophysis is inactive the sexual organs do not mature and the ossification and development of bone is deficient. The whole question is in truth still in the stage of conjecture; and much further study will be necessary before positive statements can be made.

Certain kinds of dwarfism, especially that type called ateliosis by Hastings Gilford, and some forms of pseudo-obesity, such as lipomatosis universalis asexualis of Hutchinson (now commonly called Frölich's syndrome), are almost certainly due to pituitary insufficiency, and it may be that achondroplasia and Dercum's disease (adiposis dolorosa) are due to the same or a similar cause, but until more is known about the interaction of the various internal secretory glands, in considering a particular disease it is not well to attach the sole responsibility to any one organ, however culpable that organ may at first sight appear to be, for it is possible and even probable that the dereliction of duty in any particular one may be the outcome of a primary disturbance elsewhere.

It is Garrod's opinion that pituitary excess tends to produce glycosuria, while pituitary deficiency greatly increases the glucose tolerance.

L. W.

DISEASES OF OBSCURE CAUSATION

LYMPHADENOMA (HODGKIN'S DISEASE)

Definition. A painless progressive enlargement of the lymphatic glands, involving several groups, with or without splenic enlargement and associated with anæmia, but without leukæmia.

Etiology. It is typically a disease of adolescence, and the great majority of cases occur below forty. It is much commoner in men than in women. The nature and cause of the disease are unknown, local irritation near the glands first involved, usually in the neck, has been

considered to be a precedent condition, whilst certain features are suggestive of an acute infection.

Pathology. Two varieties are generally described, hard and soft. The soft form consists of cells like lymphocytes, imbedded in a soft reticulum, the hard has much fibrous tissue and few cells. There are in addition characteristic giant cells formed from proliferating endothelial cells and eosinophile cells.

Symptoms. The initial symptom is superficial glandular enlargement, with little constitutional derangement, most often affecting the glands of the neck, unilaterally or bilaterally. Progress may be rapid or slow, and it may be months or even years before other groups are affected. In other cases a period of slow growth is followed by sudden acceleration. The order of growth is usually from the cervical glands to the supraclavicular and axillary, to the mediastinal, bronchial, retroperitoneal, mesenteric and iliac, and so to the inguinal.

The swellings are painless and not tender, unless secondarily inflamed; they are movable, discrete at first, although later they may grow into a mass or be matted by periadenitis, oval or round, generally firm, but may vary from a soft or semi-fluctuating to a quite hard consistence. They do not break down or suppurate except on secondary infection.

The spleen enlarges in a majority of cases, the liver less often.

In the early stages the patient may remain in fair health, but as the disease advances symptoms make themselves felt which fall into two groups—those due to pressure, and progressive cachexia.

The *pressure symptoms* vary with the parts affected. In the neck the enlarged glands cause cough and dyspnoea, the latter being particularly distressing and sometimes necessitating tracheotomy, which may be difficult to perform. Pressure on the cervical vessels may give rise to cyanosis. Dysphagia, oedema of the face and paralysis of the recurrent laryngeal nerve may occur. Mediastinal masses may lead to dyspnoea, dysphagia, cough, venous distension or oedema of the arms and pleural effusion. Abdominal enlargements may cause pain, ascites, oedema of the legs and jaundice.

There is usually *fever*, either continuous and of mild type, or irregular, high and intermittent; occasionally it is remittent.

The *anæmia* is of secondary type and may be extreme. Nucleated erythrocytes are rare. The leucocytes show no characteristic change in number; the differential count commonly remains normal, if increased the increase is in the polymorphonuclear cells.

Secondary growths may appear in the lungs, spleen and liver, or beneath the skin. Brown

pigmentation of the skin and pruritus are not uncommon.

Great emaciation and asthenia develop, with anasarca in some cases from the anæmia.

Diagnosis. From generalized *tubercular lymphadenitis*. Here there is more tendency towards coalescence of the glands, caseation and suppuration, with adhesion to the skin. In early cases diagnosis will depend upon examination of an excised gland, experimental inoculation and tuberculin tests. From *leukæmia*. Diagnosis will rest upon the blood examination; confusion arises in *pseudo-leukæmia*, where there is a temporary arrest of leucocytosis. From *lympho-sarcoma*. This has not always been clearly differentiated from Hodgkin's disease in medical literature. In lympho-sarcoma the growths involve the capsules, penetrate them and spread to neighbouring tissues. Diagnosis may not be possible without microscopic examination. From *splenic anæmia*. The question will only arise in rare cases of Hodgkin's disease where glandular enlargement is limited to the abdominal groups, superficial glandular enlargement not occurring in splenic anæmia. The spleen is only exceptionally much enlarged in Hodgkin's disease.

Course. The disease is probably always fatal and rarely lasts more than three years, although extremes are met with varying from a duration of three or four months only at one end of the scale up to six or seven years at the other. There may be temporary quiescence and improvement; secondary tubercular or streptococcal infections are not infrequent.

Treatment. Removal of the glands is indicated when small and limited to the neck; operation, if not curative, may prolong life. X-ray treatment has caused diminution in the size of the glands, but no permanent cure. Arsenic is the only drug of value, but it also will not cure.

E. P.

ARTHRITIS DEFORMANS (RHEUMATOID ARTHRITIS)

Great diversity of opinion exists amongst authors concerning this disease, and doubtless many descriptions under this title apply to diseases widely different in origin and manifestations. Current views upon the various forms of arthritis, both acute and chronic, are undergoing important modifications, and any classification must be accepted as provisional only and liable to alteration in the light of future knowledge. Under the name of arthritis deformans are included for present purposes cases of arthritis displaying a marked tendency to chronicity, with permanent changes in the joints or periarticular tissues; those forms of arthritis the etiology of which is clearly established (such

as gonorrhœal arthritis) being excluded. Doubtless with the lapse of time more and more cases of arthritis deformans will be included amongst those of definitely ascertained origin, but for the present, tradition and convenience sanction a description under a single heading.

The classification of cases of chronic arthritis must, in the uncertain state of knowledge, be into purely clinical groups, viz.:—(1) *Polyarticular arthritis deformans*, (a) chronic and subacute, (b) acute. (2) *Senile or localised arthritis deformans*.

Etiology. Amidst so much terminological uncertainty etiological theories must remain unsatisfactory. The view as to the origin of the disease which is steadily gaining ground and is held by some authorities to explain all cases, is that of toxic infection, the organism and the source differing, individual reaction and resistance determining the consequent changes. Amongst the influencing factors may be considered the following.

Sex. A majority of cases, variously stated, occurs in women.

Age. The twenty years between thirty and fifty cover the largest number of cases.

Family History. Heredity is not proved, but undoubtedly the belief in arthritism in families is widespread, especially amongst French writers.

Mental influences, such as strain, worry, shock, etc., have an apparent influence, probably by lowering vitality and reducing powers of resistance.

Climate. Damp, cold, low elevation and deficient sunlight appear to be predisposing causes.

Trauma. The first symptoms of the disease are often wrongly ascribed to trauma. In spondylitis and some cases of monarticular arthritis the history of trauma seems well established.

Infections. These are probably the most important factors and the primary ones. There is rapidly accumulating evidence that septic absorption is at the root of most cases of polyarthritis, bringing them to a certain extent into line with such cases as gonorrhœal and pneumococcal arthritis. Amongst the commonest sources of infection are pyorrhœa and carious teeth, tonsillitis and pharyngitis, pyelitis and cystitis, gastro-intestinal conditions, constipation, uterine discharges, influenza, suppurating wounds and sinus suppurations, bronchiectasis. Doubtless a great variety of organisms are responsible in different cases and in one and the same case, which may account for the protean character of the manifestations.

Pathology. The pathological changes are very variable, without any fixed association between the clinical picture and the etiological

factor on the one hand, and the pathological changes on the other. The manifestations in general may be grouped as:—(1) *Effusion*—not invariably present and without characteristic features. (2) *Synovial changes*. (3) *Changes in the capsule and periarticular tissue*. (4) *Changes in the cartilage*. (5) *Changes in the bone*.

According to the chief seat of the lesions three main varieties may be distinguished. (1) With lesions in synovial membranes and periarticular tissues. (2) With atrophy of cartilage and bone. (3) With hypertrophy of bone.

The *synovial membrane* is thickened, with the formation of fringes and villi; the periarticular tissues are swollen and infiltrated, the enlargement being more often due to swelling about the joint than to bony changes. The ligaments may be thickened or elongated; bursæ around the joint may be enlarged; tendons partially or entirely destroyed.

The *cartilage* becomes softened, eroded and may disappear entirely, leaving the bone exposed and eburnated. In some cases the cartilage may be replaced by fibrous tissue. In the spine the intervertebral cartilages may be replaced by bone, leading to bony ankylosis.

The *bones* may show little or no change, especially in the periarticular type. In the atrophic form there is well-defined rarefaction of the bones: the cartilage disappears and the ends become smooth. In the hypertrophic variety there is formation of new bone, especially at the edges of the articular cartilages, resulting in bony outgrowths which may invade the ligaments and tissues. These outgrowths may lock the joint. Heberden's nodes on the terminal phalangeal joints are of true bone. The muscles are atrophied; subluxation and fixation of joints may occur; peripheral neuritis and trophic disturbances are seen.

1. Polyarticular Arthritis Deformans—

(a) *Subacute and Chronic.*—*Symptoms.* This is the commonest of all forms and is mostly periarticular. The parts most subject to early attack are the hands, the affection being for the most part symmetrical, attacking corresponding joints on both sides and tending to advance from the extremities to the trunk. There is great variation in the number of joints involved, but though the selection varies in different cases it is generally the same on the two sides. The shape of the joints is gradually altered, largely by peri-articular thickening and muscular wasting and retraction, partly by bony changes, two main varieties being noticeable. (1) The joint takes a more or less spindle shape, the contour being obscured, and the bony landmarks difficult to define, a form well seen in the finger joints. The joints may contain fluid, be

hot and tender to the touch; in other cases they may have a doughy, semi-elastic feeling. These are the subacute forms of polyarthritis, occurring frequently in young patients. (2) In the more chronic cases the joint is enlarged but less symmetrically, in a more nodular manner, with obvious outgrowths and lipping of the articular surfaces. The joints are less tender, but movement is limited and painful and accompanied by grating and creaking, either from denuded bone surfaces or thickened periarticular tissues. The joints usually contain no fluid. These are not hard-and-fast divisions, and many cases cannot be assigned to one or other category. Pain is a very variable symptom; there may be little or none, or it may be most acute, especially at night. Muscular wasting is almost invariably present, the extensors suffer more than the flexors, and in the hand the interossei and thenar and hypothenar muscles waste in close resemblance to progressive muscular atrophy. Reaction of degeneration is not present, the tendon reflexes are not uncommonly increased, whilst the extent of muscular wasting does not necessarily bear any relationship to the degree of joint involvement.

The deformities resulting from combined joint and muscular changes are very marked. In the hands there is ulnar deflection of the fingers at the metacarpo-phalangeal joints; a common picture in the fingers is flexion of the first phalanx with hyper-extension of the terminal ones. The knee-joint is flexed; the ankle-joint frequently fixed; the foot is abducted and the great toe deflected to the outer side. The temporo-maxillary joint may be ankylosed and mastication become impossible.

The deformities of arthritis deformans are not peculiar to it, but may be seen in other chronic joint affections.

Irregular pyrexia and rapid pulse, secondary anæmia and trophic and vasomotor changes, such as localised sweating and "glossy skin" are not uncommon. Pigmentation, general or in patches, occurs in this as in many chronic diseases. A small percentage of cases show cardiac lesions.

In extreme cases the patient is helpless and lies with legs drawn up, arms fixed and all the joints of the extremities locked, but for the most part the patient can live an ordinary life, complaining only of some inconvenience and crippling, with a variable amount of pain.

(b) **Acute.**—No hard-and-fast line can be drawn between this and the foregoing form. It may resemble rheumatic fever with sudden involvement of many joints, swelling, particularly of synovial sheaths and bursæ, and moderate fever. There is less migration than in acute rheumatism; the affected joints do

not return to the normal and the smaller joints tend to be involved. The patients are commonly young women from twenty to thirty years of age; the disease arises frequently in connection with pregnancy.

2. Localised or Monarticular Arthritis.—This form chiefly affects old persons, is local in distribution and does not tend to be symmetrical. It frequently follows injury and is less common in women than in men; its usual seats are the hip, shoulder, and the knee. When the hip is affected there is pain, limited movement, with possibly some grating and muscular wasting. Certain forms of sciatica are associated with chronic arthritis of the hip-joint. In the shoulder irregularities due to bony thickening may be made out.

Heberden's Nodes are nodules on the sides of the distal phalanges of the fingers. They are commonly found in women between thirty and forty. They have been ascribed to gout but do not contain urate of soda, and the subjects of them rarely have involvement of the larger joints.

Spondylitis Deformans is arthritis deformans involving the vertebræ. It may be the only manifestation of the disease or be associated with arthritis of the other joints. The cervical or lumbar spine may be affected, in the former stiff neck, in the latter sciatica may be the result. Complete immobility may gradually ensue with kyphosis; the ribs are fixed, with consequent abdominal respiration; pressure on nerve roots causes pain, paræsthesiæ and muscular wasting.

Diagnosis. The acute form may be difficult to distinguish from *acute rheumatism*; the involvement of smaller joints and the persistence of the condition indicate arthritis deformans.

Chronic gout with crippling of the joints will hardly mislead if the history receive attention, and the presence of chalk-stones is decisive. Arthritis deformans is a steadily progressive disease; in gout the joints are normal in the interval, at any rate in the early stages.

Chronic Rheumatism is an ill-defined disease; repeated attacks of acute rheumatism rarely leave permanent results.

Gonorrheal Rheumatism.—Diagnosis may be difficult; the symptoms are very similar. It tends to attack the larger joints, and synovitis is often more marked.

Treatment.—There is little tendency to spontaneous recovery; a progressive disease, it too frequently advances till more or less permanent crippling results. The modern conception of the cause of polyarthritis demands that treatment should be directed towards discovering a possible source of infection. The mouth should be first investigated; carious teeth and

particularly pyorrhœa alveolaris should receive attention; if necessary, other means failing, all teeth should be extracted. The tonsils need careful examination; crypts and pockets are frequently present containing accumulation of débris and streptococci; tonsillotomy or enucleation is indicated if the tonsils are unhealthy. The nose and ears must be examined for any suppurative processes and appropriate treatment carried out. The gastro-intestinal tract requires the same thorough attention; constipation, intestinal indigestion, colitis, in fact, any abnormal stomach or bowel condition being treated; free purgation or colonic irrigation is sometimes beneficial, even if no definite disturbance can be found. The pelvic organs in women, the urethra and prostate in men, and the bladder and kidneys in both sexes must be investigated for possible sources of infection, as, for instance, by the bacillus coli. In the respiratory tract bronchitis or dilated bronchi may, although less often, be at fault. In all cases, if improvement does not follow upon treatment of the suspected source appropriate vaccine therapy should, where feasible, be given a trial.

General Hygiene and Diet. The tendency being towards progressive debility the patient should have all the fresh air and sunlight available, be suitably clad and should guard against sudden temperature changes, being prescribed an ample dietary, the fullest compatible with possibly existing gastro-intestinal disturbances. There is no evidence that reduction in the protein intake has, *per se*, any beneficial influence; rather the contrary, since a largely carbohydrate dietary is likely to cause digestive disturbance. The value of sour milk preparations has been much exaggerated. No special dietetic rules need be observed, beyond paying some regard to the personal needs and idiosyncrasies of the patient.

Exercise short of exhaustion is of benefit in preventing muscular wasting and premature rigidity of joints. Where too painful or difficult, massage and set exercises should take its place.

Baths are often of value, especially in the chronic forms; some of the subacute cases, however, are made worse through the enervating effect of prolonged thermal treatment. Douche-massage, as at Aix and Bath; mud-baths, as at Salsomaggiore, Ischl, Strathpeffer; sulphur springs and chalybeate waters, all have their places in treatment of arthritis, as well as electric, Turkish and vapour baths, and the Tellerman, Dowsing, Greville and other methods of applying dry heat. The use of cold in the shape of ice massage and the spinal ice-bag, has been recommended. Counter-irritation may be employed and the actual cautery relieves pain.

Bier's hyperæmic method is worthy of trial and likewise diminishes pain. Operative measures may occasionally be necessary to remedy deformities.

Drugs. Tonics, particularly arsenic, iodine and cod-liver oil, do good if given continuously. Intestinal antiseptics are largely used with benefit, creosote, calomel in repeated small doses, salol, guaiacol carbonate, the naphthols. Aspirin relieves pain; the salicylates are less efficacious. Thyroid extract in certain selected cases has given good results. Thiosinamine is favourably reported on by some, but has mostly disappointed expectations. E. P.

OSTEOMALACIA

Osteomalacia was originally confused with rickets, until it was recognized that in the latter the deposition of mineral matter in the bones during development is interfered with, while in the former first the inorganic and later the organic matter is removed during adult life.

The *etiology* is unknown: those causes to which it has been attributed, such as unfavourable hygienic surroundings, insufficient and unsuitable food, pregnancy and lactation, are of universal incidence and can only be contributory factors, although doubtless of importance as such.

Increased porosity of bone has been described in pregnancy, and a transition under suitable conditions from such "physiological osteomalacia" to a pathological is an attractively simple explanation of the disease, especially in view of the known influence of menstruation, pregnancy and lactation upon calcium metabolism in the female. Improvement has been recorded after oöphorectomy and Porro's operation. It must, however, be remembered that osteomalacia occurs in the male sex, whilst its geographical distribution is not easily explicable on the ovarian theory.

The disease occurs in women much more frequently than in men, in the proportion of about ten to one, and the majority of the cases are between the twentieth and thirtieth years; about three-quarters of the cases have been associated with pregnancy.

The bones in osteomalacia are soft, cut without resistance and can be twisted in the hands. The bone-tissue proper is much reduced in amount, the decalcification affecting both the compact and spongy portions. The periosteum is swollen and hyperæmic. The medullary canals are enlarged, the process of abortion beginning internally and spreading outwards. Microscopically repair may be seen going on side by side with absorption, but generally only in small amount.

The pelvic bones are those most usually attacked. The body-weight, acting through the sacrum, and the resistance of the ground, transmitted through the acetabulum, compress the pelvic ring in front and behind, producing the "triradiate pelvis"; in patients lying long on their backs it may be flattened from before backwards.

The spinal curves are exaggerated, sometimes greatly reducing the height.

The ribs are often broken from muscular action, and the chest may be deformed through the lateral pressure of the weight of the arms, the sternum being thrown forward.

The long bones are usually affected late; spontaneous fractures are apt to occur, or deformities, coxa vara, genu valgum or flat-foot. Joints remain unaffected.

The muscles are degenerated and weakened, microscopic examination showing changes similar to those of progressive muscular atrophy.

The onset of the disease is usually so insidious as to escape attention, but the earliest *symptom* is pain in the sacrum, pelvis and spine, increased by pressure and movement. The gait becomes waddling and uncertain, from inability to flex the thigh upon the abdomen. There is general muscular weakness, tremor, spasm and contracture. Spasticity, increased knee-jerk, ankle-clonus and paræsthesiæ may occur and cause error in diagnosis. Examination of the patient discloses the deformities already mentioned. The blood shows secondary anæmia; the urine contains calcium and phosphates in excess.

The disease may progress until the patient becomes bedridden and dies of intercurrent disease, or spontaneous improvement may occur. Early diagnosis is hardly possible.

The *treatment* is on general lines. Phosphorus has given good results and improvement has frequently followed castration and oöphorectomy.

E. P.

ASTASIA-ABASIA

A disorganization of the co-ordinated movements concerned in walking or standing upright, with unimpaired sensation, muscular power and other movements of the lower extremities.

This disease is one of the functional neuroses; whilst occasionally occurring as an isolated manifestation, it is usually found associated with hysteria, neurasthenia, chorea and epilepsy, and its etiology is that of these allied disorders. It occurs in youth and early adult life, and equally in men and women.

The patient cannot stand or walk, nor in some cases even sit, but falls forward, without losing consciousness. Examination in the recumbent position shows full power over and co-ordination of the muscles upon which the lost capacity for standing and locomotion depends. Sensation, reflexes, sphincters and cranial nerves show no abnormalities except those of associated hysteria. Sometimes with loss of ordinary locomotive power the patient may crawl, swim or walk backwards. In others there is irregular, partial or temporary inco-ordination. The muscular weakness of neurasthenia or psychasthenia, *e. g.* in morbid dread of paralysis, may lead to this condition.

Astasia-Abasia must be distinguished from organic and cerebellar disease, labyrinthine vertigo and myasthenia gravis. Organic spinal disease is accompanied by ankle-clonus; Babinski's sign, affection of sphincters and organic sensory changes would also be found.

The ataxia differs from that of cerebellar disease, and in the latter intracranial pressure symptoms are present. In myasthenia gravis the loss of power would be the same standing or lying, and the myasthenic reaction is conclusive.

The prognosis is good, the treatment that of other functional neuroses.

E. P.

DISEASES OF THE MUSCLES

MYOSITIS

Acute Myositis may occur as a primary disease, or it may be secondary to various fevers such as enteric, pyæmia, and other infections, especially trichina spiralis. Acute polymyositis or dermatomyositis occurs at various ages, the etiology being obscure. There is acute pain, with swelling of the extremities, considerable tenderness, rigidity of the muscles, and an erythematous rash. The onset is usually gradual, with malaise, headache, general weakness and some pyrexia. The rash may resemble erysipelas, erythema multiforme, or erythema nodosum.

The duration of the disease varies considerably, from two or three weeks to several months; there may be complete recovery, or eventually atrophy may ensue. There is never any anæsthesia, and there are no electrical changes unless muscular atrophy occurs.

Myositis is to be distinguished from trichinosis. In the latter there are initial gastric disturbances, followed by early œdema of the face and eyelids. The worm may be found in the stools or in an excised portion of the muscle. A high proportion of eosinophile leucocytes will be found in the blood, and later X-ray examination may demonstrate

the calcified sheaths of the embryos in the muscles.

Myositis Ossificans is met with usually in young children or in adolescence. The progressive form is to be distinguished from the form in which ossification occurs in the single muscle, such as rider's bone, or as the result of injury. In the progressive disease painful swellings arise in the muscles of the back, especially in the latissimus, perhaps during infancy; these swellings are firm, due to local inflammatory exudation of the muscles; they may eventually disappear, or they may become permanent from the deposition of bone in the fibrous tissue resulting from muscular atrophy. Eventually after many years in an extreme case bony ankylosis may invade the whole skeleton, the patient may become wholly immovable, even the jaw becoming fixed from ossification of the masseters and temporal muscles. Microdactyly is common in this disease.

W. H.

THOMSEN'S DISEASE

Thomsen's Disease, or myotonia congenita, is a condition which should be classed among the myopathies. It is familial, occurring in several members of the same family, and it is also notably hereditary, and it is commoner in the male sex. The peculiarity of this disease is the sudden and prolonged spasmodic contraction occurring in the muscles at the commencement of a voluntary movement, so that the movement may be inhibited for several seconds, and the relaxation of the muscles is correspondingly slow. The muscles of respiration, swallowing, the heart, and other involuntary muscles are never affected. Flexion of the fingers in clenching the hand exhibits characteristically the slow relaxation. With repeated movements the myotonic condition or stiffness appears to wear off, so that the patient may be able to walk well for miles or carry on other regular movements, such as dancing or running. After a rest, however, the myotonic condition reappears. In the majority of cases muscular atrophy is not seen, but in some it is well marked, the condition being named *myotonia atrophica* (q. v.). In this form there is symmetrical weakness of the facial muscles, with atrophy of the sterno-mastoids, vasti, and dorsi-flexors of the feet.

The family history of Thomsen's disease often shows neurotic strains, migraine, mental weakness, etc. Direct percussion of the muscles may produce slow local contractions like myoidema, or rolling the nerve with the fingers, such as the ulnar nerve, may produce slow wavy contractions of the muscles supplied by it.

The electrical reactions are peculiar, the re-

actions both to faradism and to galvanic currents giving prolonged tonic contractions. ACC is usually > KCC. Microscopical examination of voluntary muscle fibres shows them to be much larger than in normal persons, their diameter being about twice as great, and it has been shown that the red or sarcoplasmic fibres preponderate over the pale or fibrillar type.

W. H.

MYASTHENIA GRAVIS

Myasthenia Gravis, often spoken of as myasthenia, is a disease of uncertain pathology in which profound muscular weakness without atrophy is a prominent feature. The disease attacks either sex, usually after adult life. The weakness affects various muscles, especially those of the limbs, the neck, facial muscles, and the muscles of respiration and deglutition. Ptosis and varying degrees of external ophthalmoplegia are common, and weakness of the frontalis and of the sphincters of the eyes and lips are also frequent. The special characteristic of the muscular weakness in myasthenia is the rapid tiring of the muscles on exertion or after repeated contractions; thus the masticatory muscles may tire so rapidly that towards the end of a meal the lower jaw may drop of its own weight, the patient being unable to close the mouth. After a rest the muscles regain their power, the disease being thus in this respect the antithesis of Thomsen's disease. Owing to the tiring of deglutition and of the respiratory muscles suffocative attacks may ensue and sudden death may occur. Sensory symptoms are not usually present, though a certain degree of pain has been recorded.

Various infections such as influenza, septic sore throat, etc., have been followed by the disease, which is liable to show unaccountable remissions and relapses. In some cases the disease is steadily progressive to a fatal termination in a year or two, whereas other cases have lasted many years, with periods of remission and improvement. In a few cases pregnancy has had a remarkably beneficial effect upon the symptoms.

Post-mortem, many cases of persistence or lympho-sarcoma of the thymus gland have been recorded, with lymphocytic invasion of the muscles and tissues generally. The nervous system shows no changes of any kind.

Electrical testing of the muscles in a case of myasthenia usually shows the so-called myasthenic reaction, in which repeated faradic shocks or tetanizing the muscle by the faradic current exhausts its contractile power to that form of current, though the muscles will still respond to galvanism.

Differential Diagnosis. Myasthenia is to be distinguished from progressive muscular atrophy

by the absence of muscular wasting in the former. It may be sometimes difficult to distinguish from chronic bulbar paralysis, though the variability of the symptoms and the fatigability of the muscles both to voluntary effort and to faradism will decide the diagnosis.

Treatment. In the severer forms of this disease complete rest of the affected muscles is essential, and special care must be taken in the feeding with nutritious semi-solids so as not to provoke suffocative attacks. Strychnine and electrical baths may be tried in the slighter cases, but their benefit is at least doubtful. The disease appears to be due to a toxæmia which may be originated in various ways, and it is possible in the future that some form of organotherapy may be found of value. W. H.

PARAMYOCLONUS MULTIPLEX

Often called simply myoclonus, this condition consists of more or less rhythmic contractions of the muscles or parts of muscles of the trunk and limbs, never of the face. It is notably hereditary, and affects males chiefly. The muscular contractions are symmetrical, and are usually worse on excitement or on examination, and they cease entirely during sleep. There is an hysterical variety of myoclonus in which the isolated clonic muscular contractions closely resemble the previous form, but in which the symptoms are brought on by overwork, fright, worry or other psychic disturbances. The patients complain of a certain amount of weakness of the limbs and tired feeling on exertion. This form may be cured by massage, galvanic

baths, injections of strychnine, and rest from work.

Epileptic Myoclonus is a familial form of the disease, in which the muscular contractions are severe and affect the face and tongue muscles as well as the trunk and limbs. The gait is much interfered with, until walking becomes impossible. Eventually dementia may supervene. Myoclonus is to be distinguished from chronic chorea, myokymia or fibrillary contractions, from convulsive tic and from hysterical spasm. W. H.

PERIODIC PARALYSIS

Often a family affection, usually in males during boyhood or early adult life, these attacks recur without apparent cause, and may commence during sleep. Weakness usually begins in the legs, with a sensation of weariness and heaviness, which spreads within a few hours, involving all the muscles of the extremities and even of the trunk up to the neck. There is no pain, and sensation is unaffected. The facial and bulbar muscles are scarcely ever involved, and consciousness is normal. The muscles lose all their excitability both to faradism and to galvanism during the attack. The paralysis passes off after a few hours, and the patient is quite normal again. Occasionally the attacks develop very rapidly, and may pass off after a quarter of an hour or so, and I have known a patient when riding have to jump off his horse and lie down because he felt one of his attacks of paralysis coming on.

Dilatation of the heart has been described in the attacks. W. H.

VASOMOTOR AND TROPHIC DISORDERS

RAYNAUD'S DISEASE

THIS name is generally applied to many varieties of disease depending upon defective circulation, especially in the extremities. Maurice Raynaud drew attention to this morbid group in 1862, under the title of local asphyxia and symmetrical gangrene of the extremities. The description given by him was so striking as to receive immediate acceptance by medical opinion, but since that date the term has been loosely employed, and from time to time has been used to include circulatory disturbances ranging from pallor of the extremities due to cold, or associated with chilblains, to true gangrene of the extremities, depending on obliterative disease of the arteries and veins. It is desirable to make a more discriminating use of the term Raynaud's Disease, including under this title cases showing alteration of sensation

in the affected parts—often symmetrical—associated with, or followed by, the well-known triad of symptoms, namely local syncope, local asphyxia and gangrene, but not including those cases in which similar symptoms may be shown resulting from recognizable disease of the arteries and veins or of the nervous system.

Cases of true Raynaud's Disease occur usually in young adults frequently showing no other indications of disease. The parts commonly affected are the extremities, especially the hands and feet, but in some cases the nose, cheeks and ears, and even other parts may be chiefly or solely affected.

The *symptoms* consist first of pallor of the affected parts, coming on it may be suddenly, and associated with tingling or definite pain. This stage is due to constriction of the blood-vessels, especially the smaller arteries and

arterioles, supplying the affected part. Following this stage of pallor is one of intense erythema and even purpuric or cyanotic congestion of the affected area. This stage in turn passes over, the parts returning to their normal appearance, but if the constriction of the blood-vessels has been sufficiently severe, or sufficiently long, portions of the extremity or of the skin do not recover their vitality, and necrose. The tips of the fingers and toes usually show the first signs of necrosis. In severe cases much larger areas, such as a whole finger, or parts of the fingers or of the hands and feet, or large areas of the skin of the face and ears, become gangrenous. The disease tends to recur, the areas of necrosis becoming more numerous and extending with repeated attacks. In milder cases the stage of necrosis is not reached, or may only occur very slowly and as the consequence of many repeated attacks of the disease. In these cases the skin undergoes atrophy, the finger-tips becoming tapered or even peg-like.

In addition to the symptoms affecting the surface, visceral disturbances have to be noted. The patients occasionally suffer from abdominal pains—it may be of great severity—resembling colic; alterations in the circulation of the retina occur, producing amblyopia, usually of temporary character, and rarely forms of temporary paralysis may be noted, giving evidence of disturbance of the circulation in the central or peripheral nervous systems.

In some cases Raynaud's Disease is associated with well-marked changes in the blood, producing discoloration of the skin, owing to the deposition of blood pigment, hæmoglobinuria and enlargement of the spleen; all of these indicating disease of the blood itself, or of the blood-forming or blood-destroying organs. Malarial poisoning in certain cases is thought to be a predisposing factor in this disease.

Treatment. During the attack attempts must be made to relieve the vascular spasm and the pain. The means at our disposal to accomplish these purposes are unfortunately not satisfactory. The galvanic bath has been of service in some cases. It is arranged by placing the affected limb in a bath of warm salt solution, into which is inserted the negative pole, the positive pole of the galvanic circuit being applied to the healthy skin of the limb or some other part of the body. The current should be as strong as can be comfortably borne by the patient; it should be reversed from time to time and the patient encouraged to move the muscles of the limb in the bath. This treatment may be used both during and in the intervals of the attacks. High-frequency currents and faradism have also been used. Rubbing and massage of the affected parts may also be attempted, occasionally with some

advantage; often the pain is so great as to prevent this treatment being used seriously. The use of warmth during the first stage of pallor, and of cold during the subsequent period of congestion, readily suggests itself as an advisable means of treatment, but this method is often very uncomfortable to the patient. The administration of vaso-dilators in the treatment of the attack is very disappointing and of doubtful value. The pain may be so great as to necessitate the administration of opium and morphine. These drugs are specially called for in cases of long standing, when much vascular degeneration has occurred.

In the intervals of the attacks every possible care should be taken to maintain the condition of the circulation and of the nervous system by means of good nourishment and regular and sufficient exercise. Extremes of temperature, especially of cold, should be avoided. During the cold weather the wearing of warm clothing, especially warm gloves and good boots, is a necessity. The advantage of spending the winter in a warm climate is obvious.

The cases suspected to be of malarial origin should be treated by means of quinine at the appropriate periods. In others the possibility of degeneration of the blood-vessels should not be forgotten. It is difficult to be certain in any case that the blood-vessels are absolutely sound. The frequency with which vascular degenerations result from syphilis is well recognized, and the possibility of congenital syphilis as an underlying factor in the causation of changes in the blood-vessels, even in young subjects, should not be forgotten. In such circumstances the administration of mercury and of iodide of potassium will be of service in diminishing the tendency to recurrence. When visceral and nervous manifestations occur in the course of the disease, complete rest is necessary, and appropriate treatment must be carried out with the greatest solicitude.

W. H.

ANGIONEUROTIC OEDEMA

Angioneurotic Oedema is a paroxysmal oedema of nervous origin usually affecting one of the extremities, occurring in two forms, (1) a blue oedema of Charcot, (2) oedema without vaso-motor manifestations.

In both forms other neurotic symptoms are present, such as asthma, migraine, neuralgias, etc. The swelling often commences suddenly with no apparent reason, though it may follow a nervous shock or emotional excitement. In the blue oedema of Charcot the affected part becomes cyanotic and hyperæsthetic, with considerable pain, and this affection may be mistaken for cellulitis. In the form of oedema

without cyanosis there is usually some analgesia, instead of hyperæsthesia, and pain is absent.

Quincke's Disease, or acute circumscribed œdema, is a transient œdema affecting the skin of trunk or limbs or even mucous membranes. The swelling develops very rapidly and is elastic and scarcely pits on pressure. The disease is often familial and hereditary, and a serious danger in these cases is œdema of the glottis, which may cause fatal suffocation unless tracheotomy is done at once. These patients may be subject to asthma or urticaria, or attacks of violent abdominal colic—angina abdominalis—due to intestinal œdema, which may simulate biliary or renal colic or intestinal obstruction (cf. *Henoch's Purpura*). In making a diagnosis of angioneurotic œdema affecting one arm only, it should be remembered that remarkable vasomotor phenomena and œdema may be due to a cervical rib; X-rays will decide this point.

Chronic Trophœdema of Meige, or Milroy's disease, is a persistent œdema of one or more limbs, or even of a segment of a limb. It may be congenital or it may be acquired, and more than one member of a family may be affected. Usually there are other neuropathic symptoms present, the swollen limb pits on firm pressure, and a chronic swelling leads to the development of a mild degree of elephantiasis. Acute attacks sometimes occur in which the limb becomes swollen, tense and red, with rigors, pyrexia, and abdominal pain and vomiting. The œdema of the limb diminishes if the part is kept raised, though it does not disappear, and it returns when the patient gets about again, and is generally slowly progressive. In making a diagnosis of trophœdema all possible causes of œdema must be previously eliminated.

W. H.

ERYTHROMELALGIA

Erythromelalgia, or the red neuralgia, affecting the extremities, usually the feet. It occurs mostly in middle life and is commoner in the male sex. The part becomes hot and swollen, bright red, with very prominent veins, while the pain may be very severe, and there is often excessive sweating of the part. The attacks are usually worse in the evening, and are liable to be brought on by a dependent position of the limb. The patient may be quite unable to stand, and there may be faintness and general weakness, with palpitation, headache or vertigo.

Unlike Raynaud's disease, the condition is frequently unilateral, and the attacks are not worse in winter, and indeed may be worse in hot weather, though exposure and cold may have been the primary cause.

Erythromelalgia is sometimes combined with Raynaud's disease, which may be the sequel in the affected part, or the two conditions may be present at the same time in different limbs. The pathology of erythromelalgia is obscure; two views that are held are: (1) that it is due to a vasomotor neuritis, (2) that it is due to an interstitial arteritis. Injuries to a limb have been followed by erythromelalgia, and the condition has also frequently been met with in chronic forms of neuritis and in spinal diseases, such as tabes and disseminated sclerosis. In a few cases in which microscopical examination of the parts has been possible, obliterative arteritis and periarteritis have been found. On the other hand, certain cases appear to have been functional in origin, and I have seen paroxysmal attacks in the hand associated with palpitation, tachycardia and insomnia occur in a highly neurotic woman, followed by a complete recovery.

The pain and swelling abate when the limb is kept raised, and the attacks can be precipitated by hanging the limb down.

In many the disease is chronic, and in some the agony is so intense and persistent that amputation may be necessary. The treatment that should be tried is rest to the limb in a raised position. Application of cold lotions, and bromide and iodide internally often give relief, but morphia is sometimes necessary.

W. H.

SCLERODERMIA

This is also considered a tropho-neurosis, and occurs mostly in middle-aged women. It consists of a thickening of the skin and subcutaneous tissues, the surface becoming smooth, shiny and cold, with loss of wrinkles, the veins becoming unusually pronounced. It affects mostly the face and neck and upper extremities, and the upper part of the trunk. Abnormal pigmentation or leucoderma may be present, and soon atrophy may be noticeable of the deeper parts below the dense unyielding subcutaneous tissue. Facial hemi-atrophy may be associated with scleroderma, the bones and muscles sharing in the atrophy, and the skin showing white, atrophic, partially anæsthetic patches known as morphœa.

Hemi-atrophy with scleroderma may also involve the trunk and corresponding lower extremity. Vasomotor phenomena such as erythromelalgia or Raynaud's disease may accompany scleroderma, and the three conditions are undoubtedly closely associated. Sclerodactyly is the name applied to the same process affecting the fingers, which become markedly atrophic, while the skin becomes tense and shiny and gangrene may supervene.

The disease may run a very chronic course, and the prognosis as regards recovery is very grave.

Infants may suffer from a similar condition of the skin of the trunk, known as *sclerema neonatorum*. It is nearly always fatal.

W. H.

VASOMOTOR AND TROPHIC DISORDERS

Achondroplasia.—A condition of dwarfism due to intra-uterine developmental defect in the ossification of the bones laid down in cartilage. In the first year or eighteen months of life the disease may be easily mistaken for rickets, and the term fetal rickets and fetal cretinism have been applied to it. The most striking abnormality is the shortness of the limbs in comparison with the normal size of the trunk. In the infant, in addition to the excessive shortness of the upper arms and thighs, the fingers are slightly spread out, the so-called trident hand, but a beading of the ribs at the junction of the rib cartilage is present, resembling the rickety rosary. The fontanelle, moreover, is unduly large, and the vault of the skull is increased in size, points which are suggestive of rickets.

In older children the dwarfism due to the shortness of the extremities is more apparent, the femurs especially being short and curved, while the fingers do not reach below the upper border of the great trochanters. The abdomen is prominent and there is marked lumbar lordosis, the nose is sunken and the skull enlarged owing to premature ossification of the cartilaginous base. The shortness of the long bones is also largely brought about through premature ossification of the epiphyses due to periosteal ingrowth. The pelvis is contracted owing to tilting forward of the sacrum, a frequent cause of obstetrical difficulties in adult life.

Sexual development is normal, or even precocious. Many of these dwarfs reach adult life and may live to a considerable age. The intellectual development as a rule is normal.

Oxycephaly.—The German "Turm Schädel," or tower skull, is a congenital mal-development of the skull due to premature synostosis, producing a sagittal ridge of the medial frontal suture with a dome-shaped appearance of the back of the head. Occasional other slight skeletal abnormalities may be present, a certain amount of proptosis is common, and optic atrophy is often present. The disease is occasionally familial, and mental development is usually below the average.

Osteogenesis Imperfecta.—Fragilitas ossium is a foetal developmental bone defect, especially of the periosteal ossification. In the new-born infant the bones are excessively fragile, and

fractures are easily produced, or may apparently rise spontaneously; they readily heal, however, with the usual treatment. The bones are fragile and porous and may bend without breaking, the shafts of the bones and the bones of the cranial vault especially showing the defective ossification. The disease is occasionally hereditary and may be familial, and is to be distinguished from osteomalacia, a progressive disease of adolescent and adult life. Many of the infants with fragilitas ossium die early from intercurrent affections. The greatest care is necessary in the handling of the infants, but occasionally they survive, the bones gradually becoming firmer and stronger. Adult life may be reached, a fine skeleton of a man aet. 64, recently added to the College of Surgeons' Museum, shows extreme double scoliosis and curving of the long bones. Osteopsathyrosis is another term applied to this condition.

Osteitis Deformans, or Paget's disease of the bones, rarely in typical cases may affect the whole skeleton, but it is not nearly so rare when it affects a few bones only, notably those of the leg and thigh. It is a disease of late middle life, affecting chiefly males. There is sometimes a general shrinkage of stature, with increase in circumference of the head, thickening and anterior curving of the tibiae, kyphosis, deepened thorax, and widened pelvis. The clavicles may be very prominent, and large bosses of bone may occur on the long bones. The disease may be hereditary; it lasts a great many years and does not shorten life, unless from a late development of central sarcoma of the bones, which sometimes occurs.

Leontiasis Ossia, a much rarer disease affecting the bones of the skull and sometimes of the face. Owing to the increase in size of the skull, notably of the forehead and upper facial bones, a suggestion of leonine aspect may be acquired. Optic atrophy may occur as a result of the overgrowth of the bones at the back of the orbit. A famous instance of this disease was the "elephant man," who died in the London Hospital after living there some years. His skull is preserved in the hospital museum.

Hypertrophic Pulmonary Osteo-Arthropathy, a rare affection, described by Marie, in which considerable enlargement occurs of the extremities, hands, feet, wrists and ankles, with clubbing of the fingers and incurved nails. The disease is slow in development and is associated nearly always with chronic pulmonary disease, especially chronic bronchitis, tuberculosis or empyema. It is to be distinguished from acromegaly by the absence of involvement of the bones of the face and skull, or of gigantism.

Spondylose Rhizomélisque, also described by Marie, is a progressive ankylosis of the spine,

shoulders and hips, occurring in males in early adult life. The spine becomes completely rigid, with an antero-posterior curve, due to ossification of the ligaments, associated with a progressive atrophy of the cancellous tissue. The thorax becomes completely fixed and immobile, the head movements much limited, and the hip and shoulder joints partially fixed. Various infections, especially gonorrhœa, have been blamed as the cause, but the etiology is obscure.

Facial Hemiatrophy may be produced by congenital or infantile causes of wry-neck, in which the head is drawn down towards one shoulder. Cure of the torticollis by operative or other treatment, if not delayed too long, will usually arrest the development of the hemiatrophy, and by the time adolescence is reached the difference between the two sides of the face will no longer be noticeable.

Progressive facial hemiatrophy in adults is a rare affection and usually associated with signs of a chronic neuritis of the fifth cranial nerve, and especially with a skin affection, morphœa or scleroderma.

Destruction of the trigeminal nerve by

injury or operation does not set up hemiatrophy. Facial hemiatrophy may involve the whole of one-half of the face up to the middle line, causing shrinkage of the forehead, cheek and chin, with drawing over of the tip of the nose. In other cases part only of the face is involved, usually the cheek, which becomes flattened. There is no pain in this disease, but a certain degree of numbness may be present.

Microcephaly, a congenital condition of small brain and skull, the head measuring fifteen inches or less in circumference at birth. In addition to the small size there is usually considerable deformity of the skull, the forehead being low and receding, the face narrow, and the palate very high-arched. Mental impairment of varying degree is the rule, down to complete idiocy or amentia. The brain is of a simple type, being only slightly convoluted. As in other forms of idiocy epilepsy is common. Formerly extensive trephining operations were undertaken in order to provide room for growth of the brain by ablating large areas of bone, but no improvement resulted. The only treatment is educative. W. H.

DISEASES OF THE NERVOUS SYSTEM

DISEASES OF THE MENINGES

INFLAMMATION of the meninges of the brain and spinal cord rarely occurs without some involvement of the underlying nerve tissues. A more accurate name, therefore, for the condition termed *meningitis* is *meningo-encephalitis* or *meningo-myelitis*, according as the meningitis is cerebral or spinal in its disposition. But provided this fact be remembered, the word meningitis may be retained, possessing, as it does, the advantages of brevity and of long usage. In the consideration of all varieties of meningitis this point must be constantly borne in mind, as the symptoms in these diseases are often due to disordered functions of the parts of the central nervous system involved, rather than due to mere inflammation of the membrane covering them.

Meningitis may be *acute* or *chronic*, according to the course taken by the disease. It may involve the pia-arachnoid, when it is termed *leptomeningitis*, or the dura mater, when it is called *pachymeningitis*. Leptomeningitis is usually *general* in distribution; pachymeningitis is usually *local*. If the disease affects chiefly the meninges of the brain it is termed *cerebral*, if chiefly the cord, *spinal*, and if the whole of the central nervous system more or less equally, *cerebro-spinal*. If the word *meningitis* is used

without qualification, it is understood that the condition conceived of is *acute*, is a *leptomeningitis*, and is more or less *general* in its distribution. This disease is of so much greater importance than any other form of meningitis that its description will be undertaken first and will occupy the greater part of the section.

Acute Meningitis.—Acute meningitis, like acute inflammation of other serous membranes, is probably always the result of microbic infection. In the great majority of cases the whole cerebro-spinal axis is involved, but the clinical picture varies with the anatomical disposition of the inflammatory exudate. The disease is therefore often subdivided anatomically. Another division often adopted is based upon bacteriological considerations. These two classifications may well be combined, seeing that certain microbes have affinities for certain parts of the central nervous system. As already remarked, in most cases of acute meningitis careful post-mortem examination shows that the disease is cerebro-spinal. Indeed, were it not so, the diagnostic value of lumbar puncture would be very slight; whereas it is very great; even in meningitis giving only cerebral symptoms the spinal fluid removed from the lumbar region yields evidence of the infecting microbe and of the inflammation caused thereby.

CLASSIFICATION OF THE FORMS OF ACUTE MENINGITIS

<i>Region affected.</i>	<i>Micro-organisms usually concerned.</i>
I. The Vertex. (Convulsions of the hemispheres.)	Pneumococcus, Streptococcus, Staphylococcus.
II. The Base. (Between olfactory lobes and pores.)	Tubercle bacillus.
III. Post-basic Region. (Pons and cerebellum.)	Meningococcus. (Especially infants.)
IV. Cerebro-spinal Regions.	Meningococcus.
V. Spinal Cord. (Rare.)	Streptococcus, Tubercle bacillus.

In the following descriptions of meningitis four types will be dealt with. These will be found to cover the great majority of cases that arise in actual practice. The types are as follows:—(1) Pneumococcal meningitis; (2) meningococcal meningitis; (3) tuberculous meningitis; (4) streptococcal meningitis. Numbers 1 to 3 are generally primary infections of the meninges, in the sense that there is no focus of disease immediately adjacent to the brain or cord from which the inflammation spreads. Number 4 is generally a secondary infection, spreading from some such focus (*e.g.* middle-ear disease).

Pneumococcal Meningitis.—This may be part of a general pneumococcal infection, *e.g.* associated with pneumonia or pleurisy or pericarditis or endocarditis—or with more than one of these—or it may be a disease of itself, the whole brunt of the infection coming upon the meninges. In the first form it is often quite latent, the general condition of the patient being so bad that symptoms referable to the meningitis may have gone unnoticed. Moreover, the toxic state in pneumonia is often in itself productive of cerebral symptoms distinguishable with difficulty or perhaps entirely indistinguishable from those of meningitis unless a lumbar puncture be performed. The condition is often only discovered in the post-mortem room.

In the *second form* of pneumococcal meningitis the infection spends itself entirely upon the meninges, and the disease may be regarded as a primary one. The clinical picture is that of a rapidly developing fever with marked cerebral symptoms, and leading, almost always, to a fatal issue within a few days. The following account will give a fair idea of the disease.

(a) *Onset.* This is usually abrupt, with a rigor and rapid rise of temperature, or, if the patient is a young child, with a convulsion and rapid rise of temperature. *Headache* is early and marked. *Vomiting* is frequently present.

(b) *Signs of meningitis* are usually those of involvement of the vertex of the brain. *Convulsions* may be repeated and in some cases form the main feature of the disease, passing into stupor and fatal coma. The *headache* is con-

tinuous and, as is characteristic of the headache of organic cerebral disease, if *delirium* is also present these two symptoms concur; that is, the patient is delirious about his headache. This contrasts strongly with the headache and delirium of toxæmia, in which condition these two symptoms alternate. Thus in typhoid fever when delirium is present the patient does not complain of headache; when headache is present the patient's mind is clear. The *pulse* may be irregular, and is often infrequent in relation to the temperature. It should be noted that in this respect acute meningitis and typhoid fever yield similar effects. The *tendon jerks* are abolished, as also are the *superficial reflexes* (*e.g.* the abdominal reflex). *Kernig's Sign* may be elicited—on attempting to flex the thigh upon the abdomen the leg becomes flexed upon the thigh. *Rhythmical breathing* is common, especially in children, the respirations being "grouped," with periods of apnoea between the groups. Or there may be true Cheyne-Stokes respiration. *Optic neuritis* is rare, as the disease usually progresses too rapidly for this sign to appear. A blood count shows a high *leucocytosis*.

(c) *Lumbar Puncture.* However careful the physician may be in his observations, a conclusion as to whether meningitis is, or is not, present amounts at best to a high degree of probability. The writer well remembers a distinguished neurologist inviting students to study the symptom-complex in a particular case very closely, because it appeared to be such an excellent example of acute meningitis. The patient died on the fifth or sixth day of his disease, and the autopsy revealed the signs of acute staphylococcal osteomyelitis of the tibia with pyæmia. The meninges were congested, but there was no meningitis. The "head symptoms" had been the result of intense toxæmia. To this class of case the term *meningism* has been applied. It is only by an examination of the lumbar puncture fluid that the existence of meningitis can be definitely established, and lumbar puncture should, therefore, never be omitted in a suspected case of the disease. In pneumococcal meningitis the fluid is apt to be slightly turbid, yields an increased amount of albumin and a fairly large number of leucocytes, and it gives a growth of pneumococci on culture.

(d) *Course and Termination.* Nearly all the cases prove to be fatal, and most of them rapidly so. It is by no means uncommon for death to occur in three or four days, and a fatal issue has been seen even within twenty-four hours of the onset. A school-boy, aged twelve years, complained of severe headache at six o'clock on a Saturday evening, after swimming in the afternoon. During the same evening he became

delirious and was found to have a temperature of 102–103° F. He was drowsy on Sunday morning, delirium and headache continued, and he died on Sunday evening. The post-mortem examination revealed a thick layer of greenish pus over the whole of the convexity of the brain. ("And when the child was grown, it fell on a day, that he went out to his father to the reapers. And he said unto his father, My head, my head. And he said to a lad, Carry him to his mother. And when he had taken him, and brought him to his mother, he sat on her knees till noon, and then died.")

In some cases the fatal termination is delayed for as long as a week, and in rare instances recovery occurs. No doubt the gravity of the disease is due to the rapid development of the pneumococcal exudate in the pia mater and the intense inflammation of the subjacent grey matter of the brain.

Meningococcus Meningitis.—This form of meningitis occurs not infrequently in *epidemic form* (epidemic cerebro-spinal fever); sporadic cases are quite common in England, and the commonest variety of these is the so-called *cervical opisthotonus of infants*. So far as this country is concerned, therefore, two types of cases occur.

(a) **Post-Basic Meningitis (Cervical Opisthotonus).**—This is the least chronic form of the disease, and chiefly affects infants. It was originally described by Lee and Barlow, who recognized that the condition was a definite entity and were able to exclude rickets and syphilis as essential causes. The onset of the disease is usually rather insidious, though it may be ushered in by vomiting, or by convulsions, or by bronchial catarrh. The degree of fever is not usually high, and in quite a number of the cases the disease is afebrile. The child is apathetic, often drowsy, even from the first, and rarely shows the peevish state so common in tubercular meningitis. The infant wastes rapidly, and may become extremely emaciated. The most constant clinical feature is the stiffness of the neck, which leads, as the disease develops, to a marked degree of retraction of the head, giving rise to the original name of the disease. In some cases this retraction is so marked that the occiput touches the buttocks. This clinical picture is probably pathognomonic. Feeding is rendered difficult and recourse must often be had to the nasal tube.

(b) **Cerebro-Spinal Meningitis (Cerebro-Spinal Fever; Spotted Fever).**—All forms of meningitis, including tubercular meningitis, tend to be cerebro-spinal in character, as is proved not only by the symptoms, but also by post-mortem examination; removal of the cord usually demonstrates more or less exudate upon this organ, especially about the lumbar enlargement. But it is in meningococcal cases

especially that spinal as well as cerebral symptoms are apt to be present—hence the association of the name "cerebro-spinal" with the meningococcus. The mode of entry of the meningococcus into the body is not definitely known, but there are reasons for thinking that it is by way of the nose or throat.

(i.) *Onset.* This is usually less abrupt than in pneumococcal meningitis, but is occasionally fulminating. At times it is insidious. Initial symptoms are *headache, pains* in the back and limbs, *fever, constipation*—the symptoms, in fact, of any acute infective condition. It is not at all unusual to see bronchitis present, and in some cases a definite broncho-pneumonia occurs, a most misleading feature. A *rash* is occasionally present, but this is as often a simple erythema (roseolar or papular) as a purpura; it is in the epidemic cases chiefly that the petechiæ giving rise to the name "spotted fever" are common. In England these petechiæ are almost confined to the very acute cases.

(ii.) *General Symptoms during the Course of the Disease.* The *fever* tends to be of the *intermittent* variety, and sometimes this is a striking feature. *Sweats* occur, occasionally profuse and acid in smell, as in acute rheumatism. The patient *wastes* rapidly and becomes anæmic. A high *leucocytosis* (20,000–30,000) is the rule. The *joints* are affected in some cases, and a definite arthritis may occur, not rarely becoming pustular. In some of these cases a *mixed infection*, as by meningococcus plus staphylococcus aureus, is present. Rarely a true *septicæmia* occurs and leads to a rapid and fatal termination.

(iii.) *Symptoms and Signs referable to the involvement of Nerve Structures.* *Headache* is almost constant, often concurring with *delirium*. *Convulsions* are not so common as in pneumococcal and streptococcal meningitis—and if the patient is a young adult or adult are distinctly uncommon. *Stupor* is common, or a less degree of coma amounting to no more than drowsiness. The patient may lie in a state of drowsiness for long periods of time. The *head* is usually *retracted*, as in the infantile cases, but to a less marked degree. The *neck* is stiff and painful; the *back and limbs* share the same condition. The *pains* may be very severe, usually radiating from the trunk, but sometimes of an isolated and local nature. The *reflexes* and *tendon jerks* are early abolished, and usually remain absent during the course of the disease. *Babinski's sign* (extensor-plantar response) is often present. The sphincters usually escape, but of course if the stupor becomes intense involuntary micturition and defæcation may occur. *Bed-sores* develop at times, especially if the degree of emaciation is extreme, which it sometimes is. T. J. H.

DISEASES OF THE SPINAL CORD

DISEASES OF THE MOTOR TRACTS

Anterior Poliomyelitis

Acute Anterior Poliomyelitis, infantile paralysis or poliomyelitis, is an acute infective process due to an unknown ultra-microscopical infective agent which will pass through a Berkefeld filter. It is both endemic and epidemic, occurring mostly in the hot months and usually in children from twelve months to six years old; both below and above these ages it is less common. Acute anterior poliomyelitis occasionally occurs in adults even in late middle life, but this is very rare. The affection is probably acquired through the upper nasal passages. The stress of the infection falls upon the grey matter of the anterior horns, though occasionally the pons and even the cortex may be involved. Degeneration of the anterior horn cells, with areas of thrombosis and small hæmorrhages are found.

At the onset there is usually fever of 100° to 102° F. with malaise and fretfulness; pain in the back is sometimes severe, especially in the older patients, and after a day or two one or more limbs may be found paralysed and flaccid; after the first few days a general urticaria is sometimes seen. The lower limbs are affected about six times more frequently than the upper. At first the paralysis is much more widespread than that shown in the sequel, and an initial complete paralysis of both lower extremities in a child may to a large extent disappear, leaving behind only a residuum of weakness in the muscles below the knee on one side.

All degrees of severity of infection are to be met with in epidemics. The febrile stage may occur without paralysis and yet another child in the same house may develop partial paralysis clearing up after a few days, while yet a third may suffer severely with permanent motor damage. Pain is sometimes present and tenderness of the skin and limbs, but more often they are absent and the sphincters are not involved beyond temporary retention of urine. The muscles are affected in groups corresponding to spinal segments, not to peripheral nerves, and the reflexes of affected muscles will be lost. The muscles are flabby and wasting rapidly sets in, with reaction of degeneration in the most damaged muscles after a few weeks have elapsed.

Improvement usually commences after a few days, and those muscles whose faradic irritability is not lost will recover completely. The disease is usually not symmetrical, there is no rigidity, on the contrary there is marked flaccidity of the paralysed muscles and sensation is quite unimpaired.

Treatment. The child should be kept lying

on one side and a simple febrile mixture given, no direct means of attacking the infective agent being yet known. As soon as the tenderness of the skin and muscles will allow, massage should be commenced with galvanism to the paralysed muscles; the current must be given cautiously at first to avoid making the child cry and it may be given with advantage in its daily bath. Strychnine is also of service, at a later stage gymnastics and exercises may be added, and the treatment is to be maintained if possible for two years to get the best results. Contractures and deformities may result owing to the paralysed muscles, and these must be treated as they occur.

Subacute Poliomyelitis occurs in adults in chronic lead-poisoning and, rarely, is a late sequel of syphilis; other cases of obscure origin are also met with. The weakness progresses for a few weeks or months and is then stationary, wasting follows the weakness and partial reaction of degeneration is found. The form in lead-poisoning is usually limited to the intrinsic muscles of the hands; when of syphilitic origin, to the deltoids and biceps, and this is usually more or less symmetrical. W. H.

MOTOR NEURON DISEASES

Progressive Muscular Atrophy.—A slowly progressive form of weakness and muscular wasting, dependent upon a chronic degeneration of anterior horn cells, affecting mostly the upper extremities. It is not to be distinguished from chronic anterior poliomyelitis, which is sometimes described as a separate disease. It is a disease of middle life, commoner in men than in women and of obscure causation, though sometimes following injury. Most commonly the weakness and wasting appear first in the small muscles of the hand, the thenar and first dorsal interosseus muscles especially. Slowly the thenar eminence becomes flattened, with a marked hollow between the metacarpal bones of the thumb and index finger, the hypothenar muscles are much less involved. Next the weakness and atrophy may spread to the extensors of the fingers and wrist, or may involve the deltoid and biceps, the middle and lower portions of the trapezius, and the serratus anterior. The upper portion of the trapezius, the latissimus and the triceps are usually spared. The extensors of the head are sometimes severely affected, causing falling forward of the head upon the breast. Commencing in one upper extremity, the atrophy next involves the corresponding upper limb, but as a rule not symmetrically. The lower extremities are comparatively rarely affected; occasionally some of

the trunk muscles and even the diaphragm may be involved.

In the form of the disease described, where the lesion is strictly limited to the lower motor neuron, there will be no spasticity or increase of deep reflexes; indeed deep reflexes may even diminish or disappear when the particular muscles concerned in the reflexes are affected. Bulbar paralysis in this form is also very rare. Fibrillary tremors will be observed in the wasting muscles, and slight vasomotor changes are often noticeable in the periphery of the wasting limb, namely chilliness of the limb and tendency to cyanosis. Sensation is entirely unaffected, and pain is usually absent; the disease may run its course in eighteen months, but often lasts several years before death from increasing weakness or pneumonia occurs. The electrical reactions show mostly diminution of excitability both to faradism and galvanism in the wasting muscles, with KCC > ACC. In some cases in certain muscles partial reaction of degeneration may be obtained.

Etiology. Rarely due to syphilis, this disease has followed trauma and lead-poisoning, but its origin is usually obscure.

Treatment. Usually refractory and steadily progressive in spite of all treatment, a certain number of cases appear to benefit by strychnine administered hypodermically, in doses varying from $\frac{1}{50}$ to $\frac{1}{10}$ of a grain of the hydrochloride given twice a day. Galvanism and massage have little or no effect in staying the progress of the disease.

Differential Diagnosis. This disease is to be distinguished from subacute poliomyelitis, in which the onset of the weakness precedes the atrophy, and in which reaction of degeneration is found. Syringomyelia may be distinguished by the presence of areas of analgesia and therm-anæsthesia, scoliosis, arthropathies, and perhaps trophic sores; the duration of this disease is also very much more chronic. There is an infantile form of progressive muscular atrophy which is known as the *Werdnig-Hoffmann* type. This disease may be familial, several successive children in a family being affected. After the first few weeks of life progressive weakness of the trunk and limbs sets in, commencing at the shoulders and hips, and ending in complete flaccid paralysis, only slight movements of the fingers and toes remaining; the deep reflexes are lost. Sensation is normal and there is no pain, the children take food well and the wasting is often hidden by the subcutaneous fat. Death usually occurs in a few weeks from bronchopneumonia. *Post-mortem* there is found atrophy of the anterior horn cells and anterior roots. This disease is to be distinguished from spinal hæmorrhage at birth, amyotonia, infantile scurvy and myopathy.

Amyotrophic Lateral Sclerosis differs from progressive muscular atrophy by the lesion involving the upper motor neuron as well as the lower, that is to say, in addition to the atrophy of the anterior horn cells and muscles there is wasting of the pyramidal fibres in cord and brain up to their origin in the motor cortex. The muscular wasting is identical with that of progressive muscular atrophy, though usually less widespread, while the reflexes are increased with ankle clonus and extensor plantar reflex; the disease runs a shorter course and ends with bulbar paralysis and death in one and a half to two years.

Chronic Bulbar Paralysis.—Often a terminal stage of amyotrophic lateral sclerosis, but it may occur alone. Atrophy of the lips and tongue, with paralysis of the soft palate and constrictors of the pharynx and occasionally of the laryngeal abductors develops slowly, causing progressive difficulty in deglutition, nasal regurgitation and thickened raucous articulation. Dribbling of saliva is frequent, and these patients are often markedly emotional.

Treatment. At first liquids and semi-solids should be given, at a later stage tube feeding may be necessary; death usually occurs from inanition or aspiration pneumonia in one to two years. Atrophy of the nucleus ambiguus, hypoglossal and seventh nerve nuclei is found. Partial bulbar paralysis may also occur in syringomyelia, syphilitic and other forms of basal meningitis, tumour of the medulla and pons, etc.

Progressive Neural Muscular Atrophy.—A chronic slowly progressive atrophy in either sex, nearly always symmetrical, commencing in the muscles of the legs and feet, sometimes known as peroneal atrophy, or the Charcot-Marie-Tooth type. It begins usually in later childhood and sometimes in later middle life. It is occasionally familial in type. *Pes cavus*, or other forms of talipes are common and may be the initial symptoms. The knee and Achilles jerks are lost early and some unsteadiness in gait is usual, over and above the weakness and "steppage" gait due to foot-drop. The wasting slowly advances, involving the lower portion of the thighs and next the intrinsic muscles of the hands, causing claw-hand; the atrophy only rarely becomes generalized; sensory disorders are slight, amounting only to numbness of the extremities; vasomotor troubles in the feet may be met with suggestive of Raynaud's disease. *Post-mortem*, slight combined sclerosis and atrophy of anterior horn cells in the cord and of the peripheral nerves have been found.

Hypertrophic Interstitial Neuritis.—A rare form of muscular atrophy similar to the foregoing, described by Dejerine, Sottas and Thomas, commencing in childhood, associated with

severe lightning pains, deep anæsthesia, ataxy, Argyll-Robertson pupils and kypho-scoliosis. In addition to the spinal changes described above, hypertrophy is found of the peripheral nerves and spinal roots.

Progressive Muscular Dystrophies.—The various classified forms are closely allied and transitional forms occur, but all are probably varieties of the same disease and are due to congenital abiotrophy, or tendency to premature malnutrition and disappearance of the striped muscles. Certain features are common to them all, their hereditary and familial occurrence, the marked symmetry of the affection, in the large majority absence of involvement of the sphincters, or of sensation, and the absence of signs of degeneration in the nervous system. The muscle fibres are primarily affected and giant fibres often occur.

1. **The Pseudo-Hypertrophic Type** affects the male sex almost entirely, the weakness usually declaring itself in early childhood, but sometimes it is delayed until adult age. Hypertrophy of some muscles, especially the deltoids and infraspinati, is associated with atrophy of other groups, particularly the upper arm, shoulder-girdle muscles and thighs; the trunk muscles are affected later and contractures causing deformities may develop, while the deep reflexes of the affected muscles are lost. When the disease is fully developed there is marked lordosis, the gait is of a waddling type, and the patient's method of rising off the floor is characteristic, the so-called "climbing up the legs."

2. **Erb's Juvenile Type** affects both sexes and is usually later in onset than the pseudo-hypertrophic. There is no pseudo-hypertrophy, but the muscular atrophy in its grouping resembles the former type. Lordosis is observed when the back is affected, and ultimately the patient may deserve the epithet "living skeleton."

3. **Facio-scapulo-humeral, or Landouzy-Dejerine Type**, sometimes called the infantile owing to the congenital weakness of the eyes and lips in some cases. The weakness of the sphincter muscles of the eyes and lips produces the symptom known as "myopathic facies," and the skeletal atrophy may not arise until adolescence or even much later. This form is practically the same as Erb's type with additional facial weakness.

4. **Myotonia Atrophica** may be looked upon as a combination of myopathy with Thomsen's disease; it usually affects males, the atrophy generally commencing after adolescence in the sterno-mastoids, forearm and hand muscles and vasti in the thighs, together with the myopathic facies. A peculiar symptom of this type is the slow relaxation of the grip with other signs of Thomsen's disease.

5. **Amyotonia or Myotonia Congenita** is best

included with the myopathies. From birth there is noticeable extreme hypotonia of the limbs and trunk, with double-jointedness. The dorsum of the foot will lie along the tibia, and there is corresponding flexibility of other joints; the muscles are extremely small and their strength is correspondingly slight, while the deep reflexes are absent. The disease differs from the other myopathies in its progressive tendency to improvement.

Landry's Paralysis.—An acute progressive, flaccid paralysis of doubtful origin, probably infective, with slight pyrexia, beginning generally in the legs and spreading upwards to involve the trunk and upper extremities in from one to three or four weeks. Neither sensation nor the sphincters are affected, the deep and superficial reflexes are lost, and there is little or no muscular wasting. The majority of cases end fatally from respiratory failure. Post-mortem, various slight changes have been described in the spinal meninges and cord, but nothing characteristic.

The disease is to be distinguished from poliomyelitis, acute ascending myelitis and multiple neuritis.

Primary Lateral Sclerosis due to a chronic primary degeneration of the pyramidal tracts is a rare disease. Cases commonly diagnosed as lateral sclerosis are usually cases of combined sclerosis, disseminated or amyotrophic sclerosis, or secondary to an overlooked transverse myelitis, or even to pressure paraplegia from caries of the spine, tumour, etc.

Pure primary lateral sclerosis, however, is met with, and may develop either as a paraplegia, or in the hemiplegic form, in which one side is involved before the other. Sensation is unaffected. Its development is slow over a number of years, and the usual signs of spasticity are intense. In the legs the spasm is of extension and adduction at first, but ultimately the flexor muscles overcome the extensors, and in the later stages the knees are drawn up to the chin with the heels resting on the buttocks. Death usually occurs from intercurrent pneumonia, or from cystitis.

Hereditary Spastic Paraplegia is a family form of lateral sclerosis, the lesion being chiefly one of the pyramidal columns and only slightly in the posterior. Pes cavus and even scoliosis may be present and the disease runs a very chronic course.

Spastic Paralysis of Children (Little's Disease).—Under this heading may be included a variety of clinical types, due to various lesions, mostly congenital. The symptoms are briefly—weakness and rigidity of the legs and sometimes of the arms, with increase of the deep reflexes but no sensory disturbance. The gait is spastic, and adductor spasms may cause cross-legged progression. A variable degree of involuntary

inco-ordinate movement affects the arms, sometimes the face and legs also. Mental impairment is not uncommon, and epilepsy and imbecility are frequent.

Various causes have been found post-mortem for these conditions. The lesion may occur at birth, such as cyanosis from prolonged labour, or meningeal hæmorrhage, usually at the vertex. Acute encephalitis may damage the cortex either before birth or during childhood, and atrophic lobar sclerosis and porencephaly may result. In others again the lesion is purely of the basal ganglia, the cortex escaping entirely, and in such the mental functions are unimpaired and epilepsy is rare; it is these cases especially which develop the most intense inco-ordinate movements of arms, face and legs known as double athetosis. In these latter, though mobile spasm is present, there is no true spasticity, but hypotonus.

In the treatment of Little's disease massage, gymnastics and patient education are the most important points; the children are usually slow in learning and a few years behind their age in intelligence and strength. Plastic surgery is usually to be deprecated, though of occasional service. With increase of years there is a slight tendency to improvement.

Amaurotic Family Idiocy.—An infantile cerebral degeneration confined to the Hebrew race. Infants showing progressive flaccid paralysis together with signs of mental impairment, progressing to idiocy, together with the gradual development of total blindness due to optic atrophy. A cherry-red spot in the macula is the characteristic ophthalmoscopic sign; death is invariable, generally in the second year.

Erb's Syphilitic Spinal Paralysis.—A combined sclerosis of syphilitic origin, characterized by slow development and spastic gait, with increased deep reflexes, early sphincter weakness, slight tactile loss in the legs and hypotonicity of the muscles, rather than contractions. The lesion is probably generally secondary to syphilitic vascular disease in the spinal membranes. The course of the disease is slow and it may become stationary for many years, or even improvement may occur under antisyphilitic treatment.

Secondary Spastic Paralysis.—A paraplegia developing acutely or slowly from a transverse or diffuse lesion in the dorsal or cervical cord. The extensor and adductor spasm in the legs is a marked feature leading to the so-called clasp-knife rigidity of the knees; the deep reflexes are increased, with knee and ankle clonus, the plantar reflexes are extensor and the abdominal reflexes absent. There is incontinence of feces and urine, and varying degrees of anæsthesia on the lower half of the body are usual. With a lesion of the cervical cord the spasticity will involve the arms as well as the legs, the arms being semi-flexed

at the elbows. If the transverse lesion is total, flaccid paralysis will replace the spasticity, with absent deep reflexes and total anæsthesia up to the level of the lesion.

Hysterical Spastic Paralysis may simulate the organic disease somewhat closely. There may be cataleptic rigidity of the whole body up to the neck; more usually the legs only are involved; clasp-knife rigidity is not seen and ankle clonus is less regular, or even absent. Adductor spasm may not be present and the plantar reflexes are frequently absent or else flexor. The sphincters are not involved, sensation may be unimpaired or there may be anæsthesia up to the knees, which is probably patchy and irregular. W. H.

DISSEMINATED SCLEROSIS

Disseminated Sclerosis.—Usually beginning in adult life, this common disease is practically unknown in childhood and rarely commences after forty. The sexes are equally affected.

Nervous heredity plays a small part in its causation, and neither injury nor syphilis are concerned in its origin. When not directly responsible for its commencement, influenza and many other infective diseases frequently aggravate and hasten the development of the disease. Parturition has a similar effect.

Morbid Anatomy. The lesions found post-mortem consist of islets of greyish-red patches of neuroglial overgrowth, which are to be found scattered in all parts of the nervous system, no part being exempt, but they are least common in the cerebellum. Though the proof is yet quite insufficient, it seems probable that the origin of these islets of nerve degeneration is in vascular disturbances, a theory which well accords with the rapidity or even suddenness of onset of some of the symptoms.

Symptoms. Vague and indefinite at first, and frequently mistaken for hysteria, the symptoms are very protean in character. Numbness and weakness of a leg or of the hands, diplopia, various paræsthesiæ, a feeling of constriction of a limb or girdle sensation, vertigo, or rapid failure of vision in one eye, are characteristic early symptoms. Sudden loss of power in a limb is a frequent event, the weakness usually improving gradually until almost perfect recovery may occur in one to three months, such variability of signs being likely to strengthen the original diagnosis of hysteria. This mistake can be avoided by observing the presence of increase of knee-jerks, ankle clonus and extensor-plantar or Babinski reflex in the weakened leg; other distinguishing signs will be nystagmus in the lateral or vertical directions, and, if amblyopia is present, sluggishness of the pupil reflex to light. A most important symptom

is sphincter weakness, such as hesitation of the bladder, precipitancy of micturition and obstinate constipation.

Many cases improve considerably, especially if the development of the symptoms was acute or subacute; relapses are, however, inevitable, and ultimately both legs are involved in the weakness, causing the gait to be both spastic and uncertain.

In some cases intention-tremor of the hands and arms develops and the articulation becomes staccato or scanning. Optic atrophy of moderate degree is frequently present, and intention-tremor may affect the head as well as the arms and legs, though at rest no movement is to be seen. In the latter stages of the disease patients become emotional, and some loss of memory and other slight mental changes may be observed. Ultimately walking becomes impossible, flexor contractures of the legs develop, and at this stage bed-sores and cystitis prove dangerous complications.

The *treatment* consists of periods of rest with massage and mild electrical stimulation, with avoidance of over-exertion or fatigue. No drug is of any avail, though sedatives are sometimes necessary.

Prognosis. The disease often runs for many years before the bedridden stage is reached, and occasionally in the early years long periods of good health may intervene between relapses.

Pseudo-Sclerosis, described by Westphal and Strümpell, is a very rare disease, to be distinguished from disseminated sclerosis by the more profound mental changes, attacks of excitement and dementia, with its earlier onset, and occurrence in two or more members of the family. The tremor is much wilder, occurring even during rest, while the lower limbs are affected late in the disease and there are no optic changes.

In the few autopsies slight degeneration has been found in the pyramidal tracts.

Diffuse Sclerosis, also very rare, is possibly a late stage of pseudo-sclerosis. The consistency of the brain is dense and leathery, a cut section looking like ivory, due to great neuroglial increase; dementia is common and profound, other frequent symptoms being aphasia, vertigo, epilepsy, and weakness of the sphincters. The disease begins not uncommonly in childhood, is progressive and fatal usually within four years; it appears not to be hereditary, but has been said to follow injury.

Hypertrophic Sclerosis is due to local islets of neuroglial overgrowth of the outer surface of the cortex, or on the walls of the lateral ventricles. The patients are always idiots or imbeciles and frequently epileptic, the nose and cheek being often affected by adenomasebaceum.

Atrophic Lobar Sclerosis is a condition of cerebral atrophy with glial overgrowth and often

porencephaly, the result of antecedent acute encephalitis or vascular disease. In early infancy the symptoms are those of infantile hemiplegia or diplegia (*q.v.*).
W. H.

DISEASE OF THE POSTERIOR AND LATERAL COLUMNS

At one time it was thought that a primary sclerosis of the posterior and lateral columns, which led to a combination of ataxy and spastic paraplegia, occurred. It is now recognized that most of the chronic cases of this condition were really examples of disseminated sclerosis, whilst the more acute cases are now classified as *subacute combined degeneration of the cord*. It is very doubtful whether any cases remain which can legitimately be called *primary ataxic paraplegia*.

The posterior and lateral columns are also affected together in Friedreich's ataxy, in rare cases of tabes with lateral sclerosis and in some cases of syphilitic spinal paralysis and senile paraplegia. The spinal symptoms occasionally present in the late stages of pernicious anæmia and those occurring in ergotism, pellagra and lathyrism are also due to postero-lateral degeneration.

The symptoms and signs of these various conditions are those of spastic paraplegia combined with ataxy of the tabetic type, the result of the combination depending upon the degree of degeneration in the lateral columns compared with the posterior columns. The spinal symptoms of subacute combined degeneration may be regarded as a type.

Subacute Combined Degeneration of the Spinal Cord

Etiology. Subacute combined degeneration of the spinal cord is a disease of middle age, affecting males and females equally. Nothing is known as to its causation.

Morbid Anatomy. The posterior columns and subsequently the lateral columns undergo progressive degeneration, which is followed by secondary overgrowth of neuroglia.

Symptoms. The disease begins insidiously with tingling or other abnormal sensations in the feet and then in the hands, which gradually spread up the limbs till they reach the trunk. Lightning pains and girdle sensations are occasionally present.

Soon after the appearance of paræsthesia sensation becomes impaired in the same situations, the anæsthetic being always somewhat smaller than the paræsthetic areas. The sense of pain is generally lost before that of touch and the area of analgesia is greater than that of anæsthesia. In the later stages there is often complete anæsthesia to all forms of stimulation.

At a varying interval after the onset of paræsthesia and anæsthesia spastic paraplegia with ataxy slowly develops. Subsequently the spasticity gives place to flaccidity and atrophy, the exaggerated knee-jerks and ankle clonus being followed by loss of tendon responses, but the plantar reflexes remain extensor from the beginning until the end. The paralysis spreads up the legs to the trunk, the arms being comparatively slightly affected. The sphincters are always involved in the later stages.

Anæmia may precede the nervous symptoms by months or years or appear rapidly at any period, but it is occasionally absent throughout. Its character is very similar to that of pernicious anæmia, and the patient suffers from the ordinary results of severe anæmia. The mouth frequently becomes septic and there may be symptoms of chronic gastro-enteritis. Irregular pyrexia is almost always present.

Course. Death invariably occurs between six weeks and six years after the onset of the symptoms, the average being a little over one year.

Treatment. No treatment has any material effect on the fatal course of the disease, but an attempt should be made to combat the septic condition of the mouth and the gastro-intestinal symptoms. A. F. H.

FRIEDREICH'S ATAXY

Etiology. Two or more members of a family are generally affected, but the disease is rarely directly hereditary. Epilepsy and insanity may occur in relations, and one parent is often a drunkard. The disease generally begins between the ages of six and sixteen.

Morbid Anatomy. Primary degeneration with secondary overgrowth of neuroglia occurs in the posterior columns and pyramidal and spino-cerebellar tracts, especially in the dorsal region.

Symptoms. The disease develops very insidiously: the gait gradually becomes reeling, and the patient walks with his feet widely separated and with short, unequal strides. He sways on standing, and the trunk and head oscillate when unsupported. The ataxy is not much increased when the eyes are closed. The arms become ataxic after the legs, the ataxy being cerebellar rather than tabetic in character. The facial movements are ataxic, especially on talking, and articulation is indistinct and explosive. Nystagmus and vertigo are commonly present.

The strength of the limbs is at first maintained, but weakness slowly develops till the patient is completely bed-ridden. The muscles are flaccid and the knee-jerks and ankle-jerks generally, but not invariably, disappear,

and the plantar reflexes are always extensor. Lateral curvature with kyphosis and talipes equino-varus with hyperextension at the metatarso-phalangeal and flexion at the interphalangeal joints are common, a similar less-marked deformity occurring in the hands.

There is often some blunting of cutaneous and deep sensibility and occasionally paræsthesia, especially in the distal segments of the limbs. The intelligence is unimpaired and the sphincters remain intact.

Course. The disease very slowly advances for many years, death being generally due to cardiac failure, the result of congenital heart disease or myocardial degeneration, or some intercurrent disease, which the bed-ridden and feeble patient is unable to resist.

Treatment. There is no treatment.

A. F. H.

TABES (LOCOMOTOR ATAXY)

Etiology. Most patients give a history of syphilis, and the serum of a still larger number gives a positive Wassermann reaction; it is in fact doubtful whether tabes ever occurs without previous syphilis. The average interval between the onset of tabetic symptoms and the syphilitic infection is ten years. Syphilis is more likely to lead to tabes if the patient has indulged in alcoholic or sexual excess, and to general paralysis or tabo-paresis if he has been subjected to great mental stress.

The disease commonly begins between the ages of thirty and forty-five; it may occur in children as a result of congenital syphilis. It is much more common in men than in women.

Morbid Anatomy. The posterior columns are degenerated together with the posterior roots as far as the spinal ganglia, which are generally also affected. Degeneration is also common in the cranial nerves and their nuclei.

Symptoms. Lightning pains are commonly the first symptoms, but in other cases diplopia, difficulty in walking, failing vision, bladder trouble, trophic disturbances, impotence, constipation or vertigo may be the earliest complaint.

In a large majority of cases the pupils are abnormal; they are often unequal in size, but both may be extremely small; they are generally irregular in outline and may be eccentric; the response to light becomes sluggish at an early stage and is frequently absent whilst the contraction on accommodation still occurs (Argyll-Robertson pupil), the response to accommodation disappearing at a later stage. Diplopia is a common early symptom; it is often transitory and may precede the onset of other symptoms by months or years; it is due

to paralysis of one or other of the ocular muscles. Other ocular paralyses occur and there may be complete unilateral ophthalmoplegia. Ptosis may be present with or without paralysis of the external ocular muscles. Optic atrophy is not uncommon; when it is well-marked the other symptoms are usually slight, so that a completely blind tabetic patient often shows little or no inco-ordination.

Lightning pains are present in almost every case, most commonly in the legs, sometimes in the arms and thorax. Attacks of constantly recurring lightning pains may last from a few minutes to several hours.

Paræsthesia in the form of numbness or tingling of the feet or hands and unpleasant girdle sensations are common; with the former the patient may feel as if he is walking on cotton-wool. Areas of complete or partial anæsthesia are almost always present, and analgesia is also common; the ulnar side of the forearm is less sensitive to painful stimulation than the radial side in a large proportion of cases, although the reverse is normally the case. Pressure on the calves, the ulnar nerves and the testicles often causes less pain than normally. The sensation produced by a vibrating tuning-fork placed on the subcutaneous bony prominences is diminished or absent, especially over the sacrum and the bones of the legs.

Difficulty in beginning the act of micturition, incontinence of urine, and inability to empty the bladder completely are common and early symptoms. Sudden and painful desire to micturate may occur and constitutes a vesical crisis.

The sensibility of the rectum is diminished, with the result that dyschezia is common. Rectal crises, in which a sudden desire to defæcate is repeatedly experienced for a short period, generally in the morning, may occur. Gastric crises are common and are elsewhere described. In laryngeal crises a sense of constriction is felt in the throat; it is accompanied by cough and considerable dyspnoea with inspiratory and expiratory stridor.

Sexual desire is sometimes increased for a time, but at a later stage impotence is always present.

The impairment of muscle, tendon and joint sensibility results in ataxy, the patient having a characteristic staggering gait, throwing his feet out and bringing them down heavily on the ground. In slight cases locomotor ataxy can only be demonstrated when the eyes are closed or by inability to maintain equilibrium when walking toe-to-heel. Loss of muscle-sense is also the cause of Romberg's sign, the patient swaying when his eyes are closed and his feet placed together; in advanced cases he may sway on standing with his eyes open, and

in slighter cases static inco-ordination can only be demonstrated by causing the patient to stand on tiptoe or on one foot with his eyes closed. He is often unable to recognize the position of his limbs and does not recognize the direction or extent of passive movements. Ataxy of the arms occurs, but is much less frequent than in the legs.

The plantar reflex is flexor, but it may be absent if there is plantar anæsthesia. Anæsthesia in other areas is often associated with loss of the corresponding superficial reflexes.

The knee-jerks almost always disappear sooner or later, but in the early stages they may still be present or even exaggerated when the ankle-jerks are lost; the latter are therefore of more importance than the former in the early diagnosis of tabes.

Hypotonus is often present: the thigh can be flexed with the knee extended to an abnormal degree and genu recurvatum may occur.

Perforating ulcers of the foot are not uncommon; they generally follow some trivial injury to the skin or subjacent bone or joint. *Charcot's disease* of the joints is comparatively rare; the knees and tarsus are most commonly affected, the joint becoming swollen, distended with fluid and disorganized, but not painful.

The cerebro-spinal fluid contains excess of lymphocytes and may give a positive Wassermann reaction, but the latter sign is much less constant than in general paralysis of the insane.

Prognosis. The disease generally advances very slowly, death occurring between ten and twenty years after the onset. Temporary arrest is common and may last for years; in rare instances no further advance occurs at all. Ocular palsies, lightning pains and crises disappear spontaneously, whilst ataxy and bladder troubles may be completely overcome by treatment. Death is generally due to some intercurrent disease, such as pneumonia or phthisis, or some disease, such as apoplexy, aortic disease or aneurysm, in which the primary cause is also syphilis. It may also result from progressive cachexia, ascending nephritis and rarely from bed-sores or laryngeal crises. In some cases general paralysis of the insane develops, and death is due to this rather than to tabes.

Treatment. Tabes offers more opportunities for useful treatment than any other nervous disease. Whenever the Wassermann reaction is positive, salvarsan should be injected intravenously and a prolonged course of mercury, if possible by inunction, should be instituted. The Wassermann reaction should be tested twice a year, and whenever positive mercury and perhaps salvarsan should again be given. By this means arrest can sometimes be obtained, especially in early cases in which the original syphilis was insufficiently treated.

Mental and physical over-work should be avoided, but complete rest in bed always aggravates the ataxy. There should be strict moderation in alcohol, and sexual intercourse should be prohibited in the early stages, when it is still possible.

Ataxy can be cured or much relieved by the regular performance of a few simple exercises, in which what is left of the muscle-sense is rendered more efficient and is at the same time helped by vision. Lightning pains can often be relieved by heat, but analgesics, such as aspirin, phenazone and especially pyramidon, are generally required. When vesical symptoms are present the patient should try to empty his bladder completely at regular intervals of from four to one hour, according to the severity of the case, and large doses of strychnine should be given. By these means the use of a catheter can generally be avoided, but when it is required, urotropine should always be given.

A. F. H.

ACUTE MYELITIS

The term myelitis should be applied only to inflammation of the spinal cord. The majority of cases formerly described as myelitis were examples of degenerative conditions not directly due to inflammation. The chief of these were "compression myelitis," which results from pressure on the cord by tumours and tuberculous material, and "syphilitic myelitis," in which the chief change in the cord is softening due to vascular obstruction. Inflammation of the meninges and spine, whether due to the tubercle bacillus or other organisms, is generally accompanied by some degree of myelitis, which does not, however, require separate consideration. The specific infective disease, in which the anterior cornua are the chief site of inflammation, is a true myelitis, and is elsewhere described under the name of "acute poliomyelitis."

Etiology. Acute infective myelitis is a rare disease, which generally occurs without obvious cause; it may follow an acute infection, and cases have occurred during pregnancy and the puerperium, whilst others have been ascribed to injury or chill.

Symptoms. The onset is accompanied by pyrexia, headache and general malaise. Pain in the back and tingling of the legs precede the paralysis, which reaches its full development in any time between a few hours and several days. Atrophic paralysis occurs in the muscles supplied by the affected segments of the cord, whilst spastic paralysis develops in those supplied by the segments below the lesion. When the cervical enlargement is affected atrophic paralysis of the arms and spastic paralysis of

the legs is present; in dorsal myelitis the arms are spared, and in lumbar myelitis atrophic paralysis of some muscles of the legs is accompanied by spastic paralysis of those supplied by the lowest segments, unless the latter are also involved, when no spastic paralysis is present at all. In some cases the muscles supplied by segments below the lesion are at first flaccid and the jerks are lost, but at a later stage spasticity develops, the knee-jerks are exaggerated, and ankle clonus and extensor plantar reflex are present. Retention of urine and faeces always occurs unless the lumbar centre is involved, when there is complete incontinence.

Anæsthesia to all forms of stimulation is present in the whole of the body below the part supplied by the uppermost of the affected segments.

The above description applies to the majority of cases, the myelitis being confined to a small area of the cord. In *acute ascending myelitis* flaccid paralysis with complete anæsthesia begins in the feet and steadily ascends, death nearly always occurring within a few days from respiratory paralysis.

Course. Many cases are rapidly fatal; others are fatal after a few weeks owing to complications such as ascending nephritis or bed-sores. Some patients survive the acute illness and either remain totally paralysed and anæsthetic, or a certain amount of recovery takes place, which is rarely sufficient to enable them to walk with any ease or to regain complete control of the bladder.

Diagnosis. The diagnosis from acute poliomyelitis and Landry's paralysis is easy, as the sphincters are not involved, or only for the first few days, and anæsthesia is absent. In acute toxic polyneuritis the sphincters are unaffected, anæsthesia is not segmental in distribution, and paralysis is always of the atrophic type with absent jerks and flexor plantar reflex. In acute spinal softening, which is almost always syphilitic in origin, constitutional symptoms are commonly absent, signs of cerebral syphilis may be present and a history of syphilis obtainable; the serum gives a positive Wassermann reaction and the cerebrospinal fluid contains lymphocytes, whereas polymorphonuclear cells are present in infective myelitis. The spine should be examined for tenderness and rigidity, which are important signs of "compression myelitis"; the latter is further characterized by its slower onset and the presence of radiating pains and a band of hyperæsthesia above the area of anæsthesia.

Treatment. Absolute rest on a water-bed is essential. Regular catheterization is often required, and great care must be taken to avoid bed-sores.

A. F. H.

ACUTE SPINAL SOFTENING

Acute softening of the spinal cord is due to thrombosis. This is almost invariably a result of syphilitic endarteritis, spinal softening being generally associated with gummatous meningitis. Vide *Syphilis of the Central Nervous System*, and *Acute Myelitis*. A. F. H.

SYRINGOMYELIA AND SPINAL GLIOSIS

Etiology. Syringomyelia is a rare disease in which cavities form in the spinal cord. These are due to developmental defects in connection with the central canal or to spinal gliosis, in which diffuse or circumscribed overgrowth of neuroglia occurs, the centre of the new-formed tissue tending to break down with the production of cavities. The disease generally begins between the ages of twenty-five and forty-five.

Symptoms. The onset is very insidious, it being possible for any one of the symptoms of the disease to be the first to make its appearance. The most characteristic symptom is "dissociated anæsthesia," sensibility to painful and thermal stimulation being lost, whilst that to tactile and deep stimulation and the muscle-sense are intact or affected to a less extent and over a smaller area. The distribution of the anæsthesia is segmental, corresponding to the spinal segments affected by the disease. As the cervical and upper dorsal regions are most frequently involved, dissociated anæsthesia is generally present in the arms alone or in association with the trunk.

The anterior cornu cells are sooner or later attacked, progressive atrophy and paralysis of the muscles of the arms resulting. The hands are generally first affected and assume a claw-like position, paralysis of the forearms and arms following. In many cases the lateral columns are involved, so that the plantar reflexes become extensor, the knee-jerks are exaggerated, ankle clonus is present and symptoms of spastic paraplegia slowly develop. The sphincters are occasionally paralysed. The disease may spread to the medulla and pons, leading to paralysis of the muscles supplied by the cranial nerves. It does not progress symmetrically, one arm being generally much more affected than the other.

In many cases the cells of origin of the cervical sympathetic are involved, so that ptosis, narrowing of the palpebral fissure, inequality of the pupils and retraction of the eyeball occur.

In nearly all cases some trophic disturbance occurs in the upper limbs; the fingers and hands become oedematous, bullæ, ulcers and whitlows develop, the nails fall, the bones are brittle, and the shoulder-joint and less frequently

the elbow may undergo changes similar to those known as "Charcot's disease" in the case of tabes. Trophic changes frequently only begin after some injury, which may be quite trivial.

Course. The disease is very slowly progressive, the patient being often able to continue his occupation for many years. Death occurs from some intercurrent disease, invasion of the vital medullary centres or septic complications. Remissions are frequent, but complete arrest is very rare.

Diagnosis. The motor symptoms closely resemble those of the motor neuron diseases (progressive muscle atrophy and amyotrophic lateral sclerosis), but the latter have no sensory and trophic symptoms. The symptoms of cervical hæmatomyelia are sometimes very similar, but they develop suddenly and tend to improve, and those of tumour in the cervical region also develop much more rapidly than in syringomyelia. Diseases of the cervical meninges can be distinguished by the pain, tenderness and rigidity of the neck. When toxic polyneuritis produces symptoms in the arms which might suggest syringomyelia, there is generally evidence of similar changes in the legs, which moreover are never spastic. The early trophic changes may be mistaken for Raynaud's disease, but in this, as in all other conditions, a careful investigation of the sensory functions should prevent a mistake being made.

Treatment. The only treatment which has any effect on the progress of the disease is the application of X-rays to the affected segments of the spinal cord. This has frequently led to arrest and occasionally to considerable improvement. A. F. H.

SPINAL HÆMORRHAGE (HÆMATOMYELIA)

Etiology. Primary spinal hæmorrhage is very rare; secondary hæmorrhage may occur in myelitis and in tumours. Ninety per cent. of cases of hæmatomyelia are due to injuries, generally in the cervical region and often without any lesion of the spine or meninges. Most frequently the head is bent forcibly forward; hæmorrhage may also result from falls on to the back, gluteal region or feet.

Symptoms. The onset is very sudden. In the common cervical form flaccid paralysis of one or both arms rapidly develops and the muscles gradually atrophy. The legs at the same time become spastic with increased jerks and extensor reflex sometimes after an initial period of flaccidity, but they are much less affected than the arms, as hæmorrhage occurs into the grey matter and only involves the lateral columns secondarily. The arm and leg of one side are generally much more affected than those of the opposite side, the superficial

reflexes disappearing on the corresponding side. When both sides are involved, retention of urine and faeces occurs. Loss of sensation, especially of pain and temperature, occurs below the affected segment; when the paralysis is unilateral the anaesthesia involves the opposite side of the body (Brown-Séquard syndrome), though the muscle sense of the same side is affected.

Course. Improvement generally occurs, especially in the legs, but more or less atrophic paralysis of the arms always persists. Death may occur from pulmonary complications when the respiratory muscles are paralysed, from cystitis or bed-sores, and from secondary myelitis.

Diagnosis. Acute myelitis develops less suddenly and is accompanied by constitutional symptoms. Haemorrhage into the spinal membranes gives rise to root-pains and the Brown-Séquard syndrome is never present. (*Vide* also *Syringomyelia*.)

Treatment. Strict rest must be enforced. Laminectomy should only be performed if there is evidence of haemorrhage outside as well as within the cord.

A. F. H.

TOPICAL DIAGNOSIS OF DISEASES OF THE BRAIN

The localisation of diseases of the brain is based on cerebral anatomy and physiology and on the results of pathological observations.

Whilst the localisation of cerebral functions is of much practical value in clinical medicine, there are interesting facts in favour of the views of v. Monakow and others, that the so-called cerebral centres are not such sharply defined and independent areas as they are commonly held to be.

Cerebral Hemispheres

Motor and Sensory Areas and Tracts.—“*Motor*” *Cortex.* Stimulation of the ascending frontal convolution in animals causes convulsive movements on the opposite side of the body—according to the part stimulated. In man similar results have been obtained. Various areas have been mapped out and described as “motor centres” from the movements thus produced. Excision of these areas produces paralysis.

Recent experimental work has shown that in the higher apes these centres are chiefly situated in the ascending frontal convolution: and probably this is the case in man.

There is a slight extension of the “motor” area to the median side of the hemisphere—to the paracentral lobe. We may state broadly that the upper third of the ascending frontal convolution is the centre for the movements of the leg; the middle third for the arm; and the lower third for the face and tongue.

The “motor areas” are centres for movements, not for muscles.

Disease of the “motor cortex,” if irritative, produces convulsions commencing in the arm, leg or face, according to the “motor centre” implicated; and in one segment of the limb according to the part of the centre affected. These convulsions may remain limited to one limb or one side of the face (monospasm), or they may spread to the whole of one side of the body (unilateral convulsions). When severe, the other side may be finally affected. Consciousness is not lost, or lost only at the end of the fit. It is important to note the part first convulsed; this gives an indication of the part of the centre affected.

In unilateral convulsions, when the face is first convulsed, the arm is next affected and finally the leg; when the arm is first convulsed the face and leg are affected afterwards; when the fit begins in the leg the arm is affected next and then the face. In unilateral convulsions the eyes and head are often turned to the side convulsed.

When the lesion destroys the “motor centre” (usually the subcortical white matter is also affected more or less) paralysis of one limb occurs—monoplegia—which may progress to partial or complete hemiplegia. Monoplegia is the typical form of paralysis in a cortical lesion, and when the lesion is a tumour the onset is usually gradual. In a strictly cortical tumour early hemiplegia is rare; but in cortical softening or haemorrhage, hemiplegia is common and the onset sudden. After a monospasm temporary monoplegia may occur. In growth the monoplegia is progressive.

Muscles which are bilaterally associated in their action are not paralysed in unilateral disease of the cortex.

Probably the “motor” areas are not strictly motor: these cortical centres may be both motor and sensory, but never one to the exclusion of the other. In the ascending frontal convolution are represented: movement, tactile sense, topognosis (power of localising in space the point touched), muscular and arthritic sense, stereognosis (power of recognizing nature of objects in the hand by touch, when the eyes are closed) and pain.

A lesion of both the ascending frontal and ascending parietal convolutions produces far more sensory disturbance than one of the ascending frontal alone. It is probable that the ascending parietal convolution is part of the cortical area in which sensory representation of the upper limb is to be found.

The endings of the sensory neurones in the cortex are diffuse, and the sensory centres are more diffuse than the motor.

In cases of monoplegia from disease of

the cortex, diminution of sensation is often detected in the affected limb; but it is chiefly at the peripheral extremity. Tactile sensation and the muscular sense are chiefly affected, the sense of pain or temperature very seldom.

Centrum Semiovale. Lesions in the white matter of the cerebral hemisphere (centrum semiovale) often affect the motor fibres between the cortex and internal capsule, and paralysis is produced. The nearer the lesion is to the cortex the more limited the paralysis (monoplegia); lesions near the internal capsule produce partial hemiplegia. Convulsions do not occur unless the lesion is close to the motor cortex.

Lesions just under Broca's convolution may produce motor aphasia.

Internal Capsule. Lesions affecting the anterior two-thirds of the posterior limb of the internal capsule (region of the lenticulo-striate artery) cause hemiplegia—paralysis of the face, arm and leg on the opposite side. But these parts are not equally affected. As regards the face it is the lower facial muscles which suffer chiefly. The paralysis is detected on voluntary movements. On involuntary movements (laughing) the facial movements on the affected side are nearly as good as on the healthy side. The upper facial muscles, orbicularis palpebrarum and frontalis, are only slightly affected. Both eyes can be closed and the wrinkles on the forehead are seen on both sides. But often the eye cannot be closed so tightly on the paralysed as on the healthy side: and whilst the patient is able to close both eyes together, he is often unable to close or open *alone* the eye on the paralysed side.

The tongue when protruded deviates towards the paralysed (hemiplegic) side.

In the limbs all the muscles are not equally affected, and certain muscles remain affected longer than others. The arm is generally more and longer affected than the leg, the peripheral parts more than the proximal.

The paralysis is one of movements and not of separate muscles.

In the arm the muscles most and longest affected are: those which oppose the thumb and the short abductor of the thumb, the supinators of the forearm and the outward rotators of the arm, and the muscles opening the hand (extensor of the fingers and wrist); whilst the muscles which close the hand and rotate the arm inwards are least affected.

In the leg the flexor muscles and dorsi-flexors of the foot are most affected; the plantar flexors, the ilio-psoas and quadriceps least affected. The abductors are much more involved than the adductors. The gluteus medius is especially affected.

Of the trunk muscles only the upper part of the trapezius is markedly affected. On the paralysed side the shoulder droops, and cannot

be raised so high as on the healthy side when the shoulders are shrugged.

Bilaterally associated muscles are supplied by both cerebral hemispheres and are unaffected, or present only a slight and temporary hemiparesis.

At the onset conjugate deviation of the eyes and head towards the side of the brain lesion is often noted. But when unilateral convulsions occur the eyes and head are turned to the side convulsed—*i. e.* away from the side of the brain affected.

The epigastric, abdominal and cremasteric reflexes are lost or diminished on the paralysed side. The conjunctival reflex may be lost on the side of the paralysis. On the hemiplegic side the knee-jerk is usually increased; ankle clonus generally develops, rectus clonus occasionally; and the plantar reflex is of the extensor (or Babinski) type.

Rigidity of the limbs to passive movement often develops, and contracture may occur: the arm tends to assume a position of flexion at the elbow, wrist and fingers, and the leg the extended position.

The paralysed muscles do not atrophy, except from disuse. There is no reaction of degeneration. Hemichorea and hemiathetosis occasionally follow hemiplegia.

There are many points of difference between hysterical and organic hemiplegia. In organic hemiplegia the epigastric, abdominal and cremasteric reflexes are often absent, and the plantar reflex is of the extensor (Babinski) type; these reflexes are normal in hysterical hemiplegia. True ankle clonus does not occur in hysteria. In organic hemiplegia, when the patient is placed on his back with the arms crossed over the chest and asked to rise into the sitting posture, the thigh becomes flexed on the pelvis and the heel raised on the paralysed side, whilst the opposite leg remains stationary or is flexed more slowly and feebly. In hysteria both heels and legs rest on the bed during this movement.

The contraction of bands of muscle fibres of the platysma myoides can be observed, when the patient opens the mouth very widely, on the normal side but not on the side of the hemiplegia, when the paralysis is organic. In hysteria the contraction of this muscle can be seen on both sides.

Other evidences of hysteria are also of diagnostic value.

Sensory Tracts. Sensation is usually not affected in hemiplegia due to lesion of the anterior two-thirds of the posterior limb of the internal capsule, or only slightly and temporarily from indirect pressure on the sensory fibres.

It has been generally taught that lesion of the posterior third of the posterior limb of the internal capsule causes hemianæsthesia. In these cases there is usually hemiparesis or

hemiplegia, and the leg is often more affected than the arm. When the lesion extends backwards to the optic fibres behind the internal capsule or to the posterior and inferior part of the optic thalamus, hemianopsia is produced.

It is important to remember that hemianæsthesia may be due to hysteria, and this cause should always be first considered when motor symptoms are absent, when the hemianæsthesia is complete, and when vision or hearing are affected on the anæsthetic side. Hemianæsthesia due to an organic lesion is almost always incomplete. It is more marked in the limbs than on the face and trunk, and in the arm than in other parts; it is more marked at the distal extremity of the limbs than at the proximal; the different forms of sensation are affected, but often unequally. The type common in syringomyelia is never observed.

Anæsthesia from a cortical lesion has already been referred to. It often affects one limb only, and chiefly the distal part. It is usually associated with monoplegia, Jacksonian epileptic attacks, or aphasic symptoms; deep sensation is more affected than superficial. Probably loss of the stereognostic sense may be caused by a cortical lesion.

Basal Ganglia—

Lenticular Nucleus. A small lesion may cause no symptoms. If larger, the fibres of the internal capsule are affected indirectly and hemiplegia occurs. Usually it is slight and transitory.

Optic Thalamus. On the side opposite to a lesion of the optic thalamus the voluntary movements of the facial muscles are only slightly impaired, whilst there is well-marked paralysis on this side for emotional movements. This condition is the reverse of that seen in hemiplegia from lesion of the internal capsule. Other symptoms observed have been: ataxia or choreic movements of the opposite arm; hemianopsia when the pulvinar has been affected; incomplete hemiplegia when the motor fibres of the internal capsule have been implicated. Déjerine, Thomas and Roussy have described a group of symptoms due to a lesion in front of the pulvinar (in the posterior and inferior part of the external nucleus of the optic thalamus)—

1. Hemiplegia, slight and transitory, without the Babinski reflex and without contracture.
2. Hemianæsthesia (sensation for touch, pain and temperature being usually less affected than deep sensibility for position and movement).
3. Slight hemiataxia, and astereognosis more or less complete.

In addition the following symptoms are usually present—

4. Severe pains, on the anæsthetic side.
5. Chorea or athetosis on the side opposite to the lesions.

The lesion in persistent hemianæsthesia is believed by some neurologists to be usually in the optic thalamus.

Prefrontal Lobe. Motor and sensory symptoms do not occur unless the growth extends to the motor region.

In some cases localising symptoms are absent; in others mental symptoms are prominent and often occur early (mental failure and apathy; slowness in answering questions; mental irritability; drowsiness; mental impairment with cheerfulness and a tendency to jest).

In frontal tumour occasionally there is unilateral loss of smell from affection of the olfactory nerve on the under surface of the frontal lobe; the optic neuritis is occasionally unilateral (on the side of the lesion); in rare cases there is prominence of the eyeball or forehead on the side of the growth; and in some cases there is localised pain and tenderness on percussion of the frontal bone in the region of the tumour. Lesion of the posterior part of the third left frontal convolution causes motor aphasia (according to the common view). Ataxia resembling cerebellar ataxia may be produced by lesion of the frontal lobe. Occasionally the knee-jerks are absent.

When convulsions occur they are general, unless the lesions extend to or very near the motor area.

Parietal Lobe. Lesions of the parietal cortex have caused sensory disturbances (of limited distribution) affecting the muscular and cutaneous sensibility on the opposite side of the body: loss of the stereognostic sense in the opposite hand has also been observed. Lesions on the left side have caused apraxia. Word-blindness is caused by affection of the angular gyrus on the left side.

Temporal Lobe. In the cortex of this lobe are situated centres for hearing (superior temporal convolution) and for smell (uncinate convolution). Probably each ear is connected with both temporal lobes. Temporary impairment of hearing on the side opposite to a unilateral lesion has been recorded; but permanent deafness is caused only by bilateral total destruction of the cortical centres for hearing.

Unilateral destruction of the uncinate lobe produces no definite disturbance of smell. Loss of smell is only caused by bilateral destruction of these cortical centres.

Lesions of the uncinate convolution and anterior part of the temporal lobe have caused seizures (of an epileptic nature) in which the patient experiences a peculiar smell.

Lesions of the superior temporal convolution have caused unilateral or general epileptic convulsions, commencing with an auditory aura. Sometimes there is impaired hearing on the side opposite to the lesion after the fit. When the

lesion affects the posterior part of the first temporal convolution on the left side, word-deafness in its various forms is produced.

By extension or pressure upwards of a lesion commencing in the temporal lobe the fibres from the motor cortex are affected and hemiparesis or hemiplegia may develop.

Island of Reil. According to Wernicke lesions of the island of Reil produce paraphasia (by implicating fibres running between the auditory centre and Broca's convolution).

Occipital Lobe and Optic Tracts. Partial decussation of the fibres of the optic nerves occurs at the optic chiasma. The optic tracts then pass to the posterior part of the optic thalamus (pulvinar), to the lateral geniculate bodies and to the anterior corpora quadrigemina. From these parts fibres pass to the cuneus of the occipital lobe (Gratiolet's fibres). From the anterior corpora quadrigemina, fibres pass to the nucleus of the third nerve; through these fibres the reflex contraction of the pupils to light is brought about. From the cuneus, association fibres pass to the lateral convex surface of the occipital lobe, to the angular gyrus and to the auditory centre.

A lesion of one optic nerve causes blindness of one eye; a lesion of the median part of the optic chiasma causes blindness of the nasal half of each retina and therefore of the temporal half of each field of vision—bitemporal hemianopsia (this is common when a tumour of the pituitary body compresses the chiasma); a lesion of the outer part of the chiasma on each side causes blindness of the temporal half of each retina, and consequently binasal hemianopsia; a lesion destroying one half of the chiasma causes blindness of the eye on the side of the disease and temporal hemianopsia of the other eye; a lesion of the optic tract, of Gratiolet's fibres or of the cuneus lobe of one side causes bilateral hemianopsia—blindness of the right half of each field of vision when the lesion is on the left side and vice versa.

In lesions affecting the optic tract before the fibres pass to the corpora quadrigemina (nucleus of the third nerve) light thrown on to the blind half of each retina does not cause the pupil to contract, whilst they contract when light is thrown on to the other half of each retina. When the lesion is behind the point at which fibres pass to the nucleus of the third nerve (*i. e.* in the fibres of Gratiolet or in the occipital lobe), light thrown on to the blind half of each retina causes the pupils to contract (Wernicke's hemiopic pupillary reaction). A lesion of one cuneus produces hemianopsia, a lesion of both cuneal lobes causes complete blindness, cortical blindness (in both the pupil reflexes are normal). A lesion of both occipital lobes on the convex or external surface, or of fibres from

the cuneus to this part on each side, produces mind-blindness—the patient sees objects, but does not recognize what they are.

A lesion of the angular gyrus, or of the fibres going from the cuneus to the angular gyrus causes word-blindness. If the lesion extends deeply so as to affect the fibres of Gratiolet the symptoms are word-blindness and hemianopsia. A lesion behind the internal capsule may affect the fibres to the cuneus and the sensory fibres in the internal capsule or optic thalamus and cause hemianopsia and hemianæsthesia. A lesion of fibres from the visual centre to the auditory centre may cause optic aphasia—objects seen cannot be named. This symptom occurs in some cases of abscess of the temporal lobe.

Crus, Pons and Medulla.—The fibres of the pyramidal tracts lie close to the nuclei of the third to twelfth cranial nerves. By noting which nerves are spared (*i. e.* those above the lesion) and which are affected the localisation of the disease can be determined.

Crus Cerebri. The characteristic symptoms are paralysis of the third nerve on the side of the lesion, and paralysis of the face, arm and leg on the opposite side. Occasionally there is paralysis of the third nerve on one side, with ataxia or intention tremor of the limbs on the opposite side.

Pons Varolii. The most characteristic signs are paralysis of one or more of the seventh, sixth and fifth cranial nerves on the one side, and of the limbs on the opposite side. The third nerve is not paralysed.

Unilateral lesions at the upper part of the pons cause paralysis of the face, arm and leg on the opposite side; a lesion at the middle or lower third affects the cortical facial fibres after their decussation (which occurs in the pons), and the fibres for the arm and leg before their decussation in the medulla; hence there is paralysis of the face on the side of the lesion and of the arm and leg on the opposite side. Lesions at the lower part of the pons may affect the nucleus of the sixth nerve and cause paralysis of the external rectus. In these cases often there is associated paralysis of the internal rectus of the other eye for lateral movements to the side of the lesion.

In rare cases there is paralysis of the fifth nerve on one side, with hemiplegia, hemianæsthesia or anæsthesia on the opposite side.

Occasional symptoms are vertigo, vomiting, ataxia and trismus.

Irritative lesions (hæmorrhage) may cause marked contraction of the pupils.

Sudden lesions sometimes produce convulsions. A small median lesion may cause anæsthesia of the limbs and trunk on both sides, but usually only deep sensibility is affected.

Medulla Oblongata. The most important symptoms are paresis or paralysis of the muscles of articulation, phonation and deglutition, with circulatory and respiratory disturbances.

The third, fourth, fifth and sixth cranial nerves are not paralysed.

A lesion of one pyramidal tract causes paralysis of the limbs of the opposite side. When both tracts are affected all four limbs are paralysed.

Lesions of the restiform body cause hemi-ataxia. Lesions of the olivary body cause disturbance of equilibrium and involuntary movements. Lesions of the side of the medulla may cause unilateral paralysis of the tongue, vocal cord, soft palate and sterno-mastoid.

Corpora Quadrigemina. According to Nothnagel if other general symptoms of brain tumour are present, the growth involves the region of the corpora quadrigemina when (1) ataxia (of the cerebellar form) appears as an early symptom and is associated with (2) ophthalmoplegia, bilateral and more or less complete.

Cerebellum

Localising symptoms may be absent, especially when the lesion is in the lateral lobes. The characteristic symptom of cerebellar disease is a reeling or ataxic gait, like that of alcoholic intoxication, not increased when the eyes are closed. In lesion of the middle lobe there may be a tendency to fall forwards or backwards.

Other symptoms are unsteadiness and atony of the limbs on the side of the lesion, vertigo, and paresis of the sixth cranial nerve (on the side of the lesion). Usually nystagmus (lateral) is present.

Rapidly alternating movements, such as pronation and supination of the wrist, may be awkwardly and irregularly performed in the arm on the side of the lesion (adiadocoinésie of Babinski). There is also sometimes a peculiar tendency for the head and trunk to lag behind when the patient is attempting to walk forwards.

In tumour there is frequently pain on pressure over the occiput—most marked on the side of the lesion.

A lesion of the superior, middle or inferior cerebellar peduncles causes rotation round the vertebral axis, or a forcible impulse to assume a fixed position.

R. T. W.

APHASIA

In the large majority of right-handed people there are certain speech centres situate in the cortex of the left side of the brain, which may be divided roughly into motor and sensory. These centres are assumed to be connected by commissures, or conduction paths (see Fig. 1),

and the motor speech centres are connected by pyramidal fibres, through the genu of the internal capsule, to the medullary and spinal

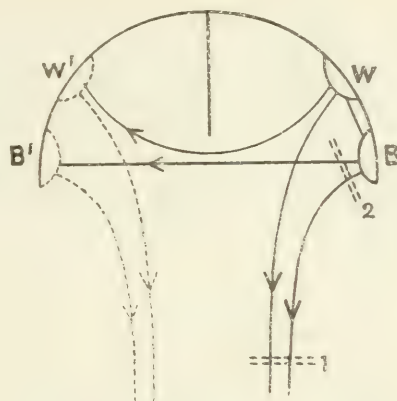


FIG. 1.—Diagram to illustrate Lesions.

B, Broca's Convolution; W, Motor Writing Centre.

motor nuclei, for the articulatory and writing movements.

Lesions in either of these cortical centres or of their conduction paths will produce various clinical forms of aphasia, or interference with speech, often associated with a right hemiplegia. In some left-handed people the speech centres are in the right hemisphere, and aphasia may then accompany a left hemiplegia.

Lesions (1) of the pyramidal fibres in the internal capsule or conduction path from the cortical motor nuclei to the medullary and spinal nuclei produce only a mechanical interference with articulation, and this form of speech interference is not termed aphasia, but anarthria or aphemia. The main motor centre is Broca's centre at the posterior end of the left third frontal convolution; lesions of this centre, B, produce motor aphasia and agraphia, the patient being practically dumb, with complete inability to write, even with the left hand, or to make words by picking out block letters. Of late years Marie has tried to discredit Broca's centre, in its place ascribing motor aphasia to lesions in an arbitrary "quadrilateral" close to the island of Reil; his theory, however, is generally repudiated.

The motor-writing centre, W, whose existence is somewhat speculative, is presumably situate in the hand centre in the left ascending frontal convolution. Lesions of these motor centres affect the intelligence only slightly, though the patients are usually emotional. The curious phenomenon frequently remarked with these lesions is that, though volitional spontaneous speech or repetition may be totally lost, yet ejaculations or oaths may be produced under the stress of emotion, or phrases such as the

Lord's Prayer, or songs learned in childhood and stereotyped upon the brain by frequent repetition may be repeated or even sung. It is thought that such stereotyped speech may originate from corresponding speech centres in the right hemisphere. In not a few patients with motor aphasia the phenomenon of recurring utterance is seen, that is to say, all attempts to speak on the part of a patient or to reply to questions produce the same word or set of syllables, often gibberish, and in any case inappropriate. These patients are able to hear and understand perfectly, and can also read and

organic lesion, and by the presence of hysterical stigmata.

The chief sensory centre is Wernicke's auditory word centre, *A*, situate in the posterior portion of the superior temporal convolution. Lesions of this centre will produce auditory amnesia, or loss of memory of words, and word deafness or inability to understand spoken words in uneducated persons and in others whose knowledge of things has been acquired by ear much more than by books. A lesion in this auditory centre will also entail comparative inability to read and write.

The auditory centre is assumed to be connected with Broca's centre by a commissure, *AB*, passing beneath the island of Reil, and a lesion (3) of this commissure would prevent the transmission to the executive Broca's centre of orderly speech and sentences originated in the auditory or word-memory centre. Partial damage of this centre, *A*, or of its commissure, *AB*, will produce the symptom known as paraphasia, in which mistakes in the use of words are made. Such a conduction aphasia will thus produce a jargon-aphasia which will be recognized as such by the patient, and the power of writing will be unimpaired. A sub-cortical lesion (4) below the auditory word centre may cut off its commissures from the centre for hearing on the same side, and the corresponding auditory centre, *A'*, in the right hemisphere; this will produce word-deafness and more or less jargon-aphasia. Such a patient will be unable to understand spoken language, hearing words as sounds only.

The visual word centre, V , is situated in the left angular gyrus; this is connected both to the auditory and writing centres, VA , VW ; it also receives commissures from the two half-vision centres in the occipital lobes, $V-Occ$. Lesions of the visual word centre will produce inability to read (alexia), or to write, with difficulty in naming objects at sight, though these may still be recognized. A partial lesion of the visual centre will induce mistakes in reading, and especially the occasional use of wrong words and other mistakes in writing—paraphasia.

A sub-cortical lesion below the left angular gyrus (5) will produce pure word-blindness, with right hemianopia owing to the lesion involving the left optic radiations. Such a patient may be able to write, though unable to read what he has just written. Word-blindness is sometimes due to congenital defect of the centre, so that reading or writing are impossible of acquirement, though the intelligence may otherwise be good. Though letters and words in these cases convey no meaning, numerals and figures may be appreciated properly.

The lesion (6) of the conduction path in the

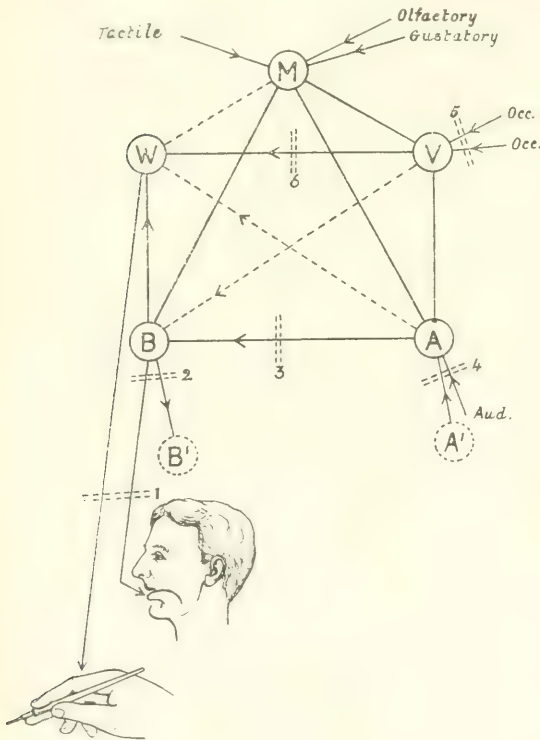


FIG. 2.

A, Wernicke's Auditory Word Centre; B, Broca's Word Centre; A¹, Right Auditory Centre; V, Visual Word Centre; W, Writing Centre; M, General Intellectual Centres.

signify their wishes very clearly by signs, and they are fully aware of the grotesqueness of their attempts at speech.

An interesting variety of motor aphasia is dumbness without agraphia, which may be produced by a sub-cortical lesion (2) close to, but not destroying Broca's centre, but cutting off its pyramidal fibres to the internal capsule and its commissure through the corpus callosum to the corresponding cortex, B¹, in the right third frontal convolution (see Fig. 2). This condition is to be distinguished from hysterical mutism by the absence in the latter of other signs of

superior parietal lobe, from the visual to the writing centre, *VW*, may produce pure agraphia. On the whole, intelligence suffers much more in cases of lesion of the sensory centres, especially of the auditory word centres, than when the damage is limited to Broca's. A valid will may probably be executed with lesions of either the auditory or visual centres singly, but when both are destroyed the intelligence will almost certainly be too seriously interfered with for the proper understanding of a legal document. All these centres are connected by commissures with the general intellectual centres, *M*, so that they act in conjunction with the brain as a whole. In deaf-mutes the auditory centre being undeveloped, the visual centre must be directly connected with Broca's, *VB*, and in congenital blindness the auditory centre must be directly connected with the writing centre, *AW*.

Apraxia is a condition allied to motor aphasia, in which there may be complete inability to perform even simple movements with one or other hand, more frequently the left, even in the absence of any weakness. It is due to the sensorimotor centres in the left frontal lobe being dominant over those on the right side; hence lesions of the callosal fibres between them may cause apraxia of the left hand, with right hemiplegia.

Agnosia is comparable to sensory aphasia, and includes visual, tactile, auditory and other special sense agnosias. Thus an object may be seen and not recognized; sounds may be audible but not understood. The lesion is usually in the lateral parieto-occipital region.

The symptoms of aphasia are often permanent, though in the majority of cases there is slight steady improvement, owing to the initial lesion having temporarily paralysed the functions of the neighbouring centres by diaschisis. One view holds that in chronic cases considerable recovery may be due to re-education of the corresponding centres in the right hemisphere.

The rarity of aphasia in children is pointed out in favour of this hypothesis, but even in them aphasia is sometimes permanent.

W. H.

CEREBRAL VASCULAR DISEASES

1. **Cerebral Hæmorrhage.**—The onset is sudden, but premonitory symptoms (headache, vertigo, drowsiness, etc.) sometimes occur. In many cases the condition commences with sudden loss of consciousness; in others syncope symptoms occur first and are followed later by coma; occasionally there are convulsions at the onset; sometimes hemiplegia or other symptoms develop suddenly without loss of consciousness. During the coma the face is often flushed. The pulse is full and of

high tension, at first it is slow, later quick. The temperature often sinks one or two degrees, but rises to normal or above normal later.

Often signs of hemiplegia can be detected during the coma. When the limbs are raised and suddenly allowed to fall they *slowly* sink down on one side, but fall down at once like a heavy weight on the other (paralysed side). In severe hæmorrhage all the reflexes may be lost on both sides; but later, if not at first, the epigastric, abdominal and cremasteric reflexes are lost and the plantar reflex is of the extensor type (Babinski reflex) on the paralysed side, whilst these reflexes are normal on the other side. When a fatal termination is approaching the pupils fail to react to light and Cheyne-Stokes's breathing is often observed.

When the comatose stage has passed signs of an organic lesion can be more clearly detected. Of these hemiplegia is the most common because the internal capsule is so frequently affected directly or indirectly. (For detailed description see article on cerebral localisation.) The loss of the superficial reflexes on the paralysed side, already described, often continues for some time after the coma has passed. Also on the paralysed side the knee-jerk becomes increased, ankle clonus develops, the plantar reflex is of the Babinski type, and Oppenheim's reflex is often present. A spastic condition of the paralysed limbs gradually develops; the muscles do not present any reaction of degeneration on electrical examination, and, with rare exceptions, wasting of the muscles does not occur, except simply to a slight extent from disuse. Temporary aphasia is often present when the hæmorrhage affects the left internal capsule; permanent aphasia when the lesion is in or near Broca's convolution.

Sensation is normal, or only slightly and temporarily diminished, in the common form of hemiplegia, which is caused by hæmorrhage from the lenticulostriate artery. But in lesions posterior to the region of the lenticulo-optic artery hemianæsthesia is associated with the motor affection. When the lesion extends backwards to the fibres of the optic tracts, or when it is in the occipital lobe, hemianopsia occurs. (For symptoms of hæmorrhage in the pons, crus or other parts, see article on cerebral localisation.) Occasionally post-hemiplegic chorea or athetosis develops after cerebral hæmorrhage.

2. **Cerebral Softening (Embolism and Thrombosis).**—The symptoms develop suddenly and are similar to those of hæmorrhage; but the high tension and slowness of the pulse, so common at the onset of hæmorrhage, do not occur; the fall of temperature is less marked; and loss of consciousness is not so frequent as in hæmorrhage. Occasionally convulsions occur at the onset.

Premonitory symptoms (headache, vertigo, drowsiness, etc.) are frequent in thrombosis, rare in embolism. In syphilitic thrombosis severe headache, usually worse at night, is very frequent. The middle cerebral artery, or one of its branches, is most frequently obstructed: hence hemiplegia (or monoplegia) is a common result. Aphasia, with or without hemiplegia, often occurs in softening on the left side of the brain. It may be total or partial (motor aphasia, or word-blindness or word-deafness, etc.). Obstruction of the posterior cerebral artery produces hemianopsia. Softening limited to the posterior parietal region may produce simply loss of the stereognostic sense in the opposite hand. Occasionally extension of the obstruction to the central artery of the retina (embolism or thrombosis) produces the characteristic ophthalmoscopic signs (white patch in the centre of the fundus with cherry-red spot at the macula). Later optic atrophy may develop, causing blindness on the side of the lesion, whilst there is hemiplegia on the opposite side (when the middle cerebral artery is also obstructed).

Diagnosis. 1. *During Coma.* Cerebral hæmorrhage and softening have to be diagnosed from unconsciousness due to other causes.

Evidence of head injury should lead to a consideration of the possibility of cerebral concussion, compression or fracture of the skull.

In the diagnosis from syncope, poisoning by opium and narcotics, uræmia, diabetic coma, post-epileptic coma, and alcoholic intoxication, the presence of unilateral symptoms is very important. Such symptoms are very frequent in cerebral hæmorrhage and softening, but do not occur in the affections just mentioned (except, perhaps, in very rare instances in uræmia, as uræmic hemiplegia).

If the limbs, when raised and allowed to drop, fall down at once like a heavy weight on one side, but slowly sink down on the other, or if the epigastric, abdominal and cremasteric reflex are lost and a Babinski plantar reflex is present on one side only, these are unilateral signs in favour of hæmorrhage or softening and against the other affections just named.

In favour of syncope would be the very feeble pulse, great pallor of the face and lips, and short duration of unconsciousness. In poisoning by opium and its alkaloids the pupils are markedly contracted.

The following points would be in favour of uræmia—well-marked œdema and albuminuria, albuminuric retinitis, absence of unilateral symptoms, gradual onset of coma often with convulsions.

In diabetic coma of the common type the urine contains sugar in large or considerable quantity, and gives a claret coloration with per-

chloride of iron; the pulse is rapid and feeble; dyspnoea is marked (deep respiration).

(The diagnosis of uræmia or diabetic coma should not be based simply on the presence of traces of albumin or sugar in the urine.)

In post-epileptic coma there is often blood-stained saliva on the lips, and the tongue is frequently bitten. The onset is sudden and there is often a history of previous epileptic convulsions.

The diagnosis of alcoholic coma should not be based simply on the smell of alcohol in the breath; it should not be made unless careful examination fails to reveal unilateral signs and evidence of all of the affections already mentioned.

2. *If the patient is first seen when the coma has disappeared*, or if consciousness has not been lost, it is necessary to examine carefully for signs of organic cerebral lesions—hemiplegia, hemianæsthesia, unilateral changes in the superficial reflexes, aphasia in its various forms, loss of the stereognostic sense in the hand, and for hemianopsia, which is so often overlooked. If such signs are detected it is then necessary to consider the nature of the cerebral lesion causing them. If these symptoms have developed quite suddenly, hæmorrhage, embolism or thrombosis are the most probable causes. The onset with loss of consciousness is a little in favour of hæmorrhage; onset without loss of consciousness a little in favour of embolism or thrombosis. Under the age of forty, embolism and syphilitic thrombosis are the most common causes; over forty, hæmorrhage or thrombosis in atheromatous arteries. Signs of cardiac valvular disease would be in favour of embolism; evidences of past syphilis in favour of thrombosis. High-tension pulse, hypertrophy of the left ventricle, accentuation of the aortic second sound, albuminuria or chronic Bright's disease, onset during the day or when the patient is excited, would all be points in favour of hæmorrhage. A feeble pulse, feeble heart's action, onset during the night or when the circulation is feeble, would be points in favour of thrombosis.

In intracranial tumour severe headache and vomiting are common; optic neuritis, usually double, occurs in about four-fifths of the cases. If paralysis occurs it usually develops *very gradually*.

In cerebral abscess there is a primary focus of suppuration in some other part of the body (ear, nose, lungs, etc.), severe headache is common, optic neuritis occurs in some cases, but not so frequently as in tumour. The symptoms do not develop suddenly.

Treatment. In cerebral hæmorrhage the patient should be disturbed as little as possible. The shoulders and head should be slightly raised. All tight clothing about the neck should be removed. An ice bag may be applied to the

head and hot-water bottles (surrounded by a blanket) to the feet. To lower arterial tension and direct blood from the brain to the portal system strong purgatives may be given when the pulse is good (one or two minims of croton oil with four minims of glycerine, or five grains of calomel). The bowels should be kept regular and the catheter used if necessary.

For meningeal hæmorrhage surgical treatment may be required (see article on head injuries). In syphilitic thrombosis mercury and iodide of potassium should be given. In thrombosis from other causes and in embolism drugs which will improve the circulation are indicated—digitalis, strophanthus, strychnine.

In the after-treatment of the hemiplegia an attempt should be made to diminish contracture and deformity by passive movements, by massage, and by weak Faradism applied so as to cause contraction only of those muscles which are the opponents of the muscles in which the greatest contracture occurs. R. T. W.

INTRACRANIAL TUMOURS

(Including gummata, tubercular masses and cysts.)

The *symptoms* are general and local. The most important of the former are headache, vomiting and optic neuritis.

In about four-fifths of the cases optic neuritis (generally double) is present. Headache is usually a prominent symptom and vomiting occurs in most cases at some period.

Less constant general symptoms are slowness of the pulse, mental failure and general convulsions. Localising symptoms vary with the situation of the growth and are described in the article on *Topical Diagnosis of Brain Diseases*.

Of most practical importance are those caused by tumour in the motor cortex. Growths in this region cause unilateral convulsions, *i. e.* convulsions commencing in one limb or one side of the face (monospasm) and remaining limited to one side, or becoming bilateral only at the end of the fit. In these attacks consciousness is not lost, or lost only at the end of the fit. Paresis of one limb *gradually* develops and progresses to monoplegia, and finally hemiplegia may occur. Observation of the part first convulsed in the fits, or of the part first paralysed, is of great localising value.

In cerebellar tumour optic neuritis almost invariably occurs. Ataxia occurs if the middle lobe is affected; but it may not develop until a late period of the disease when the growth is in one lateral lobe.

Tumours at the cerebellar-pontine angle (arising usually from the auditory nerve) cause first auditory symptoms—impaired hearing,

deafness, vertigo, noises in the ear, inco-ordination; general symptoms of growth develop—double optic neuritis, headache, vomiting; then the following symptoms may occur—affection of the seventh, sixth, and fifth nerves and nystagmus.

Tumours at the base of the skull or brain cause the general symptoms of growth and affect also the cranial nerves in the region of the disease.

Tumours of the pituitary body, and in the region thereof, produce, in addition to the general symptoms of growth, bitemporal hemianopsia at the early stage, followed by complete blindness of one or both eyes. Usually ophthalmoscopic examination reveals optic atrophy, seldom optic neuritis. Other symptoms which have been observed are obesity, glycosuria, polyuria, mental impairment and hypoplasia of the genital organs.

Examination with the X-rays may show great dilatation of the sella turcica. When the tumour is an adenoma of the anterior lobe of the pituitary body acromegaly occurs. Other forms of pituitary tumours do not cause acromegaly (Fischer).

Diagnosis. The eyes should be examined with the ophthalmoscope in all cases of suspected intracranial tumour and all serious or obscure brain affections. In cerebral hæmorrhage and softening optic neuritis does not occur, and the onset of paralysis or symptoms is sudden; whilst in cerebral tumour optic neuritis occurs in about four-fifths of the cases and paralysis or other signs nearly always develop *gradually*.

In rare instances cerebral tumour causes hemiplegia without optic neuritis; but in these cases the *very gradual* onset of the paralysis is characteristic.

Intracranial abscess causes headache, vomiting and optic neuritis, but the neuritis is not so common as in tumour. In favour of abscess would be evidence of a primary source of suppuration (in the ear, nose, orbit, lungs, etc.).

Headache, vomiting and optic neuritis (with or without albuminuric retinitis) may occur in chronic Bright's disease; and the case is sometimes diagnosed as one of cerebral tumour; but symptoms of localised lesion of the nervous system are absent, and examination of the urine and cardio-vascular system reveals marked signs of chronic Bright's disease. (In all cases of optic neuritis the urine should be examined for signs of Bright's disease.)

In rare instances optic neuritis with headache is caused by "encephalitis" from lead poisoning, but in these cases the blue line on the gums and other evidences of plumbism indicate the diagnosis.

"Serous meningitis of the ventricles" may cause the general symptoms of tumour, including

optic neuritis. But in "serous meningitis" localising symptoms are absent, remissions and intermissions in the symptoms often occur, and the illness is usually of longer duration than in tumour.

Treatment. Antisyphilitic treatment should be given in all cases at first, unless there has been no exposure to the risks of syphilitic infection. The general treatment for tuberculosis is indicated when it is probable that the tumour is tubercular. For the relief of headache the following drugs may be of service: antipyrin, pyramidon, phenacetin, aspirin and caffeine. When very severe morphia may be necessary. An ice bag applied to the head sometimes relieves the headache.

Trephining of the skull—without attempting to remove the tumour—often relieves headache and may cause the optic neuritis to subside.

When the diagnosis and localisation are clear surgical treatment should be considered. The results are unfortunately usually very unsatisfactory. But in rare cases permanent success is obtained. Early localisation is important. The best results have been obtained in growths in the motor cortex and at the cerebellar pontine angle. In some cases presenting the symptoms of tumour (chiefly cerebellar) a cyst has been found on operation and successfully treated.

When possible the operation for brain tumour should be performed by a surgeon who has had special experience of brain surgery.

R. T. W.

HYDROCEPHALUS

Hydrocephalus may be divided into congenital and acquired forms. The pathology of the acquired forms shows they are clearly due to obstruction to the normal exit of the cerebro-spinal fluid from the fourth ventricle. The pathology of the congenital form has not been demonstrated; it is also probably due to obstruction. This condition may originate in foetal life, and the head may be so large as to obstruct labour, necessitating perforation of the head. The normal circumference of the new-born child's head is fourteen to sixteen inches, and the signs of hydrocephalus may develop rapidly after birth, the circumference reaching twenty-five to forty inches or even more. The forehead becomes very prominent, and the swollen appearance of the vault of the skull above the thin peaky face is characteristic.

The sutures are separated and the fontanelle enormous. Not infrequently the condition is combined with spina bifida. Exophthalmos and depression of the eyeballs develops in the later stages, the children being usually imbecile, ill-developed and weak in the limbs. Spastic paralysis and epilepsy are common sequelæ,

and the intelligence is very rarely normal. The ventricles of the brain are enormously dilated, the overlying brain substance with the cortex often being extremely thin.

Treatment. Puncture of the ventricles under careful asepsis, followed by compression of the skull by strips of plaster. Lumbar puncture is almost invariably a failure.

Acquired Hydrocephalus may be divided into acute and chronic. The acute form is due to meningitis, which may be either tubercular or serous; it is important to distinguish the two clinically, as treatment by lumbar puncture often brings about rapid cure in the serous variety. In this form there is no occlusion of the proper channels and lumbar puncture will directly relieve the distended ventricles, the fluid being often found under great pressure. The fluid itself contains few cells and no organisms, with less albumin than in the tuberculous variety. The excessive secretion of fluid by the choroid plexuses distends the ventricles, causing flattening of the convolutions against the skull, though the acuteness of the meningitis masks the symptoms of hydrocephalus.

Obstruction to the outflow of cerebro-spinal fluid along the aqueduct by a median tumour of the pons or pineal body, or the downward pressure of a cerebellar tumour upon the fourth ventricle will lead to acquired hydrocephalus with great dilatation of the third and the two lateral ventricles. The symptoms are often intermittent, paroxysmal headache, torpor or coma; while partial or complete blindness from pressure of the distended third ventricle downwards upon the optic chiasma, together with the signs of commencing optic neuritis, will suggest the diagnosis.

The most important cause of acquired hydrocephalus is, however, posterior basic meningitis, the endemic form of cerebro-spinal meningitis. This disease is acquired in early infancy or in later childhood, and the meningitis may be recovered from, though hydrocephalus may result from obliteration of the normal exits for the cerebro-spinal fluid from the fourth ventricle into the sub-dural space. Imbecility or idiocy results, with varying grades of spastic paralysis, blindness from optic atrophy, and epilepsy. Lumbar puncture may be tried in these forms, and is sometimes of great service, but no trephining operation should be undertaken.

External Hydrocephalus is the accumulation of fluid in the sub-arachnoid spaces on the cortex, and is due to senile atrophy and other wasting diseases.

W. H.

ACUTE ENCEPHALITIS

The inflammation which occurs in the part of the brain immediately subjacent to the

inflamed meninges in meningitis does not require separate consideration, and suppurative encephalitis is considered under the head of *Cerebral Abscess*. For the acute inflammation of the grey matter of the brain, which is due to the same infection as acute poliomyelitis and may occur in association with that condition, *vide Poliomyelitis*. This article will be confined to the consideration of **Acute Hæmorrhagic Encephalitis**.

Etiology. Acute hæmorrhagic encephalitis occurs most commonly in young children as a sequel to acute fevers, especially measles, scarlet fever, diphtheria and pneumonia, and less frequently after influenza in both adults and children.

Symptoms. The acute symptoms are generally preceded by headache and irritability lasting for one or two days. The patient then suddenly becomes unconscious, but rarely so comatose that the pupillary light reflex and skin reflexes disappear. Delirium and general or unilateral convulsions may occur, the temperature is high and the pulse and respiration accelerated. When death does not occur within twenty-four hours, paralysis may develop and optic neuritis is common. There may also be pontine, bulbar or cerebellar symptoms.

Diagnosis. The absence of symptoms indicating meningeal irritation and the normal cerebro-spinal fluid help to distinguish acute encephalitis and meningitis. In the absence of localising symptoms it is often impossible to diagnose encephalitis from the cerebral symptoms, which may occur as a result of the toxæmia of the acute fever without any actual inflammation being present.

Prognosis. Acute encephalitis is frequently fatal, death occurring in less than twenty-four hours or as late as twenty days after the onset. On the other hand, recovery may be complete, but more frequently some permanent defect remains in the nature of spastic monoplegia, hemiplegia or diplegia, athetosis, or choreiform movements, and mental deficiency.

Treatment. The patient should be kept as quiet as possible during the acute stage; no other treatment has any effect upon the course of the disease. A. F. H.

CEREBRAL ABSCESS

Etiology. The most common cause of cerebral abscess is chronic otitis media, the temporo-sphenoidal lobe or cerebellum being affected. It may also occur as a sequel of suppuration in the nose and accessory sinuses, and much less frequently as a result of acute osteomyelitis of the skull, infected wounds, and carbuncles and erysipelas of the scalp.

General infections may give rise to "meta-

static" cerebral abscesses, which are frequently multiple, the most common sources of infection being chronic empyema and bronchiectasis.

Symptoms. The first symptoms are headache and irritability; the latter is soon replaced by somnolence, the patient becoming lethargic, with slow cerebration. This condition gradually increases until unconsciousness and finally coma supervene. The pulse tends to be slow compared with the temperature, which is rarely high and may be normal, except when the cerebral abscess is complicated by sinus thrombosis, in which case it is pyæmic in character. Vomiting may occur, especially with cerebellar abscess, and there may be marked emaciation. Optic neuritis often occurs in the late stages, but it may be absent throughout. The cerebro-spinal fluid may be under increased pressure, but is otherwise normal, unless meningitis is present.

For the localising symptoms, which indicate the seat of the abscess, *vide Cerebral Tumour*.

Diagnosis. The possibility of intracranial suppuration should always be considered in cases of chronic otorrhœa in which headache, irritability or other mental change, or vomiting suddenly develops, especially if the discharge simultaneously ceases. In suppurative meningitis the course is generally more rapid, the temperature higher and the pulse faster, and the cerebro-spinal fluid contains leucocytes and organisms; ocular paralyses are common, the neck is rigid and Kernig's sign is present. In infective sinus thrombosis the temperature is pyæmic and rigors occur; the pulse is rapid and irregular, tenderness is present over the jugular vein, and there may be œdema behind the mastoid process.

Prognosis and Treatment. Death always occurs unless the abscess is opened and drained. The results of operation are good when the abscess is due to a local infection; but in metastatic cases the outlook is less hopeful, as more than one abscess is frequently, though not invariably, present. A. F. H.

DISEASES OF PERIPHERAL NERVES

Neuritis.—Although the termination "itis" is often regarded as indicating inflammation, it is customary to describe certain degenerative as well as inflammatory conditions of peripheral nerves as neuritis. Changes in the spinal cord are often present, but so long as they are less prominent than those in the nerves, the term neuritis can legitimately be employed.

1. **Local Neuritis.**—Local neuritis may affect any nerve, the sciatic, facial and brachial being most commonly involved.

Etiology. Gout, muscular rheumatism and chronic intoxication with poisons, such as alcohol and the toxins of influenza, diabetes and

pyorrhœa alveolaris, which sometimes give rise to polyneuritis, make individual nerves abnormally susceptible to inflammation and degeneration. Neuritis results from the direct spread of inflammation from neighbouring tissues; this is rare in acute conditions, but common in chronic inflammations of joints, as in gout, osteo-arthritis and rheumatoid arthritis, and of fibrous tissues, as in muscular rheumatism. Exposure to cold, compression from injuries, a crutch or splint, a cervical rib or a tumour, excessive traction, as in parturition, and prolonged muscular strain may lead to neuritis.

Symptoms. Pain and tenderness along the course of the nerve and in the area it supplies are the most common symptoms. Paralysis of the muscles supplied by the affected nerve is often, though not invariably, present; in severe cases it is followed by atrophy and changes in the electrical reactions. Tendon phenomena, depending upon a reflex arc formed in part by the inflamed nerve, disappear, even if there is no paralysis or anæsthesia.

More or less anæsthesia is common and may be preceded by hyperæsthesia. Vasomotor paralysis and trophic changes occur in severe cases, the skin becoming red, shiny and atrophied; vesicles, bullæ and ulcers form; the nails become brittle, the hair falls and atrophic changes occur in the bones and joints.

Diagnosis. Neuritis should never be diagnosed until every other cause of pain has been excluded. A common mistake is to diagnose brachial neuritis in cases of osteo-arthritis of the shoulder and sciatica in osteo-arthritis or tuberculosis of the hip. These mistakes can be avoided by examining all joints near the seat of pain. The presence of neuritis in addition to chronic joint disease can only be recognized if the nerve is tender, anæsthesia is present or changes in the electrical reactions occur, as atrophy and pseudo-paralysis frequently occur in the muscles surrounding a diseased joint. A similar difficulty arises in the case of muscular rheumatism, which may also simulate neuritis as well as being sometimes associated with it. A diagnosis can often be made from a consideration of the exact localisation of the pain and tenderness, and anæsthesia and muscular atrophy, which are common in neuritis, never occur in muscular rheumatism. Referred pain and cutaneous and deep tenderness due to visceral disease may simulate neuritis, but the areas involved correspond with those supplied by spinal segments and not by peripheral nerves; anæsthesia, atrophy and paralysis are absent, and spasm rather than atony is present. After excluding all other causes of pain, the distinction between neuritis and neuralgia requires consideration. The

latter should only be diagnosed when pain is present in the absence of tenderness and all evidence of impairment in the functions of the affected nerve.

Prognosis. The prognosis is good if the cause can be removed, but the same or other nerves are liable to be recurrently affected in cases depending upon some toxic influence which cannot be permanently eradicated. With slight variations the prognostic signification of the electrical reactions in facial paralysis (*q. v.*) apply to neuritic paralysis in other situations, so long as the cause of the neuritis is no longer effective.

Treatment. Every effort should be made to discover the cause of the neuritis, as until this is removed treatment can only be symptomatic. Complete rest for the affected part is essential, and for this purpose it is often necessary to keep the patient in bed with the limb fixed by bandages or splints until all pain and tenderness have disappeared. Even then the return to activity should be gradual.

The part should be kept as warm as possible, and the daily application of radiant heat often relieves the pain. Drugs, the most efficacious of which are acetyl-salicylic acid, pyramidon, quinine, phenazone and phenacetin, are, however, frequently required, but morphia should never be given. Anodal galvanism often gives relief, and its effect can be greatly increased by soaking the anode in two per cent. quinine bichloride; in some cases cataphoresis with salicylic acid or iodine is more effective, but with these drugs the cathode must be applied to the painful part. In some cases the application of high-frequency currents gives more relief to pain than any other treatment.

Paralysed muscles must be kept in as good condition as possible, so that when the nerve recovers the muscle fibres will be in a proper state to respond to the first impulses which reach them. For this purpose massage and electricity in the form of galvanism or, when the muscle responds to faradism, combined galvanism and faradism, should be employed, but only after the acute stage has passed, and neither should ever be pushed to the point of causing pain. Passive movements are of the utmost importance, as otherwise the joints upon which the paralysed muscles act become stiff and contractures with consequent deformities result. If they are properly carried out it never becomes necessary to perform tenotomies or other orthopædic operations at a later stage. Recovery takes place far more rapidly in a relaxed than in a stretched muscle; the limbs should therefore be kept by appliances of some sort in such a position that the contraction of the healthy muscles and consequent over-stretching of the paralysed muscle is counteracted. As

soon as voluntary power begins to return the patient should be encouraged to perform active movements several times a day; these can often be commenced at an earlier stage if the limb is placed in water.

2. Polyneuritis (Multiple, Symmetrical, Peripheral, Toxic Neuritis)—

Etiology. Whereas a local neuritis is due generally to a local cause, multiple and symmetrical neuritis is due to abnormal conditions of the blood, which act simultaneously and equally on the nerves of both sides of the body. All cases of polyneuritis are probably toxic in origin, though in many cases the nature of the toxin cannot be discovered. Alcohol, lead and arsenic are the chief exogenous poisons causing polyneuritis, but mercury, copper, zinc, silver, phosphorus, carbon bisulphide, ether and aniline compounds can produce the same result. The toxins of most specific infections may give rise to polyneuritis, the post-diphtheritic form being much the most common. The polyneuritis which has been ascribed to malaria, gout and nephritis is probably really alcoholic, though the toxins of these diseases may make the nerves abnormally vulnerable to alcohol. "Phthisical polyneuritis" is sometimes alcoholic and sometimes due to the mixed infection of the lungs, and the neuritis occurring in cancer is probably also due to secondary infection. The neuritis of pernicious anæmia and leukaemia is generally, though not always, due to arsenic given as medicine. A mild form of polyneuritis may occur in pregnancy and in the puerperal period. Polyneuritis not infrequently develops with acute gastro-intestinal symptoms, the poison concerned being probably produced in and absorbed from the intestine. Exposure to cold and wet and over-fatigue sometimes precede the onset of neuritic symptoms, which are often accompanied by signs of general infection; such cases are probably infective, the patient's resistance having been lowered by the exposure or fatigue. "Senile polyneuritis" is probably due to deficient blood supply resulting from atheroma.

Symptoms. The motor, sensory, vasomotor and trophic symptoms of polyneuritis have the same general characteristics as those already described in connection with local neuritis, except that the symptoms are bilateral and the parts supplied by several nerves instead of a single nerve are often, though not invariably, affected. Different poisons tend to pick out special nerves and to attack particularly the motor or sensory fibres of a mixed nerve; the motor fibres going to certain muscles are also more often affected than those going to others supplied by the same nerve. The commonest type of polyneuritis is that in which motor and sensory symptoms occur together, the chief

examples of this being alcoholic and arsenical neuritis. Other poisons, such as lead and the diphtheritic toxin, produce a neuritis in which motor symptoms predominate or are present alone, whilst less frequently sensory or vascular symptoms are most conspicuous.

Alcoholic Neuritis occurs especially in spirit-drinkers, and the severe forms are particularly common in women. It affects the legs more than the arms, which often escape completely. Severe pain and tenderness are generally present and may occur without other symptoms. Numbness and more or less anaesthesia are frequently present, and trophic changes may occur. The tendo-Achillis jerks are always, and the knee-jerks are often, lost, and sometimes no other evidence of neuritis is present; this latent form is particularly common in patients with heart-failure due to alcohol. Paralysis chiefly affects the dorsi-flexors of the ankle, the foot being dropped and a "steppage gait" resulting; the extensors of the wrist and fingers are generally paralysed when the arms are involved. In severe cases almost all the muscles in the body may be paralysed, and death may occur from respiratory paralysis. Tachycardia is common owing to vagal neuritis. In some cases ataxy is the most prominent symptom, the diagnosis from tabes depending upon the tenderness of the calves in contrast to the analgesia present in tabes.

Arsenical Neuritis occurs most frequently in patients who have taken arsenic for long periods as medicine; it has also resulted from the accidental contamination of beer, and in individuals whose work brings them in contact with arsenic. The symptoms closely resemble those of alcoholic neuritis. Arsenical neuritis should be suspected when pigmentation of the skin and hyperkeratosis of the palms and soles is present. In doubtful cases the hair and epithelial scales should be examined for arsenic.

Lead Neuritis occurs in plumbers, painters and other individuals who work in lead, and also as a result of drinking contaminated water, beer or cider. It generally gives rise to purely motor symptoms, the musculo-spiral nerves being most frequently affected; the paralysis of the extensors of the wrist, thumb and fingers causes the wrists to be dropped and the fingers flexed. The supinator longus escapes. Much less frequently the deltoid is affected together with the muscles of the arm, and still less frequently the small muscles of the hand. In severe cases the legs may be paralysed as well as the arms, but generally less severely, the peronei and anterior tibial muscles being chiefly affected.

Diphtheritic Neuritis occurs much less frequently when antitoxin has been given early than when there has been delay or none has been given at all. It does not otherwise depend

upon the severity of the infection. The earliest and most common symptom is paralysis of the soft palate; the voice becomes nasal and food regurgitates through the nose. In severe cases the glottis is paralysed, the voice being lost and coughing impossible. In the fourth and fifth weeks the power of ocular accommodation may be lost owing to paralysis of the ciliary muscles. Other cranial nerves are rarely affected, but the limbs, especially the legs, are not infrequently involved in the fifth or sixth week. In severe cases the intercostal muscles, diaphragm and trunk muscles are also paralysed and vagal neuritis may occur. The knee-jerks and, less frequently, the tendo-Achillis jerks disappear at an early stage, and this may be the only evidence that the legs are affected. Death may result from respiratory or cardiac failure, but a large majority of cases get well. The palatal paralysis disappears in two or three weeks and that of the limbs in three or four months, but the knee-jerks may be absent even eight months after recovery is otherwise complete.

Diabetic Neuritis generally affects the legs more than the arms. Painful cramp is common, especially in the calves. The legs may be weak and occasionally ataxic, but well-marked paralysis is rare. The tendo-Achillis jerks and, less frequently, the knee-jerks are lost, and many cases occur in which this is the only evidence that neuritis is present.

A. F. H.

DISEASES OF THE CRANIAL NERVES

1. **Olfactory Nerve.**—Vide *Nasal Neuroses*.
2. **Optic Nerve.**—Vide *Diseases of the Optic Nerve*.
3. **Oculomotor Nerve, and 4 Trochlear Nerve.**—Vide *Affections of the Ocular Muscles*.
5. **The Fifth or Trigeminal Nerve.**—Vide also *Neuralgia* and *Herpes Zoster*.

Trigeminal Paralysis

Etiology. Lesions of the trigeminal nerve are very rarely isolated. Diseases of the medulla and the first two segments of the spinal cord may attack the spinal root and lead to impairment of the sensory functions; in diseases of the pons the motor nucleus is simultaneously affected. The nerve roots, the Gasserian ganglion and the three divisions of the nerve may be affected by inflammation and tumours at the base of the brain and by fracture of the skull. The first division is sometimes involved by aneurysm of the internal carotid artery, cavernous sinus thrombosis and inflammation and tumours of the orbit.

Symptoms. Pain and hyperæsthesia generally precede diminution and loss of sensation. The trigeminal nerve supplies sensory fibres

to the skin of the greater part of the face and to the mucous membrane of the inside of the mouth and nose, but the area of anæsthesia depends upon whether the whole nerve or only one of its branches is diseased. The palatal, nasal, conjunctival and corneal reflexes are lost when these parts are anæsthetic. The nasal mucous membrane becomes dry and the sense of smell is lost.

Anæsthesia of the cornea and mucous membranes makes them liable to injury; the inside of the cheek is often bitten and conjunctivitis is common. The severe keratitis which sometimes results is due to irritation of the nerve and not to loss of any trophic function. When the Gasserian ganglion is involved, herpes zoster occurs, especially in the distribution of the ophthalmic division.

Paralysis of the temporal and masseter muscles can be recognized by the absence of hardening when the teeth are clenched. Paralysis of the pterygoid muscle results in deviation of the lower jaw to the paralysed side when the mouth is opened and in inability to move it towards the healthy side.

Diagnosis. In lesions above the pons trigeminal anæsthesia is generally part only of a more or less complete hemi-anæsthesia, and trigeminal paralysis is rare. When the spinal root is involved in the cord and lower medulla, the trigeminal anæsthesia is associated with hemiplegia of the same side and anæsthesia of the opposite side of the body; when in the upper part of the medulla, the hemiplegia as well as the anæsthesia is crossed.

Treatment. There is no special treatment, but when the cornea is anæsthetic the eye should be protected by a suitable apparatus.

6. **Abducent Nerve.**—Vide *Diseases of the Muscles of the Eye*.

7. **Facial Nerve.**

I.—Facial Paralysis

Etiology. Facial paralysis may be due to a supranuclear or infranuclear lesion. A supranuclear lesion due to disease of the ascending frontal gyrus or of the fibres which pass from it to the pons is rarely isolated, the paralysis being part of a hemiplegia. Nuclear lesions occur in diseases of the lower end of the pons, the pyramidal tract and the nuclei of other cranial nerves being often simultaneously involved. Within the cranium the facial nerve may be attacked by tumours of the cerebello-pontine angle, by meningitis and by fractures of the base of the skull. It is frequently inflamed in the Fallopiian canal as a result of otitis media, and after it emerges from the sterno-mastoid foramen it may be injured by operations, pressure of forceps during delivery, and by diseases of the parotid gland.

Facial paralysis is, however, most commonly due to a primary neuritis of the nerve trunk. This condition, which is known as Bell's palsy, most frequently comes on during the night, the patient waking up with the paralysis fully developed. It is rare to obtain definite evidence of exposure to a draught.

Facial diplegia is a rare symptom of peripheral neuritis, being most frequently due to syphilitic meningitis and pontine disease.

Symptoms. The lower lid droops, the angle of the mouth is depressed, and the normal wrinkles and folds of the skin disappear. If recovery is slow, contracture of the paralysed muscles occurs, and the healthy side when at rest may appear to be the paralysed side.

The paralysis manifests itself in the inability of the patient to wrinkle his forehead, close his eyes, smile, show his teeth or whistle; food collects between the cheek and the gums, and labial articulation may be imperfect. Whilst recovery is taking place in severe cases the muscles cannot move independently, attempts to close the eyes resulting in simultaneous movements of the mouth.

When the nerve is involved between the geniculate ganglion and the origin of the chorda tympani, as it is in otitis media and many cases of Bell's palsy, the sense of taste is lost over the anterior two-thirds of the tongue.

Neuralgia in the neighbourhood of the ear frequently precedes paralysis, but generally soon disappears. In rare cases anaesthesia or herpes zoster occurs in the concha, which receives its sensory supply from the facial nerve.

Diagnosis. Supranuclear paralysis is generally part of a hemiplegia; the upper part of the face is much less involved than the lower; emotional movements, such as laughing and crying, are but little impaired; the corneal, conjunctival and nasal reflexes are unaffected, and the electrical reactions are normal.

In nuclear lesions crossed paralysis, in which the same side of the face and the opposite arm and leg are paralysed, is common, and the abducent nerve is generally affected. Electrical excitability is diminished, but the reaction of degeneration is rarely present.

When the trunk is involved the hearing should be tested and the ear examined for discharge, so that cases secondary to otitis media may be recognized; loss of the sense of taste shows that the nerve is affected in the part of its course which it runs with the chorda tympani.

Prognosis. Bell's palsy generally recovers in a few weeks, but it may last for many months or even permanently. If after ten days the smallest voluntary movements are possible

recovery will be rapid; if paralysis is still complete, the electrical reactions should be tested. If the excitability of the nerve to faradism is normal, recovery will occur within four weeks; if it is present but reduced, recovery will occur between four and twelve weeks; if the muscles are completely insensitive to faradism and the reaction of degeneration is present, recovery will not take place within three months. If at the end of a year there is still no response to faradism, the paralysis will be permanent. In the course of recovery from infranuclear facial paralysis, fibrillary twitching and tonic and clonic spasms may occur.

Treatment. Electrical treatment is of much value in cases of Bell's palsy in which voluntary movement is absent or much impaired, and in cases of facial paralysis due to otitis media. The indifferent electrode is placed over the mastoid process and the other electrode is moved slowly over the muscles and along the three main branches of the facial nerve. The galvanic current, the direction of which should be frequently reversed, is used in every case; when a muscle reacts to the faradic current this should also be employed. Massage is also of use, and active exercises should be performed regularly as soon as voluntary power begins to return.

If complete facial paralysis remains as an isolated result of fracture of the base of the skull, and if the reaction of degeneration is still present a year after a mastoid operation or the onset of Bell's palsy, an anastomosis between the hypoglossal and facial nerves should be made.

II.—Facial Spasm

Etiology. The term "facial spasm" should be confined to the cases of involuntary facial movements which depend upon irritation of the cortical centre or some part of the trigemino-facial reflex arc. It very rarely occurs as an isolated phenomenon from irritation of the cerebral cortex; it is more frequently a result of irritation of the facial nerve by tumours or meningitis. Reflex facial spasm is due to painful irritation of the eyes, teeth, nose and other parts supplied by the trigeminal nerve. The majority of cases of facial spasm, however, occur without any obvious cause.

Symptoms. In slight cases only certain muscles are affected, but more frequently all are involved. Paroxysms consisting of series of spasms occur with complete cessation or only slight contractions in the intervals. The spasms generally last for a fraction of a second, but at the height of the paroxysm they may be associated with tonic spasm and—at the onset and end of a paroxysm—with fibrillary twitching. A paroxysm is often brought on by chewing or speaking.

Diagnosis. The movements in chorea are irregular and very rarely confined to one side of the face. In tic only certain muscles are involved and the movements can be readily imitated, as they are due to involuntary repetition of movements which were first performed voluntarily; consequently the corrugator supercilii muscle never contracts at the same time as the orbicularis palpebrarum, and the platysma and external ear muscles are rarely involved. The movements in tic always cease during sleep, but they may continue in facial spasm, and they differ from the latter in being increased by excitement and in being to some extent under the control of the will.

Treatment. Any reflex or other cause should be treated. Hyoscine is sometimes of great value, and weak anodal galvanism may give temporary relief. In exceptional cases, in which the constant twitching is leading to insomnia and exhaustion, the cessation which follows injection of alcohol, though it generally lasts for only a few months, has a favourable effect upon the general health.

8. *Auditory Nerve.*—Vide *Diseases of the Internal Ear.*

9 and 10. *Vago-Glossopharyngeal Nerve.*

(a) *Glossopharyngeal Paralysis.*

Etiology. No case of an isolated lesion has been recorded, but the glossopharyngeal nucleus may be involved in combination with others in diseases of the medulla, and the roots are sometimes affected in inflammation, tumours and aneurysm in the posterior fossa. Bilateral paralysis may result from post-diphtheritic neuritis.

Symptoms. Loss of taste is present over the posterior third of the tongue, and there is partial anæsthesia with diminished reflex action in the upper part of the pharynx. The pharyngeal and oesophageal muscles are paralysed, so that in bilateral lesions dysphagia may result.

(b) *Vagal Paralysis.*—Vide *Neuroses of the Larynx.*

11. *Spinal Accessory Nerve.*

Paralysis of the Sterno-Mastoid and Trapezius Muscles

Etiology. The nucleus of the spinal accessory nerve may be involved in diseases of the cervical spinal cord, and its roots in diseases and injuries of the cervical vertebræ and meninges and along with the vago-glossopharyngeal and hypoglossal nerves in the posterior fossa. Outside the skull the nerve may be divided accidentally or destroyed by growths.

Symptoms. Disease of the spinal accessory nerve results in almost complete paralysis of the sterno-mastoid and in incomplete paralysis of the trapezius muscles, the upper part of

which is more affected than the lower. Paralysis of the sterno-mastoid leads to a loss of the prominence it normally forms and to difficulty in moving the head to the opposite side; in bilateral paralysis the head tends to fall back, and nodding becomes difficult or impossible. Atrophy of the trapezius causes the rounded contour of the neck and upper part of the shoulder to be replaced by a hollow, the outer half of the clavicle becoming visible from behind. The upper and inner angle of the scapula is displaced from the middle line, whilst its lower angle approaches the spine and is higher and more prominent than normally. Difficulty is experienced in elevating the arm above the head, owing to the absence of the normal fixation of the scapula. In bilateral paralysis the chin tends to fall on to the sternum and the power of shrugging the shoulders is impaired.

Treatment. In severe cases, especially of bilateral paralysis, a supporting apparatus is often useful, as by fixing the shoulder girdle it allows the deltoid muscle to act more efficiently.

12. Twelfth or Hypoglossal Nerve.

Paralysis of the Tongue

Etiology. The tongue is frequently paralysed as a result of supranuclear lesions, together with the arm and leg of the same side, but never alone. The hypoglossal nucleus is generally the first part to be affected in bulbar paralysis, and it occasionally undergoes degeneration in tabes, syringomyelia and disseminated sclerosis. The hypoglossal nerve may be involved in its intracranial course by meningitis, tumours and aneurysm, the vago-glossopharyngeal nerve being often simultaneously affected. After it emerges from the skull it may be involved in suboccipital caries and destroyed by wounds and tumours.

Symptoms. In the majority of cases the tongue protrudes towards the paralysed side when put out in hemiplegia, but occasionally it protrudes towards the unaffected side. Difficulty is experienced in moving the tongue towards the paralysed side within the mouth. In bilateral paralysis no protrusion is possible, and mastication, deglutition and articulation are impaired. On the other hand, little or no disturbance of these functions results from unilateral paralysis.

Diagnosis. Nuclear and infranuclear lesions are distinguished from supranuclear lesions by the paralysed side of the tongue being soft and atrophied with the mucous membrane thrown into folds; faradic irritability is diminished and fibrillary tremor may be present.

Treatment. In supranuclear and infranuclear lesions, from which recovery is anticipated, electrical treatment should be employed.

A. F. H.

TICS (CEREBRAL NERVES)

Etiology. Tics develop in excitable, intelligent individuals who have inherited a neuropathic taint, particularly when the health is impaired owing to mental overwork, worry or anæmia. A tic can always be traced to some definite stimulus, which may be so trivial that it is subsequently forgotten. Most frequently it is the motor response to some irritation: the eye is screwed up in the effort to see with an uncorrected error of refraction, the head is twisted because of a frayed collar, or the shoulder raised because of a tight armhole; the patient sniffs because he has nasal catarrh, or coughs because he has laryngitis. This motor response to sensory stimuli is normal, but it becomes abnormal when it continues after its cause has disappeared, as it then no longer serves any useful purpose. In children a tic may result from imitation.

Symptoms. A tic is a psychical affection in which the inhibitory power of the will is so feeble that co-ordinated acts which are at first required for a definite purpose continue to be performed automatically in an exaggerated form after the original purpose has disappeared. The acts can be controlled by the will at the cost of mental discomfort, which gives place to a feeling of satisfaction after the will has yielded. The tiqueur realizes the foolishness of his tic, and a conflict occurs between the illogical desire to perform it and the logical desire to restrain it.

In simple tics the facial muscles are most often involved; the head may be moved in any direction, but most commonly in the manner characteristic of the tic which is badly named *spasmodic torticollis*. Tics occur more commonly in the arms, especially in the shoulders, than the legs. Simple tics may spread to other muscles, and finally very complicated movements may result. Sniffing and coughing are examples of *visceral tics*. Every variety of weird sound may occur, either associated with other tics or independently. Many severe cases of flatulence in neurotic individuals are a result of an ærophagous tic. Exceptionally a tic may exist as a purely psychical phenomenon without any motor manifestation; the counting tic is a good example of this.

Diagnosis. Tics have been mistakenly described under the names of *habit spasm* and *habit chorea*, but a tic is more than a habit and is essentially different from spasms and chorea. A *habit* is not associated with the imperious desire which makes the performance of a tic irresistible; unlike a tic, it can be voluntarily controlled and is increased by excitement. A *spasm* is neither dependent on consciousness nor under the control of the will, and may,

therefore, occur during sleep, which is impossible for a tic. It is neither co-ordinated nor purposeful. Trigeminal neuralgia has received the unfortunate name of *tic douloureux*; the associated movement is not a tic at all, but a reflex spasm. The movements in *chorea* are unco-ordinated and purposeless; no two movements are exactly alike, whereas in tic the same movements are repeated over and over again. Chorea is a physical disease due to rheumatic poisoning, while tic is a psychical disease due to a neuropathic taint. It is rare for manifestations of *hysteria* to resemble tic: the underlying mental condition is completely different, and hysterical movements are curable by suggestion. Hysterical patients perform by choice before an audience, whereas a tiqueur tries to hide his movements.

Treatment. No drug is of use, except for improving the general health. The patient should be freed from excitement and mental overwork. In early cases the initial source of irritation may still be present and should be removed.

The treatment of tics consists in re-education. The patient is directed to keep himself absolutely still for a short period, which is progressively increased by a few seconds at a time as improvement occurs. In addition slow, rhythmical movements are repeated by the affected muscles for two or three minutes at first, the duration being gradually increased. Periods of immobilization should alternate with periods of exercise, the whole being repeated three or four times a day.

Operative interference in torticollis and other tics is rarely successful, as the underlying mental condition is unaffected, and the movements prevented by neurectomy on one side often pass to the opposite side or to other parts of the body.

A. F. H.

LESIONS OF THE SPINAL NERVES

1. Phrenic Nerve: Paralysis of the Diaphragm

Etiology. The nucleus of the phrenic nerve may be involved in diseases of the cervical spinal cord, and its roots in diseases of the meninges and injuries and diseases of the vertebræ. Outside the spinal canal it is occasionally compressed by tumours in the neck and thorax. It is sometimes affected in polyneuritis, especially after diphtheria.

Symptoms. Unilateral paralysis gives rise to no symptoms; but the breath sounds at the base are deficient, and the X-rays show absence of diaphragmatic movement. In bilateral paralysis the breathing is purely costal, and on deep inspiration the abdomen is retracted instead of pushed forward. Congestion of both

bases occurs, and defæcation and micturition are difficult.

2. Posterior Thoracic Nerve : Paralysis of Serratus Anterior

Etiology. Exposure of the neck to a draught, pressure exerted by loads carried on the shoulder, and occupations, such as plastering, which involve the constant contraction of the scalenus medius, through which the nerve passes, may lead to paralysis of the serratus anterior.

Symptoms. The inferior angle of the scapula is displaced towards the spine; on holding the arm horizontally outwards, and still more on holding it forwards, the whole scapula moves towards the middle line and its inner border becomes prominent, giving it a winged appearance. The arm can scarcely be raised above the horizontal. Anæsthesia is rare.

3. Lesions of the Brachial Plexus

(a) Lesions of the whole Plexus—

Etiology. The brachial plexus may be injured by violence applied to the neck, shoulder and arm, by traction upon the arm, and by dislocations of the humerus and pressure exerted by tumours. It is occasionally involved in polyneuritis.

Symptoms. All the muscles of the arm and the pectoral muscles are paralysed. In most cases those supplied by one of the trunks remain permanently paralysed, whilst the others recover. Anæsthesia occurs over the whole forearm and hand and the lateral surface of the arm.

When the roots are involved the cervical sympathetic is also paralysed. In lesions of the trunks and cords of the plexus the serratus anterior, rhomboids and levator scapulæ escape, as their nerves originate before the trunks of the plexus are formed.

(b) Lesions of Individual Roots.—Lesions of the roots produce motor and sensory symptoms in the muscles and in the skin areas supplied by the corresponding spinal segments.

(c) Lesions of Individual Trunks. (i) Upper Trunk : Erb's Palsy—

Etiology. In addition to the causes which may affect the whole plexus, the upper trunk is that most frequently involved, in the form of "obstetrical paralysis," which is caused by traction on the arm during delivery.

Symptoms. Erb's palsy affects the pectoralis major, deltoid, supra- and infra-spinatus, subscapularis, biceps, brachialis and brachio-radialis. The extensors of the wrist, though supplied by the middle trunk, are often also paralysed. The arm hangs by the side with the forearm pronated; elevation and abduction of the arm and flexion and supination of the forearm are impossible. There is generally no anæsthesia.

(ii) **Middle Trunk.**—In addition to being involved in lesions of the whole plexus, the fibres to the extensors of the wrist and fingers are affected in some cases of Erb's palsy, and those to the flexors in some cases of Klumpke's paralysis, but an isolated lesion of the trunk never occurs.

(iii) Lower Trunk : Klumpke's Paralysis—

Etiology. The lower trunk is that commonly compressed by a *cervical rib*, and it may be injured by falls on the outstretched hand.

Symptoms. All the small muscles of the hand and sometimes the flexors of the fingers are paralysed, a "claw-hand" resulting. Partial anæsthesia may occur along the ulnar border of the hand and forearm. A cervical rib often causes pain, tingling and numbness; its presence can generally be recognized by palpation, and always by means of the X-rays.

(d) Lesions of the Individual Cords.—Lesions of the *posterior cord* result in paralysis of the subscapular, circumflex and radial nerves, those of the *lateral cord* in paralysis of the lateral anterior thoracic and musculo-cutaneous nerves and the lateral head of the median, and those of the *medial cord* in paralysis of the medial anterior thoracic, medial cutaneous and ulnar nerves and the medial head of the median.

4. Circumflex Nerve : Deltoid Paralysis

Etiology. The circumflex nerve may be injured by the pressure of a crutch, dislocation of the shoulder, fracture of the humerus, falls on the shoulder and accidental compression during sleep and anæsthesia. It is rarely affected in polyneuritis.

Symptoms. During the paralysis of the deltoid the arm cannot be raised to the horizontal. Pain may occur in the shoulder, but anæsthesia is rare.

5. Radial (O. T. Musculo-Spiral) Nerve

Etiology. Musculo-spiral paralysis results most frequently from compression against the humerus in drunken individuals who have fallen asleep with an arm hanging over the back of a chair (*Saturday-night paralysis*). It is also the commonest form of *crutch palsy*. The nerve may be injured below the origin of the biceps by fractures, dislocations and wounds. It is involved in nearly all cases of lead neuritis, and less commonly in alcoholic and arsenical poisoning.

Symptoms. The extensors of the wrist and fingers are paralysed, so that the wrist is dropped and the fingers flexed; the brachio-radialis is paralysed except in cases of polyneuritis, and when the lesion is high in the arm extension at the elbow is impossible owing to paralysis of the biceps. When the lesion is in

the upper arm, epicritic, protopathic and deep sensibility are lost over the lateral third of the back of the hand and the back of the thumb; in lesions of the radial nerve there is no anaesthesia beyond partial epicritic loss over the back of the thumb, whereas lesions of the lateral cutaneous nerve result in the same loss of protopathic and epicritic sensation as with lesions of the nerve trunk, but deep sensation is unaffected.

6. Median Nerve

Etiology. The median nerve may be injured by wounds, especially just above the wrist, by fractures of the radius and ulna, and in dislocations of the arm. Isolated neuritis is very rare, but the nerve is occasionally involved in the professional pareses of carpenters and cigarette-makers.

Symptoms. Injury just above the wrist causes paralysis of the small muscles of the thumb and loss of flexion at the metacarpophalangeal joints owing to paralysis of the lateral two lumbricals. When injured at the elbow the pronators are paralysed, and flexion at the first interphalangeal joints and, in the case of the thumb and two medial fingers, at the second joint is impossible. Anaesthesia of the medial aspect of the thumb, the whole of the first two fingers and the lateral half of the third finger is present; it extends into the palm but not beyond the first interphalangeal joint on the dorsum of the hand.

7. Ulnar Nerve

Etiology. Ulnar paralysis results from injuries near the elbow, in the forearm and at the wrist. It is also sometimes due to a local neuritis, the cause of which is often obscure.

Symptoms. When the lesion is above the origin of the branches to the muscles of the forearm, the flexor carpi ulnaris and the ulnar half of the flexor digitorum profundus are paralysed, in addition to the interossei, medial two lumbricals and adductor of the thumb, which are paralysed in lesions at the wrist. The fourth and fifth fingers are hyperextended at the metacarpophalangeal joints, and all the fingers, especially these two, are flexed at the interphalangeal joints. Abduction and adduction of the fingers and adduction of the thumb cannot be performed. Anaesthesia occurs over the fifth finger and medial half of the fourth finger, and a corresponding area of the dorsum and palm of the hand.

8. Lesions of the Cauda Equina

Etiology. The cauda equina is involved in inflammation, which is generally syphilitic, and tumours of the lumbo-sacral meninges, and in caries, tumours and injuries of the spine.

Symptoms. In fully developed cases atrophic

paralysis, with loss of tendon-phenomena and numbness, tingling and pain, occurs in the part supplied by the affected roots. Incontinence of urine and faeces is present and the sphincter ani is patulous; vesical and rectal sensation is lost, and the escape of urine and faeces is unfelt. Sexual desire and the power of erection disappear.

In lesions commencing in the lower part of the cauda the sensory symptoms begin round the anus and over the genitals, buttocks, and bladder, rectal and sexual functions are early affected. As the lesion spreads the third, second and first sacral and the lower lumbar roots are successively involved, with corresponding spread of anaesthesia and development of paralysis, the plantar reflexes, ankle-jerks and knee-jerks being successively lost. More commonly the upper part of the cauda is primarily attacked, the symptoms being generally at first confined to one side; pain in the distribution of the upper roots is usually the first symptom and is followed by anaesthesia and paralysis, visceral symptoms being absent until a later stage. The knee-jerk is abolished before the ankle-jerk, and before the disappearance of the plantar reflex.

Diagnosis. A lesion of the conus terminalis produces symptoms which are often indistinguishable from those caused by a lesion of the lower part of the cauda, but the course is generally more rapid and the two sides more equally affected.

9. Femoral (O. T. Anterior Crural) Nerve

Etiology. The femoral nerve may be compressed by a pelvic tumour and by a psoas abscess. It is sometimes involved in isolated and in multiple neuritis.

Symptoms. The quadriceps, sartorius and part of the pectineus muscles are paralysed, extension of the knee being impossible, and the knee-jerks are lost. Anaesthesia occurs over the medial aspect and front of the thigh and the medial aspect of the leg.

10. Obturator Nerve

Etiology. The obturator nerve may be injured by forceps during prolonged labour.

Symptoms. The obturator externus, gracilis and part of the pectineus are paralysed, and the movements of approximating the thighs, external rotation at the hip and crossing the legs are impaired. There is no anaesthesia.

11. Sciatic Nerve : Sciatica

Etiology. Sciatica is due in a large proportion of cases to neuritis of the sciatic nerve. It is more common in men than women, and occurs most frequently in individuals who are liable to gout and to muscular rheumatism, the

neuritis being often the result of direct spread of inflammation from the fibrous tissue in lumbago. It is also common in diabetes, apart from the bilateral sciatica which may occur in diabetic polyneuritis, as well as in that due to alcohol and other poisons. Exposure to cold and damp is the chief exciting cause, but in many cases the origin is obscure.

Symptoms. Pain along the whole nerve or in certain points in the course of the sciatic nerve is always present. It is accompanied by tenderness, which is often most marked at the sciatic notch, in the middle of the back of the thigh, and behind the head of the fibula. Pain is increased by exercise and by stretching the nerve, as by extending the leg when the thigh is flexed. In severe cases the muscles atrophy and the ankle-jerk is lost. Slight anæsthesia over the sole, outer side of the dorsum of the foot and the peroneal aspect of the leg may be present, but is rare.

Diagnosis. Sciatic neuritis can only be diagnosed with certainty when wasting, anæsthesia or loss of the tendo-Achillis jerk is present in addition to tenderness along the nerve and exaggeration of pain caused by stretching. Sciatica due to neuralgia is rare, and should only be diagnosed in the absence of all these signs and when a careful examination of the pelvic viscera, lumbo-sacral spine, hip and sacro-iliac joints have excluded the possibility of the pain being referred from visceral or joint disease, or due to pressure upon the roots or nerve before it passes through the sciatic notch. When the symptoms are bilateral the likelihood of the pain being due to these causes is particularly great.

Treatment. Rest is essential, and in any but the slightest cases the leg should be fixed by a long Liston splint. The application of heat, anodal galvanism, cataphoresis and the administration of analgesic drugs relieve the pain, and at a later stage the high-frequency current and gentle massage are useful. In very severe cases relief can be obtained by injecting half a drachm of normal saline solution into the nerve at the most tender points along its course.

12. Tibial or Internal Popliteal Nerve

In lesions of the tibial nerve a condition of talipes equino-valgus develops with hyper-extension of the toes at the proximal and flexion at the distal joints, extension of the foot and extension of the toes being impossible. The sole and outer border of the foot are anæsthetic.

13. Common Peroneal or External Popliteal Nerve

The common peroneal nerve is much more liable to disease than the tibial and is frequently involved in alcoholic and arsenical polyneuritis.

The foot cannot be dorsiflexed or everted nor the toes extended. "Dropped foot" with flexion of the toes and a tendency to talipes equino-varus is present. The outer side of the leg and part of the dorsum of the foot are anæsthetic.

A. F. H.

PARALYSIS AGITANS (PARKINSON'S DISEASE)

Etiology. Paralysis agitans rarely begins before the age of forty-five or after sixty-five. It is slightly more common in men than in women. It is rare for more than one member of the family to be affected. Painful emotions frequently precede the onset. Though undoubtedly an organic disease, nothing is known of its morbid anatomy.

Symptoms. The characteristic symptoms are tremor and rigidity. In typical cases both are present together, but one may precede the other by a considerable period and remain the more marked feature throughout.

The tremor generally begins in one arm, the other limbs being successively affected in the course of months or years. It is most marked in the distal part of the limb. Sometimes the head is slightly affected, the jaw and tongue less commonly, the lips and eyelids very rarely. The tremor is moderately rapid; it occurs at rest and may diminish on active movement; it can be momentarily checked by an effort or by support. It ceases during sleep and is increased by excitement.

The characteristic rigidity differs from spasticity, as it is increased by passive movements, and the resistance it offers is the same whether these are quick or slow. The fingers are flexed and the thumb adducted, so that the tremor leads to "pill-rolling" movements. The elbow is flexed and the arm held closely to the side; the trunk is bent forward, the hips and knees flexed. This leads to characteristic posture and gait, short, slow steps being taken and the patient tending to fall forward. The stiffness of the facial muscles leads to a characteristically anxious expression and very slight emotional movements. Speech is slow, quiet and monotonous.

The rigidity leads to slowness and difficulty in movement; genuine weakness and rapid fatigue, with a slight degree of atrophy, occur in addition.

Owing to the stiffness the limbs frequently ache. Though sometimes emotional and depressed, patients are otherwise normal mentally. Electrical reactions, superficial reflexes and tendon phenomena are normal and the sphincters and all forms of sensibility are unaffected.

Prognosis. The disease progresses very slowly; after many years the patient becomes

completely incapacitated. Death generally results from an accident or intercurrent disease, occasionally from exhaustion or bed-sores.

Diagnosis. The disease begins later than *disseminated sclerosis*. The tremor is most marked at rest, whereas in *disseminated sclerosis* it is most marked on movement. The signs of organic disease present in *disseminated sclerosis* are always absent. *Senile tremor* occurs in older people, and is generally more marked in the head than the limbs.

Treatment. Nothing arrests the progress of disease. Hyoscine hydrobromide $\frac{1}{200}$ gr., increased if necessary to $\frac{1}{50}$ gr., three times a day often arrests the tremor. Passive movements of the limbs relieve discomfort, but acetyl-salicylic acid, phenazone or pyramidon may be required.

A. F. H.

CHOREA (SYDENHAM'S CHOREA, ST. VITUS'S DANCE)

Etiology. Chorea occurs three times as often in females as in males, and most commonly between the ages of five and fifteen.

A large majority of cases are associated with acute rheumatism; one-third have had rheumatism themselves or are attacked by the two diseases simultaneously, another third subsequently develop rheumatism, and in other cases the presence of endocarditis suggests an association with rheumatism. There is also often a family history of rheumatism or chorea. Most of the cases which are not associated with rheumatism follow other infectious diseases, especially scarlet fever. The majority of cases beginning over the age of seventeen occur in the early months of pregnancy.

The attack may be the immediate sequel to fright or an injury; it occurs especially in children who are keen on their school work.

Symptoms. The onset is generally gradual, the child dropping things and becoming fidgety, before definite choreic movements develop.

1. *Muscular Symptoms.* The movements are uncontrollable, inco-ordinated and purposeless; no two are exactly alike. They are increased by voluntary effort and attention and cease during sleep. They begin in the hands and arms; the face and head are next involved, and after them the legs, trunk and diaphragm. The patient cannot sit or walk steadily, articulation becomes incoherent and feeding difficult. Sustained effort is impossible and there may be definite paresis. Sometimes only one side is affected (hemi-chorea). The reflexes are normal.

2. *Cardiac Symptoms.* There is almost always evidence of myocardial poisoning, the left ventricle being dilated and a systolic murmur

audible at the apex. Endocarditis, leading to organic mitral and rarely aortic disease, is very frequent. Pericarditis may also occur. One half of the cases finally show signs of organic heart disease.

3. *Psychical Symptoms.* The patient is irritable and emotional. Concentration is difficult and the memory deficient; in severe cases, especially in adults, the patient may become maniacal.

The temperature is generally normal except in maniacal cases and when complications are present.

Prognosis. An attack generally lasts between one and three months, but recurrence is frequent. Very rarely death occurs in severe cases, especially in those associated with pregnancy or complications such as pericarditis.

Diagnosis. The chief difficulty in diagnosis is to distinguish chorea from hysteria, as hysterical children may develop choreiform movements as a result of imitation. For the diagnosis from tics, *vide* p. 315.

Treatment. The patient should be kept as quiet as possible, and in all but the slightest cases rest in bed is desirable. If there is a rheumatic history or pyrexia, salicylates or acetyl-salicylic acid in full doses should be given. Violent movements can be controlled by trional, 5 gr. given three to six times a day. In convalescence massage, strychnine, arsenic and iron are useful.

A. F. H.

HUNTINGTON'S CHOREA

Etiology. Huntington's chorea is frequently hereditary, several members of a family being affected. It occurs only between the ages of thirty and fifty, and males and females are equally affected. Post-mortem, general atrophy of the cerebral convolutions, together with chronic meningo-encephalitis, is found, and the heart is normal, so that the disease is quite distinct from Sydenham's chorea.

Symptoms. Choreiform movements beginning in the face and arms, later spreading all over the body. At first they are controllable, but increased by excitement and voluntary movements. Mental apathy occurs early and finally passes into dementia.

Prognosis. The disease is progressive and incurable, but does not shorten life. There is no treatment.

A. F. H.

EPILEPSY

Epilepsy, or the falling sickness, is characterized by sudden attacks of unconsciousness, which may or may not be followed by convulsions.

Etiology. In a small percentage directly hereditary it is closely allied to other neuroses, such as migraine, insanity, somnambulism, etc., some one or more of which are likely to be found in other members of the family. In a large number of cases gross brain disease is the cause, such as cerebral tumour, meningitis, infantile hemiplegia, congenital cerebral defects, vascular disease, trauma and general paralysis. A large proportion of idiots, perhaps a third, are epileptic. The lesion may be nutritional only, due to a circulating poison, as in alcoholism, uræmia and lead poisoning. Certain fevers too, especially scarlet fever, may be followed by epilepsy; rickets has been often blamed, and reflex causes, such as dentition, worms and the onset of infectious fevers, are not infrequently associated with epilepsy in children.

Very rarely a true epileptic fit may be produced by an irritation, or even touching of a certain skin area, or of a scar. Syphilis is a rare cause, occurring usually in males over thirty, and then probably due to endarteritis.

The majority of epilepsies start in early life, and fits after adult age should not be classed as simple epilepsy until the possibilities of trauma, gross brain disease, renal or vascular sclerosis, or syphilis have been excluded.

Of all the allied neuroses probably migraine is the commonest, and occasionally the two diseases may alternate or coincide in the same patient.

Varieties. The two chief forms are known as *petit mal* and *grand mal*. In the former there is no convulsion, but the patient has recurring similar attacks of transient momentary faintness, the colour changes to pallor, the eyes look strange, speech is arrested, and the attention wanders. In many there is an aura of vertigo, which may indeed go no further; these attacks are often spoken of by the patient as "sensations" or "giddy attacks."

After the attacks of *petit mal* the patient may immediately recover and be perfectly normal again; others may feel unwell and giddy for hours, with a certain amount of headache; others, again, without recovering real consciousness, pass into a state known as post-epileptic automatism, lasting from a few seconds to half an hour or more. In this state various complicated acts may be performed, as in somnambulism; the patients may continue doing correctly what they were doing before and have no recollection of their actions; more frequently they commence to undress, or they become noisy and hysterical, perhaps destructive.

Larval Epilepsy.—In this form of *petit mal* the attacks are usually very infrequent and may be altogether overlooked, though the

period of automatism that follows may be prolonged for hours or days; indeed, three months has been recorded. These attacks are generally known as loss of memory. Suddenly, without warning, the patient passes into a sub-conscious state and may disappear from his friends, turning up perhaps days afterwards many miles from home. In this state they may wander about or travel by train and behave sufficiently naturally not to attract attention.

Grand Mal.—Strong fits may occur in sufferers from *petit mal* or they may occur alone. The frequency of the attacks may range from one or two in a lifetime to several in the day, indeed sometimes may recur continuously, without consciousness being regained, to the number of one or two hundred, this condition being known as *status epilepticus*.

The fit may or may not be preceded by an *aura*, usually an indefinable epigastric sensation. This may rise into the chest and throat or even to the head before consciousness is lost, and its duration at most is a few seconds. Other warnings are vertigo, tinglings in the limbs, and sometimes auræ of the special senses, olfactory, visual or auditory, though these are less common. The patient next falls in a convulsion and may injure himself in so doing, severe burns by falling into the fire or even death being sometimes the result. The convulsion commences with general tonic spasm, the whole body being rigid, the head and eyes rotated probably to one side, the colour of the face becoming dusky; this is followed by repeated jerking contractions of the whole body. Involuntary micturition frequently occurs, but rarely defæcation, while the tongue may be bitten on one side, being caught between the grinding jaws.

Many patients show special idiosyncrasies in their fits, some never bite their tongues, others may regularly dislocate the jaw or the shoulder joint, or turn over on the face. During the convulsions the patients become deeply cyanotic, the muscular twitchings lasting half a minute or slightly more. When the convulsions have ceased the patient lies flaccid, breathing stertorously, pupils widely dilated and insensitive to light, with loss of conjunctival and all skin reflexes, and perhaps even of the knee-jerks for a few moments; these, however, return rapidly, and in some extensor-plantar reflex and ankle clonus may be obtained for a few minutes. A few patients regain consciousness rapidly, and may be perfectly well and able to resume their business in two or three minutes; more often deep drowsiness or heavy sleep may follow for some hours, or severe headache may last most of the day.

The commonest time for fits to occur is the

early morning. Some patients have their fits only at night, *nocturnal epilepsy* it is sometimes called; if it is a habit of such patients to turn over on the face there is a danger of suffocation. Nocturnal epilepsy may be overlooked, and enuresis, a sore tongue, or blood upon the pillow may be the only sign that a fit has occurred. In women fits are generally more numerous about the time of the period, and in many women the fits occur only at that time, *menstrual fits*. An epileptic subject is frequently bad-tempered, violent and passionate.

Although occasional epileptic attacks are by no means incompatible with considerable brain power and even genius—for example, Napoleon and Julius Cæsar were both subject to the malady—yet in those whose fits are frequent signs of mental deterioration are common, more or less in proportion to the fits.

Epileptic Insanity.—Some epileptic patients are subject to recurrent attacks of mania lasting for weeks or months, in which the fits usually cease. The mania is frequently of a homicidal type and may be very sudden in its onset; such patients are often permanent inmates of asylums, but should never be considered to be harmless, though practically sane for long periods at a time.

Jacksonian Epilepsy.—Unilateral convulsions, in which consciousness is retained perhaps throughout, are liable to be produced by many lesions causing irritation of the motor cortex, such as cerebral tumour, gumma, syphilitic vascular disease, tubercle, etc. The lesions are not necessarily in the motor cortex, but may be adjacent or sub-cortical; such unilateral convulsions of the arm or leg may recur almost constantly for one or two hours at a time without consciousness being lost. When convulsions have ceased there is usually hemiparesis on that side, with increase of the deep reflexes and extensor-plantar reflex, lasting for a day or two at least.

Treatment. Steady bromide treatment for many months continuously, or even years, is the most successful in the majority of cases; the form of the bromide perhaps does not much matter, though sodium bromide is the most generally suitable. According to the age of the patient the dose must be graduated, the maximum for the adult being 75 gr. daily. More usually 15 gr. night and morning will be sufficient, though in nocturnal epilepsy it will be advisable to give a single dose of 30 gr. of bromide at night, combined with tincture of digitalis five minims. The addition of two or three minims of liquor arsenicalis or tinct. belladonna will be of service in controlling the outbreak of acne, and in a few cases other drugs, such as borax 10 gr. t.d.s., lactate of zinc, and even valerian, may be of service.

Status epilepticus must be treated by chloral hydrate, 30 gr. given by enema, or by inhalations of chloroform.

Occasional tonics are sometimes useful, such as syrup ferri phosph., but strychnine is contra-indicated in epileptics. The diet should be moderate, with a minimum of meat and salt, and no alcohol should be allowed on any pretext. If fits are numerous, hard brain work, and especially excitement and quarrelling must be avoided.

Prognosis. It is impossible ever to be certain that epilepsy will not recur, but the probability of permanent cure increases with the length of time that has elapsed since the last fit. The usual practice, and a good one, is to continue the bromide mixture for two years after the last fit, then to diminish it at intervals of three months during the next year, until finally it may be dropped. Sometimes the bromide has to be stopped on account of the development of unsteadiness in gait and other ataxic symptoms. Delirium, too, may be associated with this symptom. With others, again, bromide causes considerable depression and smaller doses must be given for a time.

As regards employment, it is noteworthy that fits practically never occur when the patient's attention is concentrated upon the maintaining of his balance, as on a ladder, yet serious accidents owing to fits are liable to occur to a workman employed amongst machinery, or to a locomotive driver, or chauffeur when driving, owing to the work being practically automatic and requiring no special concentration.

W. H.

TETANY

A form of symmetrical muscular cramp affecting the extremities, and in the more severe cases the face and trunk, considerable pain attending the more extensive spasms. The majority of cases occur under the age of twenty, and the disease is rare after forty. It is found in association with a variety of causes, chief of which in children are rickets and diarrhoea. Small epidemics have been described in institutions, and certain trades seem particularly prone, such as shoemakers and tailors; it may indeed be mistaken for occupation neuroses, cobbler's or tailor's cramp. Various poisons, ergot, lead and many others, and in women pregnancy and lactation, are recognized causes. Acute fevers, especially typhoid, sometimes induce tetany. Two important types of the disease are those due to gastric dilation and excision of the thyroid, either of which forms may be fatal. It is now thought that it is excision of the parathyroids and loss of their internal secretion, which when present

neutralizes some poison normally produced in metabolism.

The spasms consist of tetanic flexion of the fingers at the metacarpo-phalangeal joints, with flexion of the wrists and elbows, the arms folded over the lower chest; the legs are extended and abducted, the toes flexed. There may be rigidity of the abdominal wall and of the neck muscles, with slight trismus, the spasms being of variable duration from a few minutes to hours or even days. Three signs are described—

1. Trousseau's, in which the spasm may be brought on by a firm gripping of the limb near its main vessels or nerves.

2. Chvostek's, or hyper-excitability of the motor nerves. This may be demonstrated by a light stroke on the side of the face in front of the ear producing facial twitching.

3. Erb's, or hyper-excitability of motor nerves to galvanic stimulation. Kathodal closure tetanus (KCTe), and even strong anodal opening contractions (AOC), may be obtained.

The disease is rarely serious, except after extirpation of the parathyroids, or sometimes in dilated stomach when gastric lavage is used.

Removal of the poison if possible, cure of the diarrhoea or rickets, etc., with sedatives such as bromide, and nutritive feeding are indicated.

W. H.

OCCUPATION NEUROSES

The commonest and best known of the fatigue spasms is writer's cramp, a neurosis characterized by spasm of the fingers, pain, tremor and weakness of the hand, brought on by the movements of writing. It is especially those who have long hours of engrossing or copper-plate writing to do who suffer from the cramped movements required in such writing. A large share, too, in the causation of the neurosis must be ascribed to a family tendency to neuroses of all kinds, and to worry, domestic or financial, affecting the patient. The most important and usually the first symptom is spasm of the fingers during writing, necessitating stronger exertions to control the writing, which becomes slower and more laborious, whilst neuralgic pain is common along the forefinger, wrist or near the elbow; if the work of writing is continuous, the symptoms increase, and the writing becoming slower and more illegible until ultimately it has to be abandoned. There is no local wasting or anæsthesia.

Various methods of holding the pen are often tried, with temporary benefit, such as between the first and second fingers, using a stout cork penholder. Sometimes the left hand may be trained to write, thus giving the complete rest to the right which is so necessary

in the treatment; ultimately the spasm may attack this hand also. An essential feature of true writer's cramp is the occurrence of the spasm and other symptoms only during the act of writing, and not in other movements.

Numerous other forms of occupation neuroses are described, such as telegraphist's cramp, violin player's and pianist's cramp and many others. The basis of *treatment* in all is the same, namely rest from the offending occupation, tonics, massage and mental sedative treatment.

Symptoms occasionally resembling writer's cramp are sometimes the initial sign of progressive spinal disease, such as syringomyelia, or tumour, or even of a cervical rib. Local lesions such as arthritis, or periostitis, or an old-standing weakness from infantile hemiplegia may be the predisposing causes of the disease. The pathology of the neurosis depends on an inco-ordination of the higher centres.

W. H.

SYPHILITIC AND PARASYPHILITIC DISEASES OF THE CENTRAL NERVOUS SYSTEM

Definition. Syphilitic diseases of the central nervous system are those which are directly due to specific syphilitic lesions, such as gummata, gummatous infiltration and endarteritis. Parasyphilitic diseases are those in which no such specific lesions are present, but which are due in some way to the syphilitic toxin, previous infection with syphilis being the essential factor in their etiology.

Etiology. Cerebro-spinal syphilis generally develops between three months and four years of infection, but its onset may be delayed for as long as forty years. In many cases the original treatment was inadequate. Alcoholic excess and over-work predispose, and injury and exposure to cold may be the exciting causes. For the parasyphilitic diseases *vide* Tabes and General Paralysis. Congenital syphilis may give rise to both syphilitic and parasyphilitic nervous lesions.

Clinical Varieties of Syphilitic Diseases of the Central Nervous System

1. Syphilitic Lesions of the Brain—

(a) *Vascular Lesions.*—Syphilitic endarteritis frequently affects the vessels of the brain; it gives rise to anæmia and softening and consequent functional deficiency, which is greatly increased if thrombosis occurs. Spasmodic contraction of the diseased arteries may also lead to transient symptoms. The middle cerebral artery and its branches are most often affected: the resulting hemiplegia, monoplegia or aphasia is of more gradual onset than when due to hæmorrhage or embolism, and coma rarely occurs. Thrombosis of the basilar artery

is a common cause of bulbar paralysis, and paralysis of any of the cranial nerves may result from softening secondary to syphilitic endarteritis of the smaller vessels. Widespread endarteritis leads to the condition known as *cerebral syphilis*, the mental and physical symptoms of which often closely simulate those of general paralysis.

(b) **Gumma Cerebri.**—Gummata frequently develop from the cerebral meninges and compress the brain, producing focal symptoms, such as Jacksonian epilepsy, monoplegia and aphasia, together with the general symptoms of an intracranial tumour, such as headache and optic neuritis.

(c) **Gummatous Basal Meningitis.**—The basal meninges are frequently involved in a diffuse syphilitic infiltration, associated with multiple small gummata and with endarteritis, which may lead to the simultaneous occurrence of cerebral softening. The meningitis leads to headache and paralysis of one or more of the cranial nerves, those supplying the ocular muscles, the trigeminal and the facial being most frequently involved.

2. Syphilitic Lesions of the Spinal Cord—

(a) **Vascular Lesions.**—Uncomplicated vascular lesions are rare; acute softening occasionally results from thrombosis in spinal arteries affected with syphilitic endarteritis. The symptoms are almost indistinguishable from those of acute myelitis (*q. v.*).

(b) **Spinal Gumma.**—Isolated gummata of the spinal meninges are rare. The symptoms they produce by compressing the cord are identical with those of spinal tumours (*q. v.*).

(c) **Meningo-Myelitis.**—The most common form of spinal syphilis is that in which meningitis in the cervical, dorsal or lumbar region is accompanied by softening due to endarteritis, the disease being known as meningo-myelitis, although the pathological condition is one of softening rather than inflammation. The symptoms are those of transverse myelitis, associated with rigidity and tenderness of the spine and local and radiating pain due to meningitis. One side is often affected more than the other: the Brown-Séquard syndrome results, paralysis occurring on the same side, and loss of sensation, especially to pain and temperature, on the opposite side. The meningeal symptoms generally precede those due to softening, and may be present alone.

Prognosis. The prognosis is good if the condition is recognized early, as response to treatment is rapid. The longer the symptoms last the less complete will recovery be, as temporary functional deficiency due to anæmia is finally replaced by permanent loss of function from softening. Acute spinal softening is generally fatal, complete recovery being very

rare. A patient who has once had a syphilitic lesion of his nervous system is always liable to further lesions, not necessarily in the same situation.

Clinical Varieties of Parasyphilitic Diseases of the Central Nervous System

The chief forms of parasyphilitic nervous disease are general paralysis of the insane and tabes (*q. v.*). Intermediate cases of taboparesis occur, and it is probable that the two diseases are simply varieties of the same parasyphilitic disease. Primary optic atrophy is common in both, and is often the most prominent symptom in tabes, whilst cases occur in which optic atrophy is unaccompanied by any other sign of nervous disease, but is none the less a parasyphilitic lesion and represents a third variety of the parasyphilitic disease. Similarly cases of general paralysis and tabes occur, with symptoms of lateral sclerosis, some cases of "postero-lateral sclerosis" being of this nature, and with degeneration of the anterior cornua (amyotrophic tabes); in rare instances these degenerations occur without the tabetic lesion, so that so-called primary spastic paraplegia and progressive muscular atrophy may be parasyphilitic in origin.

Diagnosis. The possibility of a syphilitic origin should be considered in all cases of cerebral or spinal tumour, acute paraplegia and hemiplegia, cranial nerve paralysees and all cases presenting anomalous nervous symptoms, chief reliance being placed upon a history of syphilitic infection, the presence of other active syphilitic lesions or of scars of healed lesions, and especially a positive Wassermann reaction, though none of these is certain either as positive or negative evidence. Multiplicity of nervous lesions, frequent recurrences, ocular palsies, abnormalities in the pupil and the association of severe headache, worse at night, with other nervous symptoms are points suggestive of syphilis. The presence of lymphocytes in the cerebro-spinal fluid is due to a syphilitic, parasyphilitic or tuberculous lesion, a positive Wassermann reaction of the fluid being conclusive evidence in favour of one of the former. A favourable response to antisyphilitic treatment is useful, though inconclusive evidence for syphilis.

Syphilitic, unlike parasyphilitic, lesions generally develop within four years of infection. The Argyll Robertson pupil is rare in syphilitic, but common in parasyphilitic lesions, and a positive Wassermann reaction given by the cerebro-spinal fluid is much more frequent in the latter. The response to specific treatment is generally more rapid and more marked in syphilitic than in parasyphilitic lesions.

Treatment. Prolonged antisyphilitic treat-

ment is the best prophylaxis. Directly symptoms which are suggestive of syphilis of the central nervous system appear, active treatment should be instituted. Unless the patient's condition is very serious, salvarsan should be given intravenously; at the same time mercury must be administered by inunction, intramuscular injection or by mouth, and not less than a drachm of iodide a day. The initial specific treatment should be continued for at least a year after improvement has ceased to occur, and repeated courses should be given to avoid recurrence, their frequency and duration depending upon the response of the serum to the Wassermann reaction. In rare cases, in which the effect of treatment is unsatisfactory, improvement may follow the relief of pressure produced by trephining in gumma of the brain and performing laminectomy in spinal syphilis, but no attempt should be made to remove the tumour. A. F. H.

MIGRAINE

Migraine, *megrim* (Greek, *hemicrania*), is a paroxysmal neurosis characterized by unilateral headache, commencing usually by pain over one eyebrow or temple, and spreading thence over one half of the head; it is sometimes known as bilious headache or sick headache and is very hereditary.

Other neuroses, especially epilepsy, may be present in the same family, or even in the same patient. The more characteristic cases are preceded by certain prodromal symptoms, the commonest of which are the visual phenomena known as *teichopsia*, scintillating scotoma, or the fortification spectrum, in which the vision is blurred, sometimes more on one side than the other, and specks, moving cobwebs, flames, or prismatic angles of coloured light are seen. In others, again, the visual affection takes the form of blindness of the half fields in each eye, *hemianopia*, due to arterial spasm in the occipital lobe, or the visual defect may affect one eye only, even to the degree of actual loss of perception of light, from spasm of the *arteria centralis retinae*.

These visual spectra last about twenty minutes or less, and very exceptionally may last an hour; as they disappear the headache commences, sometimes on the same side as the blindness, sometimes on the opposite. In a few the headache is preceded by a psychical aura, a mental state or dreamy stage of reminiscence, in which the patient appears to see some scene connected with a long-past life. In others, again, an excessive sense of well-being and keen appetite may precede the attack by some hours; yet others may have *hemianopic* visions at night or thrilling dreams of fire

and general catastrophe. Some persons, whose relations suffer from typical migraine headaches, may themselves be smitten by attacks of transient *hemianopia* or other visual spectra without the succeeding headache, or this may be so slight as to be scarcely noticeable. A curious aura that sometimes occurs with or without the visual warning is a tingling that runs along the lip and tongue on one side, and down the arm into the fingers, with transient paresis of the arm and also loss of speech and power of expression if the right side is affected. Rarely these *paræsthesiæ* may spread down the side and affect the leg, and indeed complete flaccid *hemiplegia* with aphasia may be of migrainous origin; this latter is rare and may lead to a bad mistake in prognosis, since the paresis is but temporary and due to vasomotor spasm. An occasional but rare accident is permanent occlusion of a vessel thus affected by spasm and a permanent *hemianopia* from occipital thrombosis or blindness of one eye from thrombosis of the central artery of the retina has resulted.

In the early onset of the attack of migraine there is usually pallor of the face, which may be succeeded by strong pulsation of the carotid and temporal arteries on the side of the headache, with flushing of the face; the central artery of the retina is now seen to be full and throbbing. The headache grows in intensity, causing complete prostration, so that patients often prefer to lie in bed propped up, in a darkened room. The pain may spread down the back of the head and neck, and sometimes it spreads across the forehead and becomes general. There is intolerance of light and nausea; retching and actual vomiting after several hours of pain may bring relief to the headache, which usually does not disappear entirely until the next morning. Occasionally the pain may last for two or even three days. Sometimes the vomiting commences early in the attack and may be frequent, but then it does not bring relief to the pain. Usually the scalp is tender and irritable and neither hairbrush nor hairpins can be tolerated.

Migraine commonly begins in childhood, and attacks are brought on by any excitement, such as preparing for a party. Both sexes suffer, and it is commonly stated that this neurosis is especially frequent in exceptionally gifted people; this is not so, for it is common in rich and poor, dull-witted and genius alike. In women this neurosis, like epilepsy, is specially likely to occur at the monthly periods, sometimes at the beginning, sometimes at the end. As the years advance the severity and frequency of the attacks usually lessen, and they may even disappear after the menopause or in later life.

Constipation and indiscretion in diet have little to do with true migraine, but alcohol, as

with epilepsy, is a factor to be avoided. Close stuffy rooms, train journeys, shopping, and similar causes of bodily and mental fatigue frequently produce attacks.

The treatment of migraine is scarcely satisfactory; once the attack is developed it cannot often be aborted, though occasionally a full dose of antipyrin or pyramidon, with two or three grains of cannabin tannate, may shorten its duration. If the headaches are frequent, one or two in a week, then a course of bromide treatment, together with mental rest and open-air life are usually advisable. W. H.

NEURALGIA

The term neuralgia, or nerve pain, is best employed for darting, shooting or sometimes burning pain, affecting either certain spots or often large areas of the trunk or limbs, in which no evidence of gross disease either of the nervous system or of other tissues can be found. It is therefore to be distinguished from the pains of neuritis, of bone or visceral disease, etc. The distinction, however, is difficult to maintain, for we often speak of tabetic neuralgia, the lightning pains of tabes associated with sclerosis of the posterior roots and columns, and post-herpetic neuralgia, the constant, burning, intolerable pains which are sometimes a sequel of shingles in old people, the lesion in this case being in the posterior root ganglion and sometimes in the posterior horn.

Neuralgia is an affection of adult life, and is commoner in women, especially with an heredity of migraine or other neuroses. Rheumatism and rheumatoid arthritis are often associated with chronic or intermittent neuralgia. The most important and by far the most frequent site of neuralgic pain is the fifth cranial nerve.

Dental Neuralgia.—A very common form is a true reflex pain felt along the various branches of the trigeminal nerve, due to inflammation from a septic neuritis of one or more terminal filaments. The pain usually radiates first along the same division; thus a carious lower molar may cause darting pain along the whole of the lower jaw, and into the ear and along the temple; as the pain increases in severity it will radiate over all three branches of the fifth nerve and even down the back of the head and into the neck and shoulder. With these reflected pains are often found areas of intense hyperæsthesia of the skin. Sometimes the pain is entirely referred, and pain in an upper jaw may be due to a carious tooth in the lower jaw on the same side, which is not apparently painful; the pain is never reflected in this way to the opposite side of the head.

Similarly visceral lesions, heart, pleura, lungs,

stomach, may cause superficial neuralgia along certain brachial or intercostal nerves; for example, the radiating pain into the arm and neck of angina pectoris.

Supra-Orbital Neuralgia is a very common form, especially in women during gestation or at the monthly period. Malaria and influenza are also common causes, the pain being then paroxysmal from about 11 a.m. to 5 p.m.; the pain is sometimes agonizing, with great tenderness over the supra-orbital notch.

Occipital Neuralgia is a rarer form, pain being felt over the distribution of the occipital nerve. Instances occur of paroxysmal pains affecting certain areas such as the solar plexus, or other regions of the trunk, in which careful examination or even operation has excluded renal or biliary calculus and other forms of organic disease; such pains have been named *douleurs d'habitude*. Diabetes, Bright's disease, chronic poisoning by alcohol, lead, ergot and other poisons, as well as tabes, must also be excluded. Treatment by butyl chloral hydrate, gelsemium, antipyrin, aspirin, etc., may bring relief, and local anodyne paints of menthol, ol. gaultheriæ, chloral and other combinations, sometimes help.

Trigeminal Neuralgia, or tic douloureux, is the most severe and intractable of the cranial neuralgias, usually commencing after thirty. Once established it never disappears, except for intervals of weeks or months, unless radical treatment of the offending nerve has been undertaken by the knife or alcohol injection. The pain is of a darting, stabbing character, coming on in sudden paroxysms, induced especially by eating, talking, laughing, etc.; the spasms may last half a minute to hours in duration, and may vanish as suddenly as they came. Very rarely bilateral, the pain usually affects the upper and lower jaw, frequently both jaws on one side, but rarely all three divisions of the nerve. Formerly neurectomies were the only palliative treatment, and excision of the Gasserian ganglion the only cure. Of late years deep alcohol injection of the nerve trunks has given as much as three to four years' relief from all pain, and more recently alcohol injection of the Gasserian ganglion promises much longer, if not permanent relief. W. H.

NEURASTHENIA

Definition. A condition of irritable nervous weakness. The term was introduced by Beard to cover a large group of symptoms pointing to either general exhaustion of the nervous system or especial exhaustion of some particular function of the nervous system, *e.g.* cerebral, cardiovascular, sexual, gastro-intestinal.

Etiology. Neurasthenia is especially a disease

of civilized races, in which the struggle for existence necessitates an intensive activity of the nervous system in acquiring new modes of adaptation to a changing and, generally speaking, an unphysiological environment. The causes are to be sought for in nature and nurture—what an individual is born with, and what has happened after birth. The inborn tendency may be due to a *neuropathic predisposition* or the inheritance of a *neurotic self-regarding temperament*; in either case an inquiry into the family history will frequently reveal in the pedigree members in the direct or collateral line who suffered from some neurosis or psychosis; again the frequency of alcoholism, eccentricity, often combined with business talent or professional success, and even genius among the members of the stock, points to a variation from the normal average towards an inborn nervous instability.

The disease affects both sexes; it may occur in children and old people; men and women at the involutional period are especially liable to it. It attacks men who burn the candle at both ends, by working hard in their profession or business by day and spending the night in gambling and sexual indulgence, resorting to stimulants and drugs to excite their flagging energies, and thus aborting the natural sense of fatigue which prompts to sleep, rest and recuperation of nervous potential. A healthy, stable nervous organization may thus be broken down. If the individual is of the self-regarding neurotic temperament and given to worry, neurasthenia is particularly liable to occur; indeed, in some cases there may be no other sufficient cause ascertainable, for it is not so much mental work as worry and introspective attention which leads to nervous exhaustion; a vicious circle is apt to be established, thereby causing insomnia, dyspepsia, mal-assimilation, failing bodily nutrition, constipation resulting in auto-intoxication and anæmia, palpitation and neuralgias, and in women amenorrhœa and dysmenorrhœa.

Nervous exhaustion occurs as a result of disappointment in love, religious doubts and fears, family troubles, unnatural sexual indulgence, sexual excesses, enforced suppression of the sexual passion, starvation of the maternal instinct, all of which are common causes of grief, anxiety or worry to both sexes and in all grades of society. But worry and nervous exhaustion may have a social-occupational basis among the middle and lower classes who have to struggle for existence. Especially liable to suffer from neurasthenia are women who obtain their livelihood as typewriters, stenographers, telephone and telegraph operators, school teachers, shop assistants and others in whom there is not only the mental stress of

their occupation, but, in addition, the worry of a precarious livelihood with a remuneration insufficient for provision in case of illness or unemployment.

Neurasthenia is common among the idle rich, especially society ladies who have no object or interest in life except to satisfy their selfish desires and pander to an inborn or acquired self-regarding temperament.

Infective Diseases, e.g. typhoid fever, septic infections and syphilis, in which the constitutional disturbance is prolonged and severe, may be followed by neurasthenia. But influenza even of a few days' duration has been accredited with causing neurasthenia; in many of these cases, however, careful inquiry shows either an acquired or hereditary neuropathic predisposition.

Errors of Refraction, e.g. astigmatism in school children and young adults, especially if there be at the same time over-pressure for examinations, may result in a nervous, irritable weakness.

Abuse of the Sexual Functions. The most frequent and potent cause of neurasthenia is related to the sexual functions. Excessive sexual indulgence, natural and unnatural, leads to nervous exhaustion. An irritable, nervous weakness, especially affecting the male sex, frequently arises from the acquirement of the habit of masturbation at school. The neurasthenia which so often supervenes as a result of the vicious habit is due not so much to the loss of the highly phosphorized complex substances in the seminal discharge, as to the mental depression and nervous exhaustion engendered by the moral shame and apprehension of results of the habit. Likewise the moral shock induced by the contraction of a loathsome disease like syphilis, coupled with the constant fear of the results, is a frequent cause of neurasthenia. This is of considerable importance; for it may present symptoms suggestive of organic syphilitic brain disease in the earliest stages.

Trauma in relation to neurasthenia is considered later.

Symptomatology. The irritability and fatigability of the nervous elements forming the anatomical substratum of consciousness, viz. the cerebral cortex, is mainly responsible for the symptoms. Every organ and structure in the body is represented in consciousness, but happy is the individual who is oblivious of the functions of the organs of digestion, circulation and respiration, for if the mind dwells upon these organic functions, invariably the organs become disturbed in their action. Lassitude and weariness like pain are protective, and these subjective feelings which own no visible objective cause are—in the case of neurasthenia

—due in great measure to the fatigue of the nervous elements.

The subjective symptoms of neurasthenia are numerous and diverse, and various combinations of subjective symptoms occur in different individuals. The objective signs are few in comparison and relatively unimportant.

The symptoms will now be considered in detail.

Headache. This symptom is rarely absent, and is usually constant. The headache may be a dull pain or there may be a vague feeling of heaviness; sometimes it is boring or lancinating. It does not necessarily affect the whole cranium, as it may be localised to the forehead, the eyes, the root of the nose, the temporal fossæ, or the neck and occiput. The different forms of headache from which neurasthenics suffer may be described by them in a most varied manner, *e.g.*, a feeling of emptiness, of muzziness, of fullness, of pressure, of constriction, of tightness. Among these expressions a feeling as of a tightly-fitting hat is frequent, and Charcot especially refers to the headache "en casque." The headache, if unrelieved, becomes more painful, and contributes largely to the mental fatigue, but more by its persistence than its intensity. Neurasthenics complain of the headache being worse in the morning on getting up, improving when they have a meal, increasing after the meal, especially if (as so often occurs) there is a difficulty in digesting it; as the day goes on the headache dies down, and after the evening meal it may disappear. In some cases the headache is continuous, in others occurs in paroxysms.

Unlike the headache of syphilis it is not worse at night, waking a patient up; in fact it generally disappears completely at night. It is alleviated by ingestion of food and sleep; on the other hand insomnia causes it to persist and intensifies it. There is not infrequently a hyperæsthesia of the scalp, and cases occur in which there is a hyperæsthesia and stiffness of the neck, accompanied by the subjective perception of creaking when the patient rotates the head and neck.

Spinal hyperæsthesia and rachialgia are not infrequent; the hyperæsthesia is generally localised, and the situations in which it is most pronounced are the cervical and lumbo-sacral regions; in the latter case the burning sensation, the numbness and various forms of paræsthesia may radiate into the buttocks and upper part of the lower limbs. The patient may complain of varied sensations of the spine, which, although not neuralgic in character, are often increased by pressure, movements of the spine, and prolonged standing or walking. Although the patient may indicate exactly the seat of the spinal pain, there is nothing to be observed, but sometimes over this area there

may be evidence of hyperæsthesia on pressure. The painful sensation may be continuous, transitory or intermittent.

Associated with this spinal hyperæsthesia there may be a feeling of weakness or heaviness in the lower extremities, which may simulate an oncoming paraplegia, due to compression myelitis; likewise the pains and paræsthesia may induce in a syphilitic the fear of tabes. Pains in the thorax may simulate pleurisy, and neuritis may be apprehended in various situations, but in neurasthenia there are no painful points on pressure.

Insomnia is one of the most frequent symptoms of irritable nervous weakness; there is lassitude and desire to sleep, but either the patient is unable to fall asleep till the early hours of the morning, or he awakens at an early hour and is unable to sleep again. Every tolling bell and every strike of the clock is heard; he is distracted by a constant flow of ideas which he is unable to dispel. After lying awake till dawn he falls asleep, awaking unrefreshed.

Such a condition leads the patient to take various drugs to induce sleep, which may in increasing doses give temporary relief, but are productive in many ways of an increase of the cause, *viz.* nervous exhaustion. Natural sleep is the first evidence in many cases of recovery.

A troublesome and frequent symptom of neurasthenia is giddiness or *vertigo*, which may be manifested in many ways and lead one to suspect, if care is not taken, that there is an organic cause for it. The patient complains of a painful feeling of instability, sometimes continuous, more often intermittent; it may be associated with dyspepsia and be attributed to it; it generally disappears with the improved sense of well-being towards evening. The patient never falls down, nor does he vomit; although he may have noises in the ears, they are usually not intense; examination of the ears reveals nothing abnormal.

Muscular weakness, giving rise to weariness and a general sense of fatigue on exertion, so that even dressing and undressing cause fatigue, is a frequent symptom. The patients often complain of feeling more fatigued when they get up than when they go to bed. The reflexes are either increased, normal or diminished; they are equal on the two sides. The knee-jerks are never absent. A fine vibratile *tremor* is a rare affection; it may simulate the hysterical tremor, or the tremor of Graves' disease. The tongue and lips may show tremor, and the pre-paralytic stage of dementia paralytica may be suggested thereby. A vibratile tremor may affect the orbicularis oculi.

Visual Sensory Disturbances. Among the more frequent disorders of the special senses are visual hyperexcitability, amounting in some

cases to a *photophobia*, *muscæ volitantes* are complained of, and *accommodative asthenopia*, which is either intermittent or continuous, sometimes renders the patient unable to read for any length of time without confusion of the visual images and various painful sensations in the eyeballs. This condition is not due to errors of refraction, but to fatigue of the nervous mechanism of accommodation. The pupils are equal, regular, and react normally, although perhaps a little sluggishly; there are no changes in the fundus observed upon ophthalmoscopic examination.

Auditory Sensory Disturbances. There is often *hyperacusis*, that is, the patients are extremely sensitive to sounds and noises; they may complain of noises in the ears, but there is nothing to account for this on examination.

Viscero-Vascular Symptoms. Among the most important symptoms of neurasthenia are those related to the *viscero-vascular functions*; for they may simulate closely many serious organic diseases.

Visceral Symptoms. A very frequent condition is a *gastro-intestinal muscular atony*, causing digestive disturbances and constipation; the patient suffers from pains at the epigastrium, relieved by food, but the digestion is slow and laborious, accompanied often by hyperacidity; hardly has the food been digested than the hunger pains again arise, to be once more relieved by food, which only leads to the same troubles. The patients often wake in the night with severe hunger pains. Owing to the atony, dilatation of the stomach and secondary fermentation may occur, and not infrequently acute crises simulating tabic crises.

In severe cases anorexia, vomiting, diarrhoea, pallor, depression and even cachexia may supervene, causing gastric ulcer, duodenal ulcer, or malignant disease to be suspected. The intestinal symptoms are irregularity of the action of the bowels, obstinate *constipation* or *diarrhoea*, borborygmi, and sometimes a *muco-membranous enteritis* with passage of casts, causing much mental distress to the patient.

Cardio-vascular symptoms are of very considerable importance, especially in view of the fact that at the involutional period of life, when neurasthenia is very prone to arise, symptoms of arterio-sclerosis are especially liable to commence, and the question arises, are the cardio-vascular symptoms due to the neurosis, or are they dependent upon the arterial changes?

The *vasomotor disturbances* of neurasthenia are a feeling of rushing of blood to the head, flushing and blushing, and the fear of the same, *erythrophobia*: sometimes a factitious urticaria occurs.

The *cardiac symptoms* are even more dis-

quieting to the patient, who is liable to suffer from palpitation, tachycardia and precordial pains which may radiate down the left arm, giving rise to a distressing *pseudo-angina*. Enfeebling of the heart's action, with coldness of the hands and feet, may occur, or the pulse may become suddenly slow and arrhythmic. These cardio-vascular symptoms may be associated with respiratory difficulties, giving rise to *paroxysms of suffocation and asthma*; a condition sometimes termed *neurasthenia cordis*.

Genital Symptoms. Neurasthenia very frequently commences with *genital* symptoms. The nervous structures presiding over the reproductive acts, in consequence of persistent masturbation, develop an irritable weakness which may be associated with various disorders of the genital organs, *e. g.* erections and nocturnal emissions, spontaneous emissions without erection, erections without emissions, incomplete coitus owing to ejaculation almost immediately, or to ejaculation without erection. Coitus in the neurasthenic is generally followed by *lassitude and fatigue* and pains in the lower part of the spine; or coitus may be impossible owing to a loss of sexual desire; or again the patient may be tormented by persistent nocturnal erections which are not relieved by coitus.

Nervous exhaustion in men and women is frequently brought on by *coitus interruptus* and too frequent *coitus*, coupled with artificial methods employed to prevent conception. The fear of impotence, the reading of books on the subject by quacks and the constant *morbid apprehension* occasioned thereby, coupled with the reflection upon *masturbation* in early life, may give rise to a sexual phobia and sometimes even end in suicide. It is no uncommon thing for men who are engaged to be married to consult a medical man because of the fear of impotence which haunts them, making their lives miserable.

In neurasthenic women the sexual organs play a less important part, but uterine pains at the menstrual periods are common. There may be frequent desire to micturate; the urine is pale, of low specific gravity, containing a diminished quantity of urea and excess of phosphates and sometimes a deposit of oxalate crystals. The nocturnal enuresis of children is due to irritable nervous weakness.

The Mental State. Most of the mental symptoms of neurasthenia are due to loss of power of attention. The intellectual faculties are never seriously affected; the patient may complain of a weakened memory or of lack of comprehension, but on actually testing this there is no evidence of much intellectual deficiency. The patient is so self-centred and absorbed in his complaint that he is apparently forgetful and unable to give the necessary

attention. There is no perversion or loss of any of the mental faculties. The patient may, however, read pages without comprehending, because he is unable to attend without fatigue; he cannot recall proper names, dates and facts because he is distracted when he heard them and they have left no abiding impression, owing to loss of power of concentrating his attention.

The neurasthenic will bring the doctor a carefully written out list of all his troubles; he will reason and listen to reason, and often go away much cheered when he is told there is no organic disease. His reasoning and judgment may, however, be capricious and uncertain, indeed loss of will-power and irresolution in acting, owing to the fear of doing the wrong thing, is not an infrequent symptom, and becomes a constant source of mental anxiety and exhaustion.

Hypochondriasis and various morbid fears or *phobias* are evidence of *psychasthenia*. While the patients are open to reason they are powerless to react against the psychic depression; often they fear they are going out of their mind. Crises of depression and excitation are especially prone to occur in women at the menstrual periods and at the climacterium.

Neurasthenic Anxiety and Imperative Ideas. The obsessive morbid fears or phobias of psychasthenia are varied and numerous, and have been designated by such names as agoraphobia (fear of open spaces), claustrophobia (fear of closed spaces), nosophobia (fear of drugs), syphilophobia, etc.

Extraordinary *imperative ideas* occur in some cases and may lead to most unpleasant and dangerous consequences. Thus cases occur in which the patient may feel compelled to touch some object whenever it is seen or impelled to read letters.

The reverse order of things may occur; the patient is afraid to touch certain objects, or every contact with a certain object necessitates ablutions to avoid contamination. Again, the psychasthenic may suffer from continued apprehension that he has made some mistake, and everything he does has to be reasoned about from every possible standpoint, until (if he be a business or professional man) he is obliged to give up his occupation.

Diagnosis. A mental picture of the subjective symptoms of the different types above described, combined with a careful physical examination to exclude organic diseases which are accompanied by the same or similar subjective symptoms will, generally speaking, permit a correct diagnosis to be made. It must, however, always be borne in mind that a neurasthenic may suffer from organic disease and that it is possible that the symptoms he com-

plaints of are in a measure due to the organic affection.

In the early stage of phthisis subjective symptoms suggesting neurasthenia may occur, viz. palpitation, feeling of weakness, tiredness, irritability and a tendency to perspire unduly. Again, arterio-sclerosis, coming on at the age when neurasthenia so frequently occurs, may be overlooked, and the symptoms attributed solely to a functional condition of the nervous system; whereas they may be wholly or in part due to a widespread arterial change affecting the nutrition of the central nervous system or the heart; or there may be chronic Bright's disease. Evidence of hypertrophy and dilatation, of valvular disease of the heart, of thickened tortuous arteries, of hypertension of the pulse, albumin and casts in the urine and retinal changes show that the subjective symptoms may be of organic origin.

The diseases of the nervous system which may be mistaken for neurasthenia are: (1) disseminated sclerosis; (2) tumor cerebri; (3) dementia paralytica, especially in the early stages with depression; (4) tabes in the preataxic stage; (5) cerebral syphilis; (6) cerebro-spinal syphilis, and (7) various forms of toxic neuritis.

It is unnecessary to refer at length to the objective signs of these organic diseases of the nervous system, one or more of which are invariably present and serve as a means of differentiation from a purely functional disease. Among the more important may be mentioned nystagmus, unequal pupils and reflex rigidity, optic neuritis, ankle clonus, Babinski's sign and absent knee-jerks; the presence of any one of these will indicate that there is an organic disease. Examination of the blood and cerebro-spinal fluid, examination of the spine and thoracic organs by the X-rays and of the stomach by the same means, after a bismuth meal, may be of great use in some cases. Melancholia and paranoia are unlike neurasthenia, inasmuch as the depression and the delusions are uninfluenced by reasoning and argument.

Course—Progress and Prognosis. The disease may commence suddenly as a result of injury or emotional shock; usually it develops gradually and runs a chronic course extending sometimes over several years, but not necessarily continuously; for there may be remissions and intermissions. The duration of neurasthenia depends largely upon the causes which have brought it about and the possibilities of their avoidance or removal.

A neuropathic predisposition is unalterable, and the course and progress of the disease in cases where this is the chief basis must depend upon the removal or avoidance of determining causes arising in the life and habits of the individual. The neurasthenia of old people

with a lowered vital reaction is always troublesome to treat, apart from the fact that it may be associated with organic disease.

The prognosis is always more favourable when the patient sleeps naturally and is able to enjoy and digest his food. Sexual neurasthenia is one of the most troublesome forms, as there is always preoccupation and frequently a morbid apprehensiveness interfering with the normal physiological conditions of the body generally. Neurasthenia associated with such organic diseases as tabes or arterio-sclerosis is always difficult to treat. Suicide seldom occurs in simple neurasthenia, but it is more liable to occur in psychasthenia, especially when there is continuous insomnia.

Treatment. Obviously the most important consideration in treatment is to find out any of the causes which have been mentioned in the section on *Etiology*, and if possible to avoid or remove them. Many slight cases require nothing more than rest from their occupation, a change of scene, a voyage, or travel and outdoor exercise, while others are so severe and chronic that they become most difficult to treat successfully.

A frequent and often successful mode of treatment is that of Weir Mitchell; it consists in isolation from friends, absolute rest in bed, with overfeeding, the diet containing a large quantity of milk, and daily massage. The massage should be gentle at first, and for not more than half-an-hour; later it may be more vigorous and extend to three-quarters of an hour. No drugs as a rule are needed, unless to promote a daily action of the bowels or sleep.

The personality of the physician in all cases of neurasthenia is an important element in successful treatment; often he has to act as confessor, especially in relation to sexual matters, excessive indulgence natural and unnatural, fears of impotence resulting in apprehensiveness prior to marriage and subsequently strained marital relations. With some patients he requires to be firm and unyielding, with others sympathetic; there is no disease in which common-sense and knowledge of human affairs plays a more important part in successful treatment than in neurasthenia.

Therapy. Symptoms require to be treated; the *headache* and painful spots on the spine may be relieved by local anodynes, *e. g.* menthol preparations, or iodine or mustard leaves; hypodermic injections of morphia and cocaine should be avoided. *Insomnia* is best relieved by trional, bromural, veronal, paraldehyde, bromides and chloral. Opium and its preparations are best not given.

As nerve tonics testicular extract and spermin have been employed in the form of injections—glidine, glycerophosphates and lecithin compounds are prescribed. It may,

however, be remarked that these phosphorized substances are contained in great abundance in eggs and milk and in all animal and vegetable foods. Arsenical preparations are useful in some cases where there is associated anæmia. Bromides are useful in cases where there is restlessness, agitation and anxiety; they are better given in thirty-grain doses at bedtime. Hydrobromic acid, combined with strychnine, quinine and sulphate of magnesia, forms a useful tonic in many cases of neurasthenia.

Hydrotherapy. The patient may be sent to a hydropathic sanatorium situated at a fairly high altitude, where the climate is agreeable, the scenery attractive and where preoccupation will be avoided by amusement and outdoor sport. Cheerful companions and the atmosphere of cure are of great importance. Some patients benefit from a cold douche for fifteen seconds, followed by brisk rubbing-down with a towel; others who are agitated and excited are successfully treated by warm sea-water baths, or the same prepared with sea-salt every other day.

Electrotherapy. The high-frequency current applied in various ways has been much employed of late, and electric baths are in some cases useful. The galvanic and faradic currents are more suitable for local treatment, especially in cases of sexual neurasthenia with spermatorrhœa or impotence.

Diet and Regimen. The diet should be light and nutritious and easily digestible, especially in cases where there is gastric and intestinal atony with hyperacidity. The meals should be well masticated, small in quantity and taken at frequent intervals, generally speaking, every three or four hours. Patients often experience relief by eating a biscuit between meals, and if the patient wakes in the night milk or some food should be at hand. In cases of intestinal atony the diet should not contain much cellulose and waste products. Nux vomica in combination with laxatives may be prescribed for atony and constipation.

Traumatic Neurasthenia and the Relation of Injury to Nervous and Mental Disease

Introduction. The medico-legal importance of distinguishing cause from coincidence in cases of injury in relation to nervous and mental disease has come into increased prominence since the introduction of the Workmen's Compensation Act; and when the State Insurance Bill becomes law the diagnosis and prognosis of neuroses and psychoses following trauma, and the detection of fraud and malingering, especially in cases of shock and slight injuries to the head and spine in which obvious and visible signs are absent, will be a constant source of anxiety to members of the profession.

Employers, except in the case of corporations and large companies, as a rule insure against accident or injury to their employees; the result is that workmen and employees are more certain of obtaining adequate compensation for injuries received. Should a company dispute the claim and the case come before a jury, just as is the case when railway, bus, tramway or other companies or corporations carrying the public are defendants in actions for damages, sympathy is generally, and sometimes improperly, felt for the individual rather than for the corporation or company. The knowledge of this fact has led to unfair claims being made, and the insurance, like the railway companies, have frequently been compelled to resist their payment. Unfortunately this has led to just claims sometimes being classed as exorbitant, causing legal intervention, lawsuits, and much money being thereby frittered away in costs, to the benefit of neither party.

Legal intervention often leads to deserving cases being subjected to prolonged worry, anxiety, sleeplessness and, consequently, bodily ill-health. A pending lawsuit to recover a just claim by a sensitive and nervous person suffering from traumatic neurasthenia will aggravate the symptoms and lead to their prolonged instalment.

Medico-legal cases naturally fall into two great groups, (a) *functional*, (b) *organic*. It is with the former, where the symptoms are almost, if not entirely, subjective, that the greatest difficulties to the medical man arise; but in many organic diseases of the nervous system following injury to the head or spine, difference of opinion may arise as regards responsibility and assessment of damages. Again, medical opinion may differ as to how far the injury received was the prime cause, a coefficient, a contributory cause, or a mere coincident in the production of the disease for which damages are claimed. From a medico-legal point of view the interest does not lie so much with cases of injury causing (a) fracture of the skull or spine, (b) hæmorrhage or (c) localised meningo-encephalitis or meningo-myelitis resulting in organic brain or spinal cord disease. In these there are definite signs and symptoms of the actual injury, with paralysis or other resulting loss of function, so that no dispute can arise as to the prime, and often indeed the sole causal factor. It is quite possible, however, for a severe head injury (even necessitating trephining) to occur and yet to be only a coincidence or exciting factor in a man who has had syphilis. Cases have occurred in my experience where a man in the preparalytic stage of dementia paralytica has suffered from a severe head injury causing a rapid development of the disease. Again, I have known instances

where a man has developed a localised gummatous meningitis of the brain or spinal cord as a result of a head or spinal injury. It would be difficult, however, to convince a jury that a head injury sufficiently severe to necessitate such a serious operation as trephining, or even one followed by paralysis without any operation having been necessary, was not the prime cause of general paralysis, insanity or epilepsy; and the fact that there was a history of acquired syphilis in the first mentioned, and an hereditary taint in the last named, would not convince the jury that if this head injury had not occurred the patient would have suffered from paralysis, epilepsy or insanity. But in a shock or concussion there may be little or no external evidence of injury to the head or spine, nor any gross nervous disorder discernible, such as irritation or paralytic phenomena, but the higher functions of the brain as an organ of the mind may have been profoundly disturbed; the man may have lost consciousness for some time; he may be unable to recollect how the accident happened or recall the experiences of his life for some time (perhaps minutes or several hours) previously; and as a result of the shock to the nervous system a neurasthenia ensues in which a characteristic feature is an inability of the brain to exercise sustained attention on account of the mental fatigue which occurs. A further proof that concussion produces a profound disturbance of the functions of the brain is afforded by the well-known fact that a man who has suffered from a severe head injury is rendered intolerant of alcohol; a dose which previously may have had little or no effect may, after a head injury, readily produce toxic symptoms.

Diagnosis of Functional Neuroses and Psychoses. The diagnosis of functional neuroses and psychoses following injury and the detection of malingering is always a source of much anxiety and trouble to a medical man. To form a just opinion on a case requires the exercise of sound judgment of character and knowledge of the previous conduct and habits of the injured person.

The medical man who knows, or has ascertained, that the patient is the member of a stock in which epilepsy, insanity, hysteria, or other neurosis or psychosis occurs among its members, will recognize the probability of a neuropathic tendency. He will infer that a comparatively slight trauma in such an individual, such as that produced by a blow on the head which may or may not cause loss of consciousness, without any fracture or obvious injury of the head, is quite sufficient to cause serious symptoms in an individual predisposed to a neurosis or psychosis by an acquired or inherited *locus minoris resistentiæ* in the nervous

system. Thus a man who is known to be a chronic inebriate, or a subject of lead poisoning, or a person who has had syphilis, especially one who, by his habits of life has been known to have exhausted his nervous system by sexual excesses, mental stress involved in gambling and speculating, associated with smoking and drinking, may be on the verge of neurasthenia when he meets with the accident. A certificate may be written to the effect that he is suffering from "traumatic neurasthenia," thus implying that the injury was the sole cause of his condition, and a claim for excessive compensation made.

Again, as the result of injury to a chronic inebriate, "delirium tremens" is not an infrequent consequence, and this, for the sake of compensation claims, has been termed "traumatic neurasthenia." Indeed, so much fraud has been perpetrated under the term "traumatic neurasthenia" that many lawyers know that such a diagnosis does not carry much weight in a court of law unless the man's previous character and conduct are above suspicion. The medical experts employed by railway companies are fully aware that after a settlement has been effected the symptoms frequently disappear rapidly, but it does not necessarily follow that, because a rapid improvement has taken place after the claims have been settled, the symptoms of neurasthenia following head injury have not been genuine. Many patients, relieved of the anxiety and sleeplessness, accompanied by bodily ill-health, caused by the pending lawsuit, soon recover, because an important cause of the exaggeration and prolongation of the nervous exhaustion was thereby removed.

The differential diagnosis of neuroses and psychoses from gross organic diseases is very important. Following an injury the patient may suffer from convulsions, paralysis, paresis, ataxy or neurasthenia, and it is necessary to ascertain whether the symptoms are due to functional or organic disease. The diagnosis of hysterical paralysis may be difficult; there may be a hemiplegia, a monoplegia, or a paraplegia. The deep reflexes may be exaggerated, but there is no true clonus and Babinski's sign is absent; there is no true paralysis of the sphincters, but temporary retention of the urine is common in hysteria. A careful examination of the patient, remembering the diagnostic differences which serve for the discrimination of hysteria and neurasthenia from organic diseases of the nervous system, will enable the practitioner generally to come to a correct conclusion. But these functional neuroses, especially traumatic neurasthenia, in which the symptoms are almost entirely subjective, may be assumed by malingerers, and a differential

diagnosis is not always easy; moreover, it is of great importance, because a man may truly be incapacitated, especially in occupations involving mental work, for a considerable time after the injury. Seeing that the symptoms may be all subjective, it may be extremely difficult to distinguish the genuine symptoms from those which might be assumed in order to obtain a better compensation; and in forming a judgment, as before remarked, previous conduct and character, as well as present behaviour, must be taken into consideration. A malingerer will probably overdo the symptoms; although he will say that he was stunned, he will describe the accident and the events preceding it, which we know is unusual when the accident or blow is severe enough to produce unconsciousness; instead of a mental dullness and apathy, with loss of memory, he will often show mental alertness in describing his symptoms. He may assert that he is unable to walk, or he may simulate a hemiplegia, and yet give none of the characteristic signs of functional or organic paralysis. Not infrequently, however, he has heard of increased knee-jerks, and then the jerk sometimes can be elicited by striking *at* but not *on* the tendon. This anticipation is very suggestive of his mental attitude. Again, spurious clonus can be often detected by making the patient count slowly, then at different rates, while you are obtaining the clonus; it will then be noticed that he is unable to attend properly to two actions at the same time, and the rhythm of the clonus will vary, or the contractions become irregular and halting. A plantar extensor response may be simulated, but by suggestion it can be changed from one side to the other or converted into a flexor response. If an extensor response occurs it is not the slow, deliberate extension of the big toe, with fanning of the little toes, so characteristic of organic disease of the lateral columns of the cord. Asked to touch the tip of his nose with his finger, his eyes being shut, he may fumble about like an ataxic, but none of the other signs of ataxy would be present.

Symptoms of Traumatic Neurasthenia. A common history may be thus illustrated. A man falls from a car when it is starting, or he has been injured in a railway collision; for a short time he may be dazed and unconscious. Perhaps several ribs or a limb are broken; perhaps the scalp is wounded and he is bruised on various parts of the body. He may be able to get up and walk or is taken home or to the hospital. The wounds may heal well but he is shaken in his "nerves." He suffers with headache, weakness of memory, incapacity for work, irritability of temper, palpitation, dyspepsia and insomnia, symptoms indicative

of a mild neurasthenia. In the severe forms, in which concussion has occurred, the patient after recovering consciousness is dazed and exhibits mental dullness and confusion; he is often unable to recollect the circumstances of the accident; for months, and even longer in severe cases, there is an inability to undertake any serious or prolonged mental effort without fatigue and, generally speaking, there is headache, usually occipital, and without any cause. Any mental effort requiring sustained attention, deliberation and judgment the subjects of traumatic neurasthenia are unable to undertake. Irresolution or indecision indicative of enfeebled will-power frequently results, interfering seriously with his occupation, especially if it be one involving responsibility. The bank clerk who could add up correctly and rapidly columns of figures without effort is no longer able to do so. The foreman or overseer of a workshop overlooks more than he oversees. The carver at a restaurant is unable to attend to the orders of the customers, and for a whole year may remain out of a situation in consequence, as happened in one of my cases.

In very severe cases of concussion the symptoms of Korsakoff's psychosis may occur. Thus there may be marked mental confusion, disorientation of time and space, mistakes in identification of persons, and especially loss of memory of recent events without hallucinations or delusions. In some cases "*commotio cerebri*" may be complicated by contusion of the brain without any discoverable fracture, and in addition to the symptoms just described there may be epileptiform convulsions and mania. The common cause of Korsakoff's psychosis is chronic alcoholism; it especially affects women; and chronic inebriate men, as well as chronic inebriate women, are not infrequently admitted to hospitals and infirmaries, having fallen down a flight of steps or from a car or omnibus, or they have been knocked down in the street by a vehicle, or have received a head injury in a brawl. The patient may smell strongly of liquor, or be known to the police as a chronic inebriate—such information helps in a diagnosis as the prime cause of the symptoms. I have occasionally heard of cases, however, in which there was no toxic basis. When alcohol or a toxic agency is the cause there are usually hallucinations and delusions and some evidence of neuritis.

Prognosis. Another question of great importance is the prognosis, for injury which has produced traumatic neurasthenia may eventually terminate in an incurable fatal brain or cord disease. Several months may elapse before symptoms of traumatic epilepsy or general paralysis come on; and if such occurred within a few months rather than immediately after,

or a long time after, it might be presumed that the injury was a determining factor in the onset of the disease. Indeed, it might be affirmed, and with good reason, that had not the injury occurred the epilepsy or paralytic dementia would not have affected the patient. Yet hospital cases and asylum statistics show that head injury *per se* is not a frequent cause of epilepsy and is very rarely a cause of insanity. Since modern investigation shows that syphilis is an essential factor in the production of general paralysis, injury can only act as an exciting cause, and even then it is not common. Still, as with epilepsy, there is in general paralysis always the difficulty of discriminating between cause and effect. The same applies to injury and tabetic symptoms. Thus a man in the preataxic stage may suffer a slight mishap, such as a fall from a cart, and sustain a fractured femur or dislocation of a joint. The existence of Argyll-Robertson pupils and the examination of the blood and cerebro-spinal fluid would show that he was suffering from a disease in which a slight injury would cause a serious disablement; indeed, it might have occurred without any injury. It would, however, be difficult to convince a jury on this point.

Again, the first manifestation of both epilepsy and general paralysis may be a sudden lapse of consciousness—a fit or seizure—whereby the individual may sustain a head injury. The loss of consciousness following the head injury may be due to the disease and not to the trauma. Thus a bricklayer may fall from a ladder, or an engineer's mechanic may be injured by machinery, through sudden lapse of consciousness owing to pre-existing disease; later, if he developed epilepsy or general paralysis and claimed compensation, it might be asserted with justice that the accident was in consequence of pre-existing disease, although there was no very definite evidence to prove that he had suffered from it. Such rebutting evidence in a claim for compensation, however, could not be made if a brick had fallen on the man's head, or if a head injury resulted from the breaking of a machine.

Again, paralytics in the early stages and epileptics are impulsive and quarrelsome; they are therefore liable to receive head injuries from blows or from being knocked down in a quarrel, and the wife and friends often attribute the disease to the injury received. There is no doubt that trauma may be a cause of epilepsy, but how far the head injury is the primary and sole cause, or merely an exciting factor in a person predisposed to epilepsy by an inborn taint, by alcoholism or syphilis, is difficult to decide. Very often an epileptic may for some long time have been manifesting signs of the disease unknown to friends and relatives; he

may have had attacks of *petit mal* or fits during sleep, or impulsive automatism; then perhaps while at his employment he falls down in a fit and injures his head severely and remains unconscious for some time. His symptoms may be exaggerated by the accident, and his friends now take more close notice of his bodily and mental condition, and attribute all the symptoms they now see and the fits which occur to the injury.

Tubercular Meningitis in children may undoubtedly follow head injury, and I have myself seen cases of quiescent *disseminated sclerosis* lighting up with fresh access of symptoms as a result of the shock of a fall or injury.

Recovery from the traumatic neuroses and psychoses, especially from neurasthenia, largely depends upon the removal of all those causes which tend to excite nervous irritable weakness (*vide p. 326*). If there is an inborn neuropathic tendency delay in recovery or even a permanent instalment of the affection may be expected. Again, age, sex and the severity of the symptoms following the injury help in establishing a prognosis as to the time before the patient will be fit to return to his occupation. The character of the occupation, the number of hours worked per day and whether attended with responsibility and concentrated attention, are factors which will help the medical man in forming a judgment as to the fitness of the patient to return to his employment. Inquiry relating to sleep, digestion, assimilation and general improvement in the sense of well-being and nutrition of his patient will materially assist him in forming a conclusion. In traumatic neurasthenia time is often saved by a prolonged rest and freedom from worry, cares and responsibility. The danger to life is very small in traumatic neuroses and psychoses.

An important question is, how long a time may elapse between the injury or accident and onset of the neuroses or psychosis? The time is never very long in neuroses and psychoses. In epilepsy following trauma I have met with cases that certainly did not develop for eight weeks, and some cases have been reported in which the epilepsy began years after the injury to the skull.

The medical treatment is the same as that given in the section on *Neurasthenia*.

F. W. M.

AMAUROTIC IDIOCY (TAY-SACH'S DISEASE)

Definition. A fatal disease affecting Hebrew children, characterized by blindness and progressive paralysis due to a characteristic degenerative change of the neurones of the retina and nervous system.

Etiology. The disease is confined to the offspring of Jewish parents; it affects both sexes; it has not been associated with any conditions of nurture, such as breast feeding or artificial feeding, embryonic surroundings or injury. There is no history of difficult labour, use of forceps, or of any injury in utero, or during parturition. Neither syphilis nor tuberculosis of the parents can be held responsible, nor can it be attributed to any of the infectious diseases. In the absence of any proof of toxic conditions or nutritional failure, it may be inferred that it is in all probability occasioned by an inborn failure of durability of the germinal determinants of the nervous system peculiar to the Jewish race.

Symptomatology. The children affected by this disease are generally born at full term, to all appearances in perfect health and vigour, and for the first three to six months they appear to thrive and to be a joy to the mother, who notices nothing unusual in the behaviour of the infant. The first indication to her may be that the child is unobservant of her presence and its limbs are moved less than before; later, as paralysis of voluntary movement progresses, the mother notices that the child is unable to hold its head up or even sit up. She may call in a medical man to account for her apparently well-developed and healthy child, for no obvious reason showing these unusual symptoms; more often the doctor is called in on account of a bronchial or gastrointestinal affection to which these children are especially liable.

In addition to blindness, loss of movements and flaccidity or perhaps spasticity of the limbs, he may find the reflexes normal, subnormal or somewhat exaggerated, contrasting with a partial or complete absence of the child's observance by sight of surrounding objects; he may be struck by a sensitiveness to sound and touch. He may obtain a history of convulsions, but they are by no means a constant symptom. A medical man called in to see a Jewish child presenting such symptoms and history should at once make an examination of the fundus oculi, and if the ophthalmoscope reveals a *cherry-red spot at the macula*—the characteristic pathognomic condition of the disease first described by Warren Tay—the diagnosis is certain; for there is no other disease in which this condition has been described.

Prognosis. The prognosis is as certain as the diagnosis, for it may with confidence be asserted that the symptoms will progress; the child will become totally blind, if it is not already so, the paralysis will be progressive and will end in contracture. Marasmus and death will supervene in all probability before

the child is two years of age and certainly before it is three.

Inquiry of the mother, who is in all probability an alien, may elicit the fact that an infant born previously to the patient had suffered from similar symptoms and died before two years of age, death having been attributed to an intercurrent disease, the nervous affection not having been recognized.

Treatment. There is little or nothing to be done except to guard against intercurrent affections. No means are known at present for arresting the disease. Inquiry may be made by the parents regarding the safety of elder children; upon this point they may be reassured, but it cannot be said that children born in the future may not be similarly affected, inasmuch as it is not uncommon for two or more children of a large family to suffer from this disease. Prevention, as far as we know, resolves itself into discouragement of the marriage of blood relations and of persons

with an inherited neuropathic and psychopathic taint.

Pathology. As the disease is etiologically and clinically pathognomonic, so the microscopical changes in the nervous system are practically speaking pathognomonic. The convolitional pattern of the brain is complex and well developed, quite unlike that of an idiot's brain; hence the term idiocy is hardly correct. The substance has a dense, firm, leathery feeling due to a great overgrowth of neuroglia tissue. Microscopically, all the neurones in the body, including the sympathetic, are affected. There is a disappearance in the nerve cells from without inwards of the Nissl substance (kinetoplasm); the body of the cell swells up and undergoes degeneration; the nucleus is the last-formed element of the cell to disappear. The ganglion cells of the retina, especially in the neighbourhood of the macula, show this change. There are no vascular changes to account for this condition.

F. W. M.

II.—DISEASES OF CHILDREN

BREAST FEEDING

HUMAN milk is the only perfect food for the baby during the first nine months of its life, and only under quite exceptional circumstances is it justifiable to take it off the breast. Tuberculosis, nephritis, mental disease, septicæmia and other serious infections of the mother may make weaning necessary, and it is advisable also in pregnancy. Congenital syphilis in the child is a particular reason against weaning, as it is in sore need of breast milk.

Management of Breast Feeding.—The nursing mother should put her baby to the breast eight-hourly the first day, four-hourly the second day, and thereafter with the inflow of milk regular feeding should be started. Contrary to the usual practice, experience shows that five feeds in the twenty-four hours are all that are required. The best times for feeding are 6 a.m., 10 a.m., 2 p.m., 6 p.m. and 10 p.m. If the baby is trained to this routine from the beginning the result is very satisfactory, granted that the child is healthy. The longer intervals and the complete rest at night are beneficial alike to the mother and the baby's stomach. Under normal conditions one breast should be used at each feed, and the meal should last about fifteen minutes. Absolute regularity of meals should be maintained, and on no account should the baby be put to the breast because it cries, or be allowed to remain unfed beyond the proper hour because it is asleep. Many infants suck ravenously and empty the breast in less than ten minutes, to suffer later from colic and flatulence or vomiting. The mother must prevent this by compressing her nipple between the first and second fingers of her disengaged hand, for by so doing she can regulate the flow of milk. Before and after each feed the nipple must be cleansed with soap and water and carefully dried. If this plan be diligently followed there is no need to swab out the baby's mouth, which is an advantage, because any but the most gentle manipulation rubs off the superficial layers of the mucous membrane. Any soreness or tendency to crack is best treated by bathing the nipples in forty per cent. spirit lotion; if actual abrasion occurs the unaffected breast should be used, and the cracked nipple anointed with glycerine and tannic acid.

The diet of the nursing mother should be plain and plentiful. Tea and coffee ought to be taken in moderation only, and alcohol is unnecessary and may be injurious. At least a quart of additional milk should be drunk daily.

Her room should be kept warm and airy; and when allowed out, at first driving and later walking exercise, carefully regulated to avoid fatigue, are beneficial.

The clinical evidences that the breast milk is suitable are the appearance and weight of the baby and the absence of gastro-intestinal disturbance. An analysis of the milk is seldom useful. If progress is not satisfactory, attention should be paid to the mother's health and diet. More rest, both physical and mental, a more liberal diet, *cascara sagrada* to correct constipation, and iron for anæmia, will often improve the quality of the milk sufficiently to remedy the defect. Malt extract is a very useful addition to the mother's food. Drugging and menstruation are possible causes of persistent unexplained vomiting or diarrhœa on the part of the infant. If in spite of treatment the breast milk is still inadequate, it should not be abandoned but supplemented by two or more artificial feeds in the twenty-four hours, according to circumstances. Partial breast feeding is far better than no breast feeding. F. L.

ARTIFICIAL FEEDING OF INFANTS

When a mother cannot nurse her baby at the breast some artificial substitute must be found. Wet nursing, it is true, may be advisable if the child is very delicate and artificial food does not agree, but it is unpopular through its many drawbacks, social, moral and æsthetic. The only practicable substitute is cow's milk. Ass's milk, condensed or desiccated milks, and the various proprietary infant foods, although valuable as temporary expedients, are unsuitable chemically or physiologically for ordinary use and are far too readily advocated. The price of a patent food is an index of the extent to which it is advertised, rather than of its nutritional value. Golden rules to be observed in infant feeding are *scrupulous cleanliness, absolute regularity of feeding and avoidance of excess.*

The Milk should be obtained from a clean dairy farm, where in hot weather it should be cooled directly after milking by standing it either in ice or cold water. It should be delivered twice a day in air-tight sterilized bottles, and a guarantee should be obtained that it has not been sterilized, pasteurized, or preserved in any way. The mixed milk of several cows is better than so-called nursery milk, which is said to be obtained from one cow only, for the composition of the former is more

constant. Soon after delivery it should be scalded to render harmless any tubercle bacilli or other organisms which it may contain. Pasteurization and sterilization, besides being troublesome, increase its liability to subsequent contamination, whilst the latter may produce scurvy. Boiling makes it unpalatable. For these reasons scalding is best. It is easily done by standing the bottles up to their shoulders in a vessel full of water which is brought to the boil and kept at the boiling-point for five minutes. When removed, their caps should be readjusted, and they should be stood in a cool place (preferably on ice, in the summer) until required.

The **Feeding Bottle** should be boat-shaped, free from sharp angles and from screws, and wide-mouthed enough to permit efficient cleansing. The teat should fit directly on to the bottle, and be capable of being turned inside out. The hole of its nipple should be circular and only large enough to allow the milk to flow out at the rate of about a drop per second when the bottle is inverted. Tubes of any kind are dangerous. After each feed the bottle must be rinsed out with very hot water until it is clean, and afterwards immersed in clean cold water until it is used again. The teat must be thoroughly cleansed inside and out in the same way and also left in clean water. The vicious habit of "comforter" sucking should on no account be permitted.

Methods of Feeding.—For the first week of life *whely* is the best artificial food. It may be prepared by adding a drachm of Fairchild's peptemica to a pint of milk at 100° F., allowing it to stand until the curd separates and straining. It must be heated to 155° F. to destroy the ferment, unless administered alone. If prepared in this way it contains the lactalbumin, salts and sugar of the milk, but only .2 per cent. to .5 per cent. of fat. After the first week this may be gradually strengthened by adding increasing quantities of milk. By this means the infant's stomach is gradually trained to do its work, and is in no danger of being disordered by attempting to deal with cow's milk at a time when it is quite unfitted for it.

Feeding by Diluted Milk.—Cow's milk differs chemically from human milk, especially in three ways, containing as it does a higher percentage of proteid, a considerable excess of casein over lactalbumin, and a higher percentage of calcium salts. Attention has been paid chiefly to the first of these distinctions, and it is usual to negative it by diluting the milk with water, barley water or lime water. Plain boiled water is generally the best diluent. If barley water is used, it should be prepared from pearl barley. A tablespoonful is washed and put in a saucepan with one pint of cold water. This is brought to the boil,

allowed to simmer for half-an-hour and then strained. Until the age of three months, one part of milk to two parts of diluent may be given, from three to six months, equal parts, and from six to nine months, two parts of milk to one of the diluent. Thereafter no dilution is necessary.

Since the milk has been diluted it is necessary to add more sugar and fat. The best form of sugar is lactose, but it is expensive. Malt extract, is an excellent substitute, and cane sugar, although less digestible, is usually satisfactory. The amount of sugar to be added differs according to the baby's age, but a good plan is to allow a domestic teaspoonful (5 ii) or a lump of cane sugar, half-an-inch square, to every three ounces of the mixture. By this means an extra five per cent. of sugar is added.

Both human milk and cow's milk contain about 3.5 per cent. of fat. When milk has been diluted it is usual to make up the fat content by adding separated cream, which contains forty-eight per cent. of fat. A useful rule to remember is that the addition of each drachm of cream to three ounces of the mixture increases its fat value by two per cent. For example, if milk has been diluted with two parts of water it contains 1.2 per cent. of fat, if new cream be added in the proportion mentioned above, its fat content is raised to 3.2 per cent., or nearly normal. It is advisable, however, to defer adding cream until artificial feeding is agreeing, then to increase it very slowly.

Feeding by Undiluted Milk (Whole Milk).—For some years I have relied almost entirely on undiluted citrated milk, citrate of soda being added to the milk in the proportion of two grains to the ounce, as originally suggested by Sir Almroth Wright. The citrate renders the curd soft and diffuent, like that of human milk, and so obviates the need for dilution. A simple way of employing this method is to make a solution of twenty grains of citrate of soda to a drachm of water. A drachm of this solution should be added to each half-pint of milk, which may readily be done after it has been scalded.

The advantages of this method are obvious. It is simplicity itself, the volume of the feed is small—an important matter, there is little danger of contamination, and no cream or sugar need be added. Cream is expensive, often impure, variable in fat content, and rich in preservatives. I have found this method of infant feeding the most successful in every way in all but exceptional cases.

Frequency and Quantity of Feeds.—It is customary to feed infants unnecessarily often. If trained from the beginning, five meals in the twenty-four hours are all that they require. The best times, as for breast feeding, are 6 a.m., 10 a.m., 2 p.m., 6 p.m. and 10 p.m. Meals more

often than every three hours by day and one meal at night, in the case of healthy children, probably do more harm than good. More important than the frequency is absolute regularity by the clock. Each feed should last about a quarter-of-an-hour. The proper guides to the amount of milk which should be taken at each feed are the baby's appetite, the condition of its stools, and the evidence of the scales. The first of these generally suffices. Under no circumstance should its appetite be forced, for it is better to allow a meal to go altogether by the board than to worry an embarrassed stomach. The following table of the average total quantities of milk suitable for the twenty-four hours may be taken as a rough indication, and from it the quantity at each feed is readily derived.

	Ounces.
Until the end of the first month . . .	3-6
During the second month . . .	6-8
.. .. third .. .	8-10
.. .. fourth .. .	10-15
.. .. fifth .. .	15-20
.. .. sixth .. .	20-25
From seventh to ninth month . . .	25-30

To feed by the table, however, is a sign of weakness, for it implies that all babies are physiologically alike. In case of doubt or difficulty it is wise to begin with amounts far below the average and then to increase them in accordance with the baby's appetite. F. L.

CURD INDIGESTION

A certain number of infants have difficulty in digesting cow's milk. The difficulty may be slight and easily overcome, or it may amount to intolerance of cow's milk in almost every shape or form. To this state of affairs the name "curd indigestion" is sometimes applied; the term is not a very happy one, because it assumes, (what is not always the case) that the difficulty lies in digesting the curd of the milk. Now it is well at the outset to say plainly that we are as yet very much in the dark as to why some infants do not thrive on cow's milk, and also as to which particular constituent of milk gives rise to difficulty. In all probability the casein is blameworthy in some cases, but in others, and these are the most difficult to manage, the indigestion and failure to thrive are almost as conspicuous after the milk has been so modified as practically to eliminate curd formation altogether. It is impossible within the compass of a short article to do more than indicate how curd indigestion may best be prevented, or, if it is present, be cured.

The symptoms of curd indigestion are, briefly, failure to thrive, along with the ordinary signs

of indigestion—irregularity of the bowels, colic, flatulence and vomiting. The motions are usually more numerous than normal, and often of a greenish colour; they generally contain visible mucus, and whitish flakes of so-called "curd." It is by no means certain, however, that these white masses in the stool are always undigested casein; sometimes they consist of soaps, sometimes of fat, and sometimes, probably, of casein.

Curd indigestion occurs in a certain number of infants whose feeding from birth has been unexceptionable; in these we must suppose there is a natural difficulty in digesting cow's milk. Much more commonly, however, it results from a faulty diet. Prevention is much easier than cure, and if more attention were paid to the rational feeding of infants and to the first signs of the diet disagreeing, we should see fewer cases of intractable curd indigestion. Over-feeding is the most frequent fault, either giving feeds which are too bulky, or in which the milk is not enough diluted (see *Artificial Feeding*). Lack of cleanliness, irregular feeding, unsuitable articles of diet, an attack of acute diarrhoea—anything, in short, which means a digestive upset, is very apt to be followed by intolerance of cow's milk, which may be of considerable duration.

In dealing with a case of curd indigestion we proceed on the following lines: In the first place, the composition of the diet should be scrutinized, because the fault may be an excess of fat. If the mixture which is being given contains more than 3.5 per cent. it is not unlikely that this may be the cause. In such a case the patient should be ordered a mixture of milk one, diluent two, with milk-sugar to bring the percentage up to six—say a tablespoonful to every ten ounces. If there is no excess of fat, the most generally useful remedy, at the outset, is sodium citrate, which should be added to the feeds in the proportion of one grain to each ounce of milk. This greatly diminishes curd formation; if as much as two grains to each ounce is given, curding is probably prevented altogether. The advantage of sodium citrate is that it often enables us to avoid excessive dilution of the milk. This plan of citrating is often quite successful; as time goes on the citrate is gradually diminished and finally withdrawn altogether. If citrating fails, peptonizing should be tried, Fairchild's peptogenic milk powder being used. Peptogenic milk ought, however, to be prepared without the added cream recommended in the instructions. If peptogenic milk is not tolerated, milk fully peptonized (thirty minutes) in the ordinary way may be used. A baby which is not able to digest this fully peptonized milk has very feeble digestive power, and its rearing will be a matter

of much difficulty. As an alternative to peptonized milk (particularly among the poor), condensed milk (one full teaspoonful of sweetened milk to three ounces of water) may be tried. So far as digestibility goes, the two are almost on a par. Whether peptonized or condensed milk is employed, it is essential to remember :— (1) that the diet is not adapted for prolonged use, but is a temporary expedient only, and (2) that the return to ordinary cow's milk should be gradual, never sudden.

If none of these foods succeed, recourse may be had to whey, but practically whey is seldom of much use in this class of case, serviceable though it proves after acute diarrhoea. Its nutritive value is too low for a diet which must be adhered to for several weeks, and moreover, it is often badly borne in cases of curd indigestion. In these circumstances buttermilk ought to receive a trial. It is prepared thus : To thirty ounces of buttermilk add one level tablespoonful of flour, and two level tablespoonfuls of cane sugar; boil the whole, stirring constantly. This mixture contains an excess of carbohydrate but very little fat, and its casein is already coagulated in fine flocculi. Some infants who digest ordinary milk very badly thrive well on this buttermilk mixture. It can be continued for five or six weeks, and the change from it to fresh milk should be very gradual.

Other alternatives are to employ a dried milk food, such as Allenbury, or dried milk, such as Glaxo, or to add to milk some lactalbumin (marketed under the proprietary name Albulactin). The addition of lactalbumin is said not merely to supply the deficient soluble albumin in cow's milk, but to render the casein more digestible, and it has given good results in many cases. Personally, I have found it less useful than might theoretically have been anticipated. In those cases of well-marked intolerance of cow's milk, carbohydrates are sometimes well digested, and in selecting a food this should be kept in mind. This is why some infants thrive better on dried milk with an added cereal, or on condensed milk, than on peptonized milk which, *a priori*, is more digestible. If, therefore, a baby cannot digest peptonized milk, a food containing carbohydrate should be tried.

Two other courses are open to us, but on account of their cost are only available among the well-to-do. The best is to employ a wet-nurse; the other, to try ass's milk. The latter costs, in London, three shillings a pint; in the country an ass or donkey in milk may be purchasable. Ass's milk must not be boiled on account of the large amount of coagulable lactalbumin it contains, and this renders its transport and preservation difficult in warm

weather. Of drugs in the treatment of curd indigestion there is little to say. In bad cases alcohol is of use; it acts as a food and a sedative. About one drachm of good brandy may be given in the twenty-four hours to an infant a month old. In treating these cases regular weighing is of the utmost assistance; the stools also should be carefully watched. J. S. F.

THE USE OF ARTIFICIAL FOODS

Artificial foods for infants have been much decried and justly so, for so far as the healthy infant is concerned they are both unnecessary, and inferior to cow's milk, but they are nevertheless unquestionably useful under certain circumstances. The general objections to artificial foods fall under the following heads :—(1) Their continued use is liable to cause scurvy. Most of the makers are fully alive to this, and advise that fresh fruit juice be added to the diet. Whether this is really a certain preventive is doubtful. To produce scurvy an unsuitable diet must be continued for several months, and the risk is one which, if realized, can easily be guarded against. This objection does not militate against the use of an artificial food as a temporary expedient. (2) In their composition most foods depart from the standard—human milk; they nearly always contain excess of carbohydrates, either as sugar or starch, and fat is apt to be deficient. For this reason children fed on these foods are more likely to become flabby and rickety than children fed on cow's milk. (3) Economically, artificial foods are more expensive than good cow's milk. (4) The habitual prescription of some favourite artificial food engenders in the mind of the practitioner a disinclination to consider the requirements of his small patients in an intelligent way, and this, unquestionably, has led to much routine and rule of thumb dieting of sick infants and been a hindrance to rational treatment. Among the advantages of artificial foods are :—(1) Digestibility. There is no doubt that, whether by reason of their low fat content, or on account of the changes which the casein undergoes in the process of manufacture, most artificial foods are more easily digested than cow's milk. (2) Sterility. If prepared with reasonable care patent foods are less liable to bacterial contamination than cow's milk. (3) They are available under all circumstances (*e.g.* at sea) whereas fresh cow's milk is sometimes unobtainable.

The number of patent foods on the market is very great, and it is neither possible nor necessary to have more than a general idea of their composition. They may be divided into three groups : (1) milk foods, intended as substitutes for cow's milk; (2) malted foods,

which require the addition of milk; (3) unmalted foods, which also require the addition of milk (Neave's, Ridge's food). These main groups require further subdivision. Under (1) come (a) condensed milks, sweetened and unsweetened; (b) desiccated milks, e. g. Glaxo; (c) desiccated milks with added starch, either completely malted (Allenbury) or partially malted (Milo). Under (2) come (a) completely malted foods (Mellin), and (b) partially malted (Savory and Moore, Bengel). Many partially malted foods are completely converted in the process of preparation. The composition of some of these is shown below—

	Proteid.	Fat.	Milk Sugar.	Cane Sugar.
Ideal condensed milk— unsweetened	8.3	12.4	16	
Desiccated milk—Glaxo	21.7	25.4	42.9	
Nestlé's condensed milk— sweetened	9.7	13.7	15	37.2
			Carbohydrate.	
Allenbury No. I.	9.7	20	60.8	
Mellin's food	7.7	—	82.2	
Bengel's food	10.2	1.2	79.5	
Ridge's food	9.2	1	81.2	

The proprietary foods which are designed merely as additions to milk (groups (2) and (3)) are during early infancy superfluous, because if a baby can digest cow's milk it requires nothing else until the seventh or eighth month, when any starchy food can be given. The only foods, therefore, which require detailed consideration are those of the first group, which are occasionally useful as complete substitute foods. The composition of some of these, as prepared for use, is as follows—

	Proteid.	Fat.	Milk Sugar.	Cane Sugar.
Glaxo	2.1	2.5	4.29	
Ideal milk (1 to 3 of water)	2.1	3.1	4	
Nestlé's milk (one tea- spoonful to 3 ozs. water)	1.8	2.5	2.8	7
			Carbohydrate.	
Allenbury No. I.	1.56	2.3	7.2	

The use of these foods is justified under two conditions: (1) When fresh milk is unobtainable; or (2) when a baby cannot digest ordinary milk. In either case their use is merely temporary. When only convenience and not superior digestibility has to be considered, as on a sea voyage, it is not very material which we select. Ideal Brand unsweetened milk or Allenbury are as good as any. When we are driven to use one of these foods for an infant whose digestive powers are feeble, it

should be remembered that the dried products are on the whole more digestible than condensed milk. From the table it will be seen that Glaxo and Ideal milk are very similar in composition, and so with Nestlé and Allenbury. Glaxo and Allenbury, however, are more digestible than the other two, and a food of one or other of these types ought to be chosen.

Proprietary foods are less likely to injure infants under four months than older children, because scurvy rarely occurs before the fourth month. If they are used for more than a few weeks it is safer to give some grape or orange juice in addition, in order to diminish the liability to scurvy. J. S. F.

FAULTS AND FALLACIES IN INFANT FEEDING

Some of the chief misconceptions which exist in connection with this subject are as follows—

1. *That it is possible to devise a substitute food as good as human milk.* The more we learn about the subject, the more clearly does it appear that it is impossible to prepare artificially any food which is more than a rough approximation to human milk. Milk is something more than ordinary food; it is a *specific* food, and the milk of every species of animal is specifically adapted to the needs of the young. The variations in the composition of the milks of different animals are nature's adaptations to her own ends, and probably besides the variations we know, others quite as important escape us entirely. Notwithstanding much painstaking research, nobody has yet discovered what particular component of cow's milk renders it indigestible by many infants.

2. *That fresh milk, as obtained commercially, is superior to boiled milk.* It is a widely-spread delusion that boiled or sterilized milk is not a good food for infants. It is objected that it is less digestible, less nutritious, less antiscorbutic, and finally, that it is an "unnatural" food. The true position is as follows: If we had a milk supply above suspicion, and could get pure, clean milk, free in particular from tubercle bacilli, distributed to the consumer in such a way that there was neither a likelihood of its becoming sour nor a risk of its having been contaminated, boiling, sterilizing, or cooking in any way would be unnecessary. At present we are far from this ideal, and the raw milk of commerce is a dangerous food. Cooking does not render milk less digestible, but the reverse; it diminishes its nutritive value very slightly, or, if the milk has been heated in a closed vessel so that no scum forms, not at all. Boiling does not make the milk of the cow a more "unnatural" food than before. There remains, then, only the question of scurvy.

Unquestionably, boiled milk can cause scurvy, but it seldom does so, and the risk is easily guarded against. It is an incomparably less serious risk to run than that of infecting an infant with tubercle bacilli from raw milk.

3. *That "one cow's milk" is a desirable food.* Owing to variations in the composition of the milk of the cow, it is best to use the mixed milk of a herd, which will maintain a more uniform composition.

4. *That the more milk a child takes, the better.* Over-feeding is more common than under-feeding. On an average a baby requires about one-seventh of its body weight of milk daily. Some children thrive on one-tenth; others require one-fifth; more should not be given.

5. *That large quantities of cream are beneficial.* A mixture for a baby should not contain more than three to three and a half per cent. of fat. If it contains more, fat indigestion is likely to ensue.

6. *That failure to thrive shows that the child needs more food.* This may be the reason, but it is much more likely that the food is otherwise unsuitable. Too much may be being given; or fat, or (especially in older children) carbohydrate may be deficient.

7. *That vomiting during the first few weeks of life in a breast-fed baby is due to the mother's milk disagreeing.* It is often a sign of congenital hypertrophy of the pylorus, and this should be excluded before weaning the infant.

8. *That a child suffering from acute diarrhœa will starve if milk be stopped and water or albumin water substituted.* The first thing to do in a case of acute diarrhœa is to stop milk completely, in every shape and form.

9. *A list of common faults:—*(1) *Too frequent feeding.* During the second month the interval should be at least two and a half hours, and from the third month three hours. (2) *Imperfect cleansing of bottles and teats.* Use the simplest pattern of bottles, and never allow milk to dry in them. If the bottle is not to be thoroughly washed after a meal, rinse it out and allow it to stand full of water until it is time to cleanse it. Teats should be rinsed after and boiled before use. (3) *Allowing milk which has been boiled to cool slowly.* It should be chilled under a tap as quickly as possible, and preserved, covered, in a cool place. (4) *Allowing an unfinished feed to stand over for future use.* (5) *Frequent changes of diet.* If the food has been intelligently chosen it should not be altered without good reason until it has had a week's fair trial. Constant changes lead to nothing but confusion. (6) *Too bulky feeds.* The average rule is an ounce for every month, up to the eighth. (7) *Giving starches too early.* Nothing but milk is required until the seventh month. (8) *Under-*

feeding towards the end of the first year. This is nearly as common as over-feeding in the early months. By the ninth month a healthy child begins to use his muscles a great deal, and requires starches—the energy producers of the food—in fair quantity. Cereals should be added to the milk about the seventh month; by the ninth or tenth the infant should be encouraged to chew bread and butter, or crust, and ought to have a saucer of porridge, or its equivalent, once or twice a day. Towards the end of the year eggs should be given. It is a mistake to restrict a child of ten or eleven months to milk and thin gruel. J. S. F.

INFANTILE SCURVY

Etiology. The age-incidence of infantile scurvy is remarkably constant. The disease does not arise before the fifth, nor, with the rarest exceptions, after the twelfth month of life. Eighty per cent. of cases occur between the ages of six and ten months. The type of child affected is the fat if somewhat flabby infant with a pretty pink-and-white complexion. Marasmic infants do not get scurvy. It is more common in the children of the rich than of the poor.

The disease is a separate entity from rickets, as was originally recognized by Glisson (1651), and again emphasized by Cheadle and Barlow. The terms "acute rickets" and "scurvy-rickets" should therefore be abandoned. Both scurvy and rickets are due to faulty feeding, but for different reasons. The earliest signs of rickets are commonly but not constantly found in scorbutic infants.

Of the diets which may produce scurvy the patent infant foods, consisting of desiccated milk with added cereal, stand pre-eminent. By far the greatest number of cases in England arise from the use of these proprietary articles. The administration of milk with these does not altogether do away with the danger of scurvy. The use of condensed milk is another frequent cause of the disease. Milk sterilized by prolonged boiling has been productive of many cases in America, but in France Budin has shown that such a diet does not necessarily set up scurvy. His method of feeding was to use undiluted milk of good quality, sterilized for forty-five minutes in separate bottles, each bottle containing sufficient for one feed only. Feeding many hundreds of infants in this way, he encountered no example of scurvy.

Pasteurized and peptonized milk have also produced scurvy, but are less prone to do so than the foregoing diets. Cases have been reported on fresh milk, even breast-milk, but such are infinitely rare.

Pathogenesis. The various theories account-

ing for the causation of scurvy are enumerated under scurvy in adults. The most widely held as regards infantile scurvy is that the disease is due to the absence of fresh food—the antiscorbutic element is thought to be some fresh or vital element. This view can hardly be accepted, since (1) scurvy can be cured by the administration of boiled fruit-juice; (2) pasteurized milk is less scorbutic than milk which has undergone prolonged boiling, although either process is equally effective in destroying any vital element such as an enzyme; (3) milk sterilized by prolonged boiling does not produce scurvy, if used in Budin's method as described above. It is important to note that with prolonged boiling the calcium citrate in milk changes from its amorphous and soluble form into a crystalline and less soluble form, and consequently tends to sink and be lost for the purposes of feeding if a large quantity of milk be sterilized in one vessel.

Some chemical explanation of scurvy seems more satisfactory. Hutchison has found that the curative properties of fruit-juice reside in its crystalloid salts, and that a mixture of the malate, citrate and tartrate of potassium cures scurvy. Diminished alkalinity of the blood does not seem to be the entire cause of the disease, since lime-juice cures scurvy, yet further diminishes the alkalinity of the blood, while in other conditions of acidosis no scurvy occurs. The exact origin of infantile scurvy is therefore still obscure. Probably some chemical explanation will ultimately be found to be correct.

Morbid Anatomy. Hæmorrhages occur under the periosteum of the bones, particularly near joints; the neighbouring muscles may be infiltrated with blood. Bleeding may also occur elsewhere. The alkalinity of the blood is diminished and the changes of chlorosis are found.

Symptomatology. The symptoms of scurvy are due to the hæmorrhages. The earliest is generalized tenderness; sometimes erroneously regarded as a rachitic symptom. Hæmorrhage into the gums is a very important sign. It only occurs when teeth are erupted or are on the point of eruption, when, however, it is practically constant. Bleeding may also occur into the mucous membrane of the palate, a valuable sign in the absence of erupted teeth. Subperiosteal hæmorrhage in the limbs is usually the first symptom to attract attention. This causes severe pain, resulting in the immobility of the limb (pseudo-paralysis). The lower limbs are most commonly affected. Usually the hæmorrhage is sufficient to produce a red, shiny, exquisitely tender swelling. Occasionally there is epiphyseal separation due to bleeding into the epiphyseal line. Hæmaturia is com-

mon; microscopical evidence of hæmaturia is probably constantly to be found in infantile scurvy.

Less common symptoms consist of hæmorrhage into the orbital tissues, producing a "black-eye"; sometimes sudden proptosis. Bleeding into the mucous membranes, or purpura, hæmorrhage into the gastro-intestinal tract, joints, lungs or brain are rare. In very severe cases bronzing of the skin and sinking-in of the sternum may occur.

Diagnosis. There is seldom much difficulty in recognizing scurvy to one familiar with the disease. The extreme tenderness of the affected immobile limb, causing the infant to scream lustily as soon as it is approached, combined with the spongy gums and perhaps hæmorrhages elsewhere, form a very typical picture. Most mistakes arise from ignorance of the disease.

The age-incidence of infantile scurvy separates it from rheumatism (which does not occur in infants under two years), and from syphilitic epiphysitis (which almost invariably appears in infants under three months of age). Acute poliomyelitis is differentiated by the absence of swelling, the comparatively slight tenderness and the later appearance of wasting. Acute osteomyelitis shows high fever, toxæmia and a marked leucocytosis. In doubtful cases other signs of scurvy should be carefully looked for, particularly the spongy gums and hæmaturia.

Scurvy is sometimes mistaken for meningitis, owing to the loud screaming of the patient on being handled or even approached. Such screaming is, however, very suggestive of scurvy, and is entirely different from the occasional calling-out of a semi-comatose infant with meningitis.

Prognosis. Infantile scurvy is rarely fatal if quickly recognized. With treatment improvement is certain and immediate. Within three days there is a very definite diminution of the characteristic tenderness. Fresh hæmorrhages under treatment are very exceptional, but may occur early from screaming.

Treatment. Infantile scurvy can and should be prevented by adopting correct methods of feeding. If for any reason scorbutic diets are being given, care should be taken that after the third month some antiscorbutic in the shape of fruit-juice should be given daily.

Should the disease have appeared the baby must be handled as little as possible. Its clothes should be arranged so as to be easily removable; it should be carried on a pillow. Affected limbs should be wrapped in wool and the weight of the bedclothes taken off them by means of a bed-cradle. The mouth may require gentle sponging with a pledget of damp wool.

Proprietary foods should be replaced by cow's

milk; as fresh milk is only slightly antiscorbutic there is no objection to having the milk boiled if its cleanliness is doubtful.

To cure scurvy add to the diet fruit-juice in the shape of grape- or orange-juice. Give a drachm of either every four hours at first. Raw meat juice, a drachm twice daily, is of value. Potato cream, made by adding milk to the floury part of a potato baked or boiled in its skin, using the part immediately under the skin, may be given in doses of a drachm twice daily. Sodium citrate may be given. Care must be taken to prevent the onset of diarrhoea, which may prove dangerous; hence fruit-juice is preferable to potato cream in the treatment of scurvy.

During convalescence correct feeding, with cod-liver oil and iron, should be prescribed.

R. M.

COLIC AND FLATULENCE

Of all minor ailments to which a baby is liable, colic is perhaps the most common; it is very often associated with flatulence. Colic shows itself by attacks of crying, during which the infant writhes and draws up its legs on the abdomen, the screaming and pain often subsiding suddenly along with the expulsion of wind either by the mouth or anus. Recurrent colic is extremely wearing to an infant and distressing to its mother; it is also one of the earliest signs of indigestion, and if it is neglected the foundation of much future trouble will be laid. When one is called to see a baby who is said to be screaming from colic and distended with wind, the first thing to do is to assure oneself of the correctness of this diagnosis, so far as it goes. Colic is the most common cause of paroxysmal screaming, but there are others—the irritation of uric acid gravel, or of highly concentrated urine, the pain of otitis media, and the presence of an anal fissure, for example. Fissure is a cause of screaming fits which is constantly overlooked. The character of the attacks differs from that of colic. The fit of screaming lasts for a longer time and the baby strains, arches its back and straightens out the legs instead of flexing them. On inspection a small crack just inside the anal canal is seen. These small fissures quickly heal on the application of a little antiseptic ointment. Having excluded these extra-intestinal causes of pain, we must remember that although colic is usually caused by some comparatively trifling condition, it may be due to intussusception. The abdomen, therefore, should be carefully examined with this possibility in mind. By inspection of the abdomen it is usually not difficult to say whether the flatulence, which is almost always present along with simple colic, is intestinal or gastric, and when we have settled this, and have looked

at a stool and obtained a history of the diet and digestion, we are in a position to diagnose more or less accurately what is wrong. Gastric flatulence is often caused by allowing the child to gulp down feeds too quickly and to suck air at the same time. This generally results in a vomit within a quarter of an hour after a feed. In gastric flatulence due to fermentation in the stomach, the vomiting and pain occur later.

The *treatment* of the first variety of flatulence is to correct the method of administering the feeds. In the second variety, three to five grains of sodium bicarbonate combined with three or four minims of spirit of chloroform will often give relief, or three to four grains of bismuth carbonate suspended by pulv. trag. co. in a teaspoonful of aq. anethi. If there is much distress lavage of the stomach is the most efficacious remedy. Intestinal disturbance is, however, a more frequent cause of abdominal pain than gastric flatulence, and when a baby is fretful, disinclined to suck, and suffering from recurrent attacks of pain, no remedy is so quick and effectual in its action as a full teaspoonful of castor oil. When a baby is actually screaming in an attack the nurse should lay him on his face on her knee, then on his back, so that by changing his position frequently she may assist the expulsion of flatus. For immediate relief of the pain a small enema of warm water—two to four ounces—will often soothe; warmth should be applied to the abdomen, or, what is better, the child may be put into a warm bath. The most obstinate cases of colic are those which are due to constipation, and if there is any reason to suspect this the rectum should be examined. Sometimes the lower bowel is found loaded with hard faecal masses, even though a daily motion is said to have been secured. When this is the case, injections of warm oil, followed by enemata of warm water, will help to remove the trouble, but it may be necessary to scoop out the masses with the finger. For recurring intestinal flatulence and colic half to one grain of grey powder twice or thrice a day is often useful; sodium bicarbonate or magnesium carbonate may be added. The milk ought to be citrated. Since, however, colic is merely a symptom of indigestion, its treatment forms a part of the larger subject of infant feeding which is discussed in other articles (*Infant Feeding; Curd Indigestion*).

J. S. F.

MARASMUS

Marasmus, or wasting, is an exceedingly common occurrence in infancy. Although, strictly speaking, *marasmus* is only a symptom,

it so often exists without any discoverable cause and produces so characteristic a clinical picture as to justify us in speaking of it as a disease of infancy. There is no hard and fast line between mere failure to thrive and marasmus, but by general consent the latter term is reserved for the bad cases, in which the infant's weight is diminished by a third or more and in which the prospect of recovery is small.

The symptoms of marasmus are too well known to require a long description. The infant is extremely emaciated, there being an almost complete absence of subcutaneous fat. The skin is inelastic and hangs in loose folds, has lost its healthy colour, and is often the seat of intertrigo or one of the skin affections due to pyogenic cocci. The face is pale, wrinkled and has lost its normal roundness; the sucking-pads are prominent. The infant's demeanour is listless; it lies with the arms and legs flexed for the sake of warmth; the cry is feeble. The fontanelle is usually depressed and the outlines of the cranial bones are distinctly seen. In cases of pure marasmus physical examination seldom reveals anything further. The abdomen is soft and can be easily palpated; the lungs are normal save, perhaps, for a few rhonchi; the heart-sounds are feeble. The mouth may be coated with thrush; there is usually neither vomiting nor diarrhoea. The bowels are, as a rule, constipated and the motions hard, pale and scanty. The appetite may be good or even excessive; in some cases, however, the infant is disinclined to suck. Albuminuria is not uncommon.

When we meet with a case of marasmus it is of the greatest importance to endeavour to ascertain its origin, because the prospect of recovery depends to a large extent on whether or not a remediable cause exists. The following are among the most common organic causes of wasting in infancy: (1) congenital heart disease; (2) latent empyema; (3) mongolism; (4) hypertrophy of the pylorus; (5) in some cases, congenital syphilis, when evidences of the disease will be obtained. It is, however, an error to base a diagnosis of syphilis on wasting alone; (6) tuberculosis is a rare cause of wasting during the first months of life. If after a careful physical examination no organic lesion can be discovered, we have to do with simple marasmus, and the next point which requires consideration is the past and present state of the digestive functions. Inquiry should therefore be made as to the diet, particularly (1) the exact quantities of food given, and (2) whether the food consisted chiefly of milk, or chiefly of carbohydrate, or whether fat was in excess. Further, we must ascertain whether the baby vomits, or whether he has diarrhoea. Contrary to what might be anticipated, the cases

of marasmus which are most likely to improve under treatment are those in which there is a history of improper feeding, causing chronic vomiting and diarrhoea. The worst cases are those in which the previous diet does not seem to have been unsuitable, and in which the wasting is the only symptom.

The treatment of marasmus is difficult and unsatisfactory. It is most essential to weigh the patient regularly, once or twice a week; in no other way can the progress be judged of. If circumstances admit, a wet-nurse should be procured. Many of these cases can be saved in no other way. In most instances, however, we are compelled to resort to artificial feeding, and our choice of a food is guided to some extent by the previous history. Marasmus is more often due to over or improper feeding, than to under-feeding; it may be that some particular food element is in excess. Whatever the error be, we try to counteract it by arranging a diet which tends to the other extreme. Thus, if the infant has been given too much cow's milk, eliminate milk altogether for a time, and give albumin water supplemented by a malted or unmalted starch. On the other hand, marasmus may have followed a diet too rich in carbohydrate; in that case, diluted milk may be tried. As a rule, however, no specific error in the feeding can be made out, and under these circumstances one might begin with peptonized milk, diluted with an equal bulk of water, and if this be well borne the peptonization can then be gradually discontinued. Both from the point of view of treatment and of prognosis the amount of milk given is of great importance. The nutritive requirements of a normal infant are met by a daily quantity of milk equalling from one-tenth to one-fifth of its body weight—on an average, about one-seventh, and on this quantity an infant ought to thrive. In bad marasmus this rule does not hold. We find that, although the child is digesting a quantity of milk sufficient for its needs, its weight remains stationary or falls. This is a very bad sign, because it shows that the assimilative powers are profoundly disturbed. From the point of view of treatment it is also important because, if an infant is taking a quantity of milk adequate to the normal requirements, and is not gaining weight, it is useless to increase the amount in the hope of doing good; instead, a complete change of diet should be tried. At present we are quite ignorant of the pathology of marasmus, and of the nature of the underlying metabolic disorder, and if an ordinary well-regulated diet fails, it is necessary to experiment. The following are sometimes successful, though it is impossible to predict what will suit a given case: (1) Dried milk preparation, such as Glaxo;

(2) soluble albumins, such as albulactin; (3) artificial foods, such as Allenbury; (4) butter-milk (see *Curd Indigestion*). Thyroid extract ($\frac{1}{3}$ gr. thrice daily) is sometimes of striking benefit, and should always be tried. If no good is seen in the course of a fortnight, it may as well be discontinued. Otherwise, drugs are of no value. Marasmic infants ought to be kept warm, and the general hygienic surroundings should be as good as possible. It is often advisable to send them out of town, into the country, especially in warm weather.

J. S. F.

CONGENITAL PYLORIC STENOSIS

This is a condition manifesting itself during the first days or weeks of life and associated either with spasm only, or with spasm and hypertrophy of the pylorus. The affection is to be recognised by the presence of the following symptoms: (1) vomiting, (2) constipation, (3) rapid wasting, (4) visible peristalsis of the stomach wall, (5) a palpable pyloric tumour, and (6) the absence of all signs of any grave constitutional disease.

Vomiting is the first sign and, coming on as it usually does during the first few days or weeks of life in an apparently healthy infant, it is usually ascribed to the food. It persists, however, in spite of many changes in the feeding methods, and one may note that although each new food tried may appear to be successful at first, the vomiting soon returns. No nausea or distress accompanies an attack of vomiting, and as soon as the stomach is empty the child is ready for another feed. The vomited matter consists of altered food and mucus, but contains no bile, and only in the later stages some altered blood. The stomach becomes dilated and hypertrophied and at the same time the vomiting becomes more forcible, or "projectile," as it is called. Constipation is next observed and the small motions passed contain little faecal matter. Examination of the abdomen after a meal will show a characteristic peristaltic movement of the stomach, a series of contractions passing from under the ribs on the left side above the umbilicus towards the right side. In some cases the pylorus can be felt as a hard movable tumour lying below the liver. The result of the pyloric obstruction is that the infant dies slowly of starvation. Little or no food passes the pylorus, and even water enters the system with difficulty. The face becomes pinched and senile in appearance, the muscles waste, the body appears to be drying up, the skin is shrivelled, and the temperature is subnormal. The cry changes to a more or less constant whining, the result of hunger, which is relieved only temporarily by food.

Opinion is still divided as to whether the treatment of this condition should be medical or surgical. Medical treatment should always be given a trial in the first instance. The object is to supply a non-irritating food which is digestible and leaves no solid residue in the stomach. Warm normal saline solution may be given at first for twenty-four hours so as to rest the stomach. Breast milk, peptonized milk, weak albumen water, whey, raw meat juice and malt extract are suitable foods to try. The feeds should be small, one to two ounces at a time, and given at frequent intervals, one to two hours by day and less frequently by night. The vomiting is caused by the accumulation of food in the stomach, and this is to be checked by gastric lavage, once or twice a day at first and later according to the findings as regards undigested food. The wash-out also shows whether the food given is being digested and is capable of passing the pylorus. The system calls for the presence of much more fluid than can at first be tolerated by the stomach, so that it is often advisable to give saline injections either per rectum or subcutaneously. Opium, belladonna and bromides have been recommended for the relief of the pyloric spasm, but as a rule they do little or no good.

While the above medical treatment will prove completely successful in a number of cases, in others it fails. The prolonged care and attention which are necessary are only available in the case of well-to-do patients. In hospitals such young infants do not thrive as a rule, and often they are reduced to a very low ebb before admission. Surgical treatment by gastro-jejunostomy or pyloro-plasty is sometimes followed by excellent results, but such an operation is always very serious at this early age and in these debilitated subjects. Even after a successful operation the sudden entrance of food into the bowel, which has been lying inactive for weeks, may induce severe and fatal diarrhoea.

G. A. S.

ABDOMINAL PAIN

Abdominal pain may occur locally in the abdominal wall as the consequence of rheumatic myalgia, from inflammation of the sheaths of the muscles or from peritonitis. On the other hand, the pain may be referred from the central nervous system, as in *tabes dorsalis*, spinal caries or herpes zoster. More commonly it is referred from the thoracic, abdominal or pelvic organs. Disease of the abdominal organs themselves, which is the commonest cause of abdominal pain, does not lead to the production of local pain, for these organs are, in the ordinary sense, insensitive to tactile and other forms of stimulation which produce pain, and only give rise to sensa-

tions of referred pain in superficial areas of the abdominal wall, which are supplied by sensory nerves belonging to the corresponding spinal segments. These referred pains are so constant and definite in their distribution, that from their accurate localisation a reliable diagnosis may often be made of the particular abdominal organ which is the seat of disease. Unfortunately, young children seldom describe the situation of these referred pains with accuracy sufficient for the purpose of a definite diagnosis, but since the seat of the subjective pain not infrequently corresponds with areas of superficial hyperæsthesia, what is wanting in the first method of diagnosis may be supplemented by information derived from the second. Hence, when a child complains of abdominal pain it is desirable, when possible, to map out on the abdominal superficies any existing area of hyperæsthesia by gentle scratching with the point of a needle. If such an area can be mapped out and it is found to correspond with the site of the subjective pain, the correctness of the diagnosis is doubly probable.

In disease of the stomach there is referred pain which corresponds to the peripheral distribution of the fifth, sixth, seventh and eighth dorsal segments, and it is for the most part localised along the mid-abdominal line between the tip of the xiphisternum and the umbilicus. Disease of the cardiac end of the stomach—an ulcer, for instance—causes pain in the upper third of this line, disease of the pyloric region causes pain in the middle third, while disease of the median section of the stomach causes pain to be referred to the lower third of this line. Pain is also sometimes felt in the jaw and neck, owing to the central connections of the pneumogastric, which supplies the stomach, and the trigeminal nerve, which supplies sensory filaments in these areas.

In disease of the duodenum the pain is referred to the central abdominal line just above the umbilicus, and sometimes to the right of this line just below the ribs, to the area, in fact, which corresponds with that of a distended gall bladder.

In disease of the small and large intestine the seat of the pain is chiefly in the umbilical area. As a rule it is not very clearly defined and tends to be migratory and intermittent—two most important diagnostic features. If the small intestine is the seat of disease the pain is mainly umbilical, if the large intestine is affected the pain may be in the middle line of the hypogastrium. If the disturbance be at the splenic flexure—a by no means uncommon site—the pain is seldom below the middle of the hypogastrium. If the disease is of the descending limb of the colon, the pain is referred below the middle point of the hypogastrium.

In disease of the vermiform appendix the pain is usually referred to the umbilical area. Sometimes, however, to the right iliac region, while there may be pain also and some stiffness in the lower part of the erector spinæ.

Areas of superficial hyperæsthesia can seldom be mapped out on the abdomen in cases of disease of the intestines.

In disease of the gall bladder and ducts the painful areas include—

1. Back, side and front of abdomen.
2. Right shoulder and outer side of right arm.
3. Head and face.

In renal disease, especially renal calculus, pain is felt in the iliac region, groin and testicle, in fact in the peripheral distribution of nerves of the eleventh and twelfth dorsal segments and of the first and second lumbar. The pain may be confined to the side opposite the lesion (the reno-reflex).

In disease of the pancreas the pain is referred to the middle line of the epigastrium, and is most marked about one inch above the umbilicus; the pain may extend round the left side or even to the infrascapular region.

In disease of the uterus, ovaries and tubes in female children the pain is referred to the areas supplied by the eleventh and twelfth dorsal segments, and by the lumbar and sacral nerves, especially the third and fourth sacral. Hence pain is felt in the lower part of the hypogastrium, lumbar and sacral regions behind, and the iliac in front and occasionally down the legs. The seat of pain most diagnostic of disease of these organs is situated two inches to the inner side of the superior iliac spine on the left.

It is important to remember that *in pneumonia and pleurisy* the pain is often referred to the epigastrium, and that *in hip disease* it may be referred to the iliac fossæ, as well as to the epigastrium. The site of abdominal pain alone can not be trusted to afford a reliable diagnosis, but taken in conjunction with its character and duration it affords supplementary evidence of the greatest value in arriving at a correct diagnosis of the organ affected.

The treatment of abdominal pain must be conducted in accordance with the directions given under the sections devoted to the organs affected.
E. P.

INDIGESTION AFTER INFANCY

The varieties of indigestion included under this heading may be classified according to the organ mainly affected, as gastric, intestinal, pancreatic, etc.; or according to the predominant symptoms, vomiting, diarrhœa, colic, etc. All classifications are, however, unsatisfactory owing to the functional dependence of one digestive organ upon another, and to the fact

that the disturbance is seldom confined to one organ. From the point of view of treatment it is important to discover the organ primarily in fault.

Gastric Indigestion.—In primary disturbances of gastric digestion vomiting is nearly always a prominent symptom. In acute gastritis there are, in addition, epigastric pain, thirst and a red tongue. In chronic hyperchlorhydria or hyperacidity of the gastric contents, there are epigastric pain, heartburn and a sinking or hungry feeling before meals; the diagnosis may be confirmed by a test meal and an analysis of the chyme. In achylia, a condition in which HCl and pepsin are absent from the gastric secretion, or present in greatly reduced amount, there are gastric and abdominal pain, diarrhoea of an offensive character, much undigested food in the motions, and often marked wasting. In dilatation of the stomach, pyloric spasm, hour-glass contraction and other disturbances of the motor functions, in addition to characteristic vomiting, epigastric pain or discomfort, and visible enlargement or peristaltic movements of the viscus, there may be nervous symptoms, such as headache, restlessness or even tetany. The size of the stomach and the character of its motor functions may be demonstrated by the administration of a large dose of bismuth and an ordinary test meal, and subsequent X-ray observations.

In acute gastritis the treatment is suspension of all food for twenty-four hours or longer—the administration of milk of magnesia, carbonate of bismuth and opium. Heat may be applied to the epigastrium, and thirst may be assuaged by *small* pieces of ice given by the mouth. In hyperacidity the treatment is the avoidance of all highly flavoured foods, and the administration of simple meals of milk, jellies, vegetables, fruit and carbohydrates, and the exhibition of alkalies and bismuth some two hours after food when the feeling of hunger begins to return.

In achylia the treatment is pepsin or papain and hydrochloric acid immediately after meals, and in disturbances of the motor functions of the stomach lavage is often most useful, especially if combined with small and rather concentrated meals at somewhat long intervals.

Pancreatic Indigestion, especially when combined with hepatic insufficiency, is very common in early childhood. Under such conditions there are loss of weight, loss of appetite, copious light-coloured stools which contain a great excess of fat, an unpleasant odour to the breath, and a tongue which is coated at the back and strawberry marked at the tip with prominent red papillæ. The diagnosis may be clenchd by the administration of Prof.

Sahlis' keratin-coated pills of iodoform. This test is a means of estimating whether the pancreatic secretion is active or not, for trypsin is necessary for the digestion of the keratin coating, and the liberation of the iodoform in the intestine. Soon after iodoform is set free, iodine in the form of iodides or iodates can be detected in the saliva, by testing with chloroform and nitric acid; if present a pink coloration is imparted to the chloroform. If pancreatic secretion is inactive no iodine appears in the saliva.

The *treatment* for pancreatic indigestion is the administration of a saline aperient in the morning, and half a drachm of liquor pancreatis after each meal.

Intestinal Indigestion is probably the commonest form of indigestion among young children. It generally takes the form of mucous enteritis or colitis, and is due to over-feeding, the consumption of indigestible and irritating foods, or to cold. In recent cases the stools are copious, light-coloured, fatty and offensive, and they always contain large quantities of mucus. This mucus is not always apparent unless the fæces are broken up in a large quantity of water; large pieces of mucus or even casts of the bowel may then be detected. In long-standing cases the motions may be scybalous and coated with inspissated mucus and blood.

The appetite is generally bad, but may be ravenous, and there is nearly always serious loss of weight. The child is fretful, has night terrors, grinds his teeth, is pale, sallow and has dark rims round his eyes. The breath is often offensive, and there are frequent colicky pains, generally along the course of the colon, and especially at the splenic flexure. These pains recur at the taking of meals, when the bowels are moved, or with violent physical exercise. The "pain in the chest," or the so-called "stitch in the side" so commonly complained of by children, is often due to a chronic form of mucous colitis. The incomplete digestion and accumulation of food which is inseparably associated with this condition leads to intestinal fermentation and decomposition, and the whole series of nutritional disturbances and nervous symptom which are the concomitant of a toxæmia of this kind.

The *treatment* is severe restriction of carbohydrate foods, the avoidance of all pips, seeds, husks, skins, etc., which are calculated to irritate the intestinal mucous membrane. The food should consist chiefly of skimmed milk, jellies, eggs, broths, digestible vegetables, and protein foods or biscuits. A teaspoonful of sulphate of sodium, sulphate of magnesium, and carbonate of sodium in equal parts should be given every morning in the form of an effervescing draught with lemon or orange juice. After each meal

a tablespoonful of the following emulsion should be given :—

R Liquoris Pancreatis ℥ xv
 Calcii Hypophosphitis gr. i
 Ol. Cinnamomi ℥ $\frac{1}{4}$
 Acid. Benzoic gr. $\frac{1}{8}$
 Glusidi gr. $\frac{1}{8}$
 Paraffini Liquidi Puri B.P. ʒ i
 Decoctum Chondri Crispi ad ʒ ss.

The good influence of this emulsion in inhibiting intestinal decomposition, and in promoting digestion and assimilation is, as a rule, immediately apparent.

E. P.

DENTAL CARIES IN CHILDREN

Caries of the Teeth is due to the decalcification or demineralization of the enamel and dentine and to the subsequent disintegration of the organic matrix by the action of peptonizing and liquefying bacteria. The decalcification is due to the eroding action of acids introduced into the mouth or generated *in situ* by the fermentation of carbohydrate food left as a residue in the mouth after eating. Teeth present varying degrees of vulnerability or resistance to these disintegrating agencies in accordance with the character of the initial structure, their subsequent nutrition, the health of the individual, the uses to which they are subjected, the neutralizing power of the saliva and the facility with which the latter can reach the affected part. It is now generally believed that the most potent factor in the determination of caries is the presence of carbohydrate food left in contact with the teeth, and the longer such residue is allowed to remain undisturbed the more serious is the damage. Hence, owing to the tenacity with which it adheres to the teeth pappy carbohydrate food when eaten by children just before bedtime is a prolific source of dental caries.

Irregular arrangement of the teeth and want of smoothness in their surfaces interfere with the natural processes whereby the teeth are freed from adherent matter and kept clean.

Dental caries is now so common among all classes, and especially among the proletariat, that its prevention has become one of the most vital problems for the consideration of public health authorities and school hygienists. The education of teachers, parents and children in the rational methods of teeth preservation must be the first step towards reform. The following are the most important prophylactic measures.

In the first place quite young children or even infants must be taught the habit of thorough mastication of food by the eating of relatively hard varieties of food from the time of the eruption of the milk teeth. At first hard crusts

and biscuits may be given for this purpose, and later fruits, nuts and other fibrous varieties of food, which require active mastication and which give exercise to the jaws and teeth. Since most of these foods actually clean the teeth it is important that they should be given at the end rather than during or at the commencement of the meal. Secondly no food or sweets should be allowed between meals, and every precaution should be taken to ensure a clean mouth during the hours of sleep. The necessity for the frequent use of the tooth brush has been greatly exaggerated, for, even at the best, its efficiency in cleaning the teeth is insignificant as compared with the eating of hard and detergent articles of food. None the less its use should not be neglected before retiring for the night. A moderately hard tooth brush should be employed with a crenated edge. The greatest attention should be paid to cleaning the biting surfaces of the molars and to the interspaces between the teeth. Care should be taken not to injure the delicate gingival fringes of the gums by misapplied energy. Antiseptic dentifrices cannot be depended upon to prevent dental caries, the natural defences of the mouth against sepsis should be fostered, and above all the mouth should be kept free of food debris. On the other hand, the free rinsing or swilling of the mouth with warm water at the end of a meal or before retiring for the night has distinct advantages, and for the neutralization of acid products there is no better mouth wash than milk of magnesia; in rheumatic, rachitic and other conditions in which there is any tendency to an acidosis or to acidity of the blood, this precaution is especially indicated.

Caries must be sought for at points at which one tooth is liable to injure another by contact or pressure, at the exposed roots, and in the depressions of the molars, and when found can only be checked from further progress by a proper "stopping."

E. P.

CONSTIPATION IN CHILDREN

For practical purposes it is convenient to consider constipation in infants and older children separately.

Constipation in Infants.—In infants constipation may be due to a malformed anus or rectum, to "congenital" dilatation of the colon (Hirschsprung's disease), to hypertrophic pyloric stenosis or to pyloric spasm; or to cretinism.

Apart from such conditions as these, constipation is common enough in babies, particularly in those fed at the breast. An excess of protein or a deficiency of fat in the milk predisposes to intestinal stasis, since the delicate musculature of the infant's intestine is unable to propel onwards intestinal contents if bulky or dry.

In the same way a diet of undiluted cow's milk, citrated or sterilized, perhaps predisposes slightly to constipation. Starvation must not be forgotten as a cause of constipation. Where much vomiting is present such an explanation of constipation is obvious, but in breast-fed infants who do not vomit, starvation may be overlooked. The only method of gauging accurately the amount of milk obtained by a baby from the breast is to weigh the child carefully before and after a feed.

Symptoms. Normally the stools during the first two months of life number four daily. After the first week they are yellow in colour and of a slightly sour, non-fæculent odour. Gradually they become darker, more fæculent and less frequent. During the second year the bowels act twice in the twenty-four hours, and during the third year the motions become formed.

With constipation the bowels act once in one, two or three days, or even less frequently. The motions become hard and dry, often pale and chalky. In severe cases little pellets of dark fæcal material are passed. Defæcation is accompanied by screaming and much straining; occasionally slight hæmorrhage occurs.

When constipation arises acutely, particularly where the gastro-intestinal tract has previously been out of order, various symptoms result from the absorption of toxins from the bowel: fever and drowsiness are frequent, and convulsions may occur.

In chronic cases of constipation in infants the two most prominent symptoms are those of colic and wasting. Colic can be recognized by the way the infant draws its legs up and by the relief afforded by the passage of fæces or flatus. Wasting does not occur in all constipated infants. Many babies at the breast, for instance, do extremely well, although they are habitually somewhat constipated. On the other hand, there are cases in which failure to gain weight synchronizes with periods of constipation, and in which treatment must be directed towards relieving the condition of the bowels before satisfactory progress is made. In a few instances the emaciation is extreme, and here some cause such as starvation, hypertrophic pyloric stenosis, or Hirschsprung's disease should be carefully sought.

Treatment. For a purge in a case of acute constipation no drugs are better than castor oil or calomel. For an infant of one year the dose of these is one drachm and one grain respectively. The peculiarity of castor oil is that its efficient aperient action is followed by a sedative or constipating action, which may or may not be advantageous. It must be clearly understood that the regular administration of a castor oil mixture containing up to five minims of oil will

not provoke a regular action of the bowels, but will have only a constipating effect. Such a mixture is invaluable in cases of diarrhœa but is harmful in cases of constipation.

Constipation in breast-fed infants must for the most part be treated on the lines about to be described. In a few cases it is possible to alter the character of the mother's milk sufficiently to overcome the constipation. Malt extract, for instance, may be administered to the mother in order to increase the amount of fat in her milk.

Chronic cases of mild constipation in infants may be treated by the addition of barley-water, brown sugar or cream to the diet. Water may be given between feeds in order to increase the fluidity of the intestinal contents. Magnesia or a drachm of manna in milk may be sufficient in very mild cases. Olive oil (one-half to one drachm once or twice daily) is rather more efficient. Grey powder, given in one-quarter to one-half grain doses thrice daily, is very useful in slight cases and a valuable adjunct to other measures in more severe instances. It may be combined with two or three grains of sodium bicarbonate if there is colic.

In more severe cases the bowels must be kept open by daily injections of olive oil or by soap suppositories until a regular action is obtained by other means. Abdominal massage is of the greatest value and should be ordered in all severe cases. It is best done by trained hands but, if necessary, the child's mother may be instructed to rub the abdomen along the course of the colon. Combined with massage mild aperients will often suffice. Should they fail such a mixture as the following may be ordered:

R—Sod. Sulph. gr. v-x
Ext. Casc. Sag. Liq. ℥x-xv
Tr. Nucis Vom. ℥ss-i
Tr. Belladonnæ ℥i
Aq. Menth. Pip. ad ʒ i-ii

This should be given once to thrice daily, as necessary, and in small doses should be administered for several months to effect a complete cure. For a stronger mixture add ten to twenty minims of syrupus sennæ.

Constipation in Older Children.—Painful conditions of the anus, fissure or hæmorrhoids are rare causes. Intracranial disease and mental deficiency are associated with constipation.

Errors in régime and education are more important. Lack of exercise and fresh air, and imperfect education in regular habits and overcoming shyness are important predisposing causes in chronic cases.

The commonest dietetic causes are a deficiency of fluid and an excess of bulky indigestible foods often given in an attempt to overcome the complaint.

In children most cases of constipation depend upon the fact that the intestinal contents are too dry and bulky for the enfeebled intestinal muscle to propel.

In a few cases in nervous children the colon can be felt rigidly contracted (spastic constipation). Such cases require special treatment.

Symptoms. Acute constipation may give rise to rather alarming symptoms. The temperature may be raised to 103° and the child become drowsy and apathetic but irritable when disturbed.

In chronic cases, even of great severity, the child's health may remain extraordinarily good. Often, however, the sallow complexion, darkly-ringed eyes, slightly coated tongue and foul breath give a characteristic picture. Such children are easily fatigued, their temperature at night may be slightly raised. They tend to suffer from disturbed sleep, somnambulism or night-terrors. Their appetite is capricious. Thread worms are commonly present. The abdomen protrudes, especially along the course of the colon.

Treatment. In acute cases castor oil and calomel are the best purges. Syrup of senna (one to two drachms) is pleasant but uncertain in action. A mixture of equal parts of the confections of sulphur and senna (one drachm) is more efficient. Compound liquorice powder works well, but many children object to its bulk. Rhubarb is useful when a secondary astringent action is required; it may be combined with calomel. Phenolphthalein ("Purgen," "Laxans") is an active purge for occasional use.

In chronic cases general and educational treatment should not be neglected. As already mentioned the administration of bulky and indigestible substances, such as apples, bananas, currants, green vegetables, is usually a great mistake. Such a scheme fails in all but the mildest cases. Of such measures the best is thin oatmeal porridge. Water should be freely taken at and between meals, to increase the fluidity of the intestinal contents. Similarly the saline aperients are very useful. The muscular tone of the intestinal walls should be improved by massage, and such drugs as cascara, strychnine and belladonna.

A chronic case should, therefore, be tackled on some such lines as the following:—(1) The diet should be investigated; fluid should be added and bulky fruits withdrawn. (2) Abdominal massage should be practised once or twice daily. (3) Such a mixture as has been given above should be ordered in proportionately larger doses. (4) A morning saline, such as Apenta water (half a wine-glassful) or sodium sulphate, may be necessary. (5) These measures should be kept up in gradually diminishing quantities for at least six months.

Where the tongue is much coated a preliminary course of powders containing one grain of grey powder or half a grain of calomel with some sodium bicarbonate should be given. Similar treatment is useful where the motions are pale or where much mucus is passed. In the latter cases a mixture containing rhubarb, soda and strychnine is valuable.

A most excellent aperient for children is the infusion of senna pods (three to six pods). It acts well and is almost tasteless. If given over a long period it may be curative.

When the colon can be felt persistently contracted reliance should be placed upon administration of salines and belladonna: massage is contra-indicated. R. M.

DIARRHŒA

By diarrhœa is meant the passage of abnormally frequent stools of an abnormally liquid character. In the first instance diarrhœa may be regarded as a protective and conservative process whereby the bowel is relieved of poisonous or injurious material. It may, however, represent an intractable and exhausting habit due to some persistent cause of irritation, as, for instance, an ulcer of the mucous membrane. The commonest cause of diarrhœa is the development within the bowel of an abnormal bacterial flora, which generates from the nutrient media products of a poisonous character which irritate the bowel. Indiscretions of diet, indigestible articles of food, and other agencies which inflict damage on the lining mucous membrane undoubtedly impair its vital activities and thus interfere with its power of acquiring or manifesting immunity to the bacterial agencies to which it is constantly exposed.

Inasmuch as the peristaltic movements on which diarrhœa depends are themselves under the control of local and central nervous mechanisms, it is clear that there can be no determination of diarrhœa without central or reflex stimulation of the nervous mechanisms. Emotion and other forms of psychological stimuli are by no means infrequent causes of acute or even chronic diarrhœa in children.

In acute cases of Diarrhœa, both in infants and young children, the attack may be ushered in by colicky pains, vomiting, fever, depression or even collapse. Owing to the frequent generalization of infections in children, diarrhœa is often a symptom of infective disorders, the chief incidence of which may fall on other organs, as, for instance, on the lungs. Thus pneumonia, bronchitis and most of the specific fevers may commence with an attack of diarrhœa. At the commencement of an attack of diarrhœa it is not, therefore, safe to assume that the digestive tract is alone involved.

The chief indications for *treatment* are: (1) to clear the bowel of the cause or the effects of the irritation; (2) to keep the bowel at rest and give it an opportunity of recovery; (3) to combat the depression or collapse.

To effect the first purpose a drachm of castor oil may be safely administered. This method of treatment is especially indicated when there is reason to suppose that the small intestine is seriously involved. If the large intestine, and especially the descending limb of the colon, is mainly involved, and especially when there is much vomiting, an enema of hot water may be given through a long catheter and at a temperature of about 103° F. The quantity of water should be ample, one or two pints are often not too much, but the water should be allowed to flow freely out of the anus, so as not to distend the colon and thus cause pain. To keep the bowel at rest after the administration of the enema or after the castor oil has acted, it is a sound practice to suspend food entirely for twenty-four hours or longer—although small quantities of stimulants may be given, such as brandy or sal volatile, to counteract exhaustion. If food of any kind is given it should consist of small quantities of rice water, egg water or arrowroot gruel. Astringent or antiseptic drugs are not as a rule necessary or advisable, but if it is thought desirable to resort to these, aromatic chalk, opium and the salts of bismuth will be found most useful. Bismuth should be given in heroic doses if given at all. The following will be found a useful draught for a child one year of age with acute diarrhœa which does not immediately cease after the preliminary treatment above directed:

Glycerini Bismuth Carb. ʒ i

Pulv. Creta. Aromat. gr. x

Tinct. Cardamomi ℥ xv

Tinct. Opii ℥ i

Aq. Cinnamomi ad. ʒ ii.

To be given in one dose or in smaller doses at very short intervals. The amount of opium should be varied with the age of the child.

The collapse may be treated by external warmth, stimulants and by the subcutaneous injection of normal saline, injected, when possible, by the slow continuous process. The advantages of sea water over ordinary saline solutions has not yet been demonstrated.

Chronic Diarrhœa may be symptomatic of constitutional disease or complementary to failure of some other excretory organ, or, as is more usually the case, it may represent a primary disturbance of function of some part of the digestive system itself. Of the latter causes of diarrhœa, ileo-colitis is far the most common, although achylia (suppression of gastric secretion), acholia (insufficiency of hepatic

and pancreatic functions), ulceration of the bowel or disturbance of the nervous mechanism of peristalsis (lienteric diarrhœa) may also be occasional causes.

The seriousness of the condition depends on (1) the duration, (2) the degree of wasting, (3) the causation. The character of the stools may afford useful information with respect to the cause. In ileo-colitis mucus of some kind is always found in excess. If the small intestine is chiefly involved the mucus is intimately mixed with the motion; if the colon, and especially the lower portion of the colon, is the seat of the catarrh the mucus may be passed independently or incompletely mixed with the rest of the dejecta. In all cases the motions should be thoroughly examined after well stirring in a large quantity of water, by this means curled or rolled up pieces of mucus can be more easily identified. In achylia evidence of failure of gastric digestion is sometimes given by the excess of indigested proteid matter, meat fibre, milk curd, etc. which is found in the stools. In acholia the stools are very fatty and light-coloured. In ulceration of the bowel there is sometimes evidence of blood, pus, sloughs or tubercle bacilli. In lienteric diarrhœa undigested food of all sorts is found in the motion, which often bears more the appearance of vomit than fæcal matter.

Treatment. The general management of diarrhœa is much the same in all cases, no matter what may be the cause of the condition. The food must be so regulated that no undigested remains reappear in the motion. This may necessitate complete peptonization of all food by artificial means, or in less severe conditions it may mean restriction of those particular classes of food which by examination of the motions are proved to remain undigested. Cellulose material of all kinds, such as pips, seeds, husks, skins, etc., must be avoided, and indeed such forms of the cereal foods as contain irritating particles of cellulose, such as oatmeal or shredded wheat. Highly flavoured or spiced food, foods which are very hot or very cold, and in fact all stimulating varieties of food which are calculated to excite peristaltic action should be given with extreme caution. Long intervals of rest should be given between meals, and the meals themselves should be concentrated rather than fluid or bulky. Inasmuch as the vasomotor system, and the distribution of blood throughout the system, exercise an active influence on the function of the bowel, it is of extreme importance to avoid abnormal congestion through external cold of the extremities or of other parts of the body—cold feet and wet feet should be particularly avoided.

With respect to the drug treatment of chronic diarrhœa, it may be stated *ab initio* that

there is no drug of equal value with castor oil given in repeated small doses, or once a day in medium doses of half to one drachm, especially in those cases in which there is chronic colonic inflammation. In cases of achylia, especially if the suspected absence of gastric juice is confirmed by a test meal, pepsin in three-grain doses and dilute hydrochloric acid in five-minim doses should be given immediately after each meal. Pepsin also in combination with hydrochloric acid exercises a beneficial influence on this variety of diarrhœa. In cases of pancreatic insufficiency, with or without hepatic derangement, liquor pancreatis should be given in full doses of half to one drachm shortly after each meal. With marked hepatic insufficiency and absence of bile colouring matter in the motions, glycocholic acid sometimes exercises a favourable influence. The proprietary preparation Chologestine, which contains pancreatin, glycocholic acid, salicylate of sodium and benzoate of sodium, is a convenient form in which to administer this somewhat nauseating drug. This preparation may be given in two- to four-drachm doses about one hour after meals.

In cases of chronic diarrhœa with evidence of much intestinal toxæmia, I have little faith in the value of the so-called intestinal antiseptics, salol or beta-naphthol, or in such astringents as tannigen. Their antiseptic powers are used up before they reach the lower part of the descending colon. As an antiseptic I have more faith in sulphur, owing to its obstinate resistance to chemical reaction and the greater probability of its survival in the more distal tracts of the intestine. There is, in my opinion, a more reasonable chance of restraining or inhibiting bacterial decomposition in the large bowel by promoting the development of antagonistic and harmless bacteria of the nature of lactic bacilli. The continued administration of sour milk, lacto-bacilline or other active varieties of the lactic acid bacilli by the mouth has frequently in my experience been productive of the best results. I believe, however, that during a course of treatment of this kind it is desirable to counteract the absorption of an excess of lactic acid into the system by the free exhibition of saccharated lime water or aromatic chalk powder, or, if such aperients do not add to the intensity of the diarrhœa, burnt magnesia or milk of magnesia. For a child one year of age the quantity of sour milk to be administered in the twenty-four hours should not exceed fifteen ounces, in diluted portions of five ounces three times a day. I have at times found it of advantage to irrigate the colon with a weak solution of milk sugar in which lactic acid bacilli have been suspended. Either with or without the lactic bacilli, lavage of the colon by the Plombières method with a long soft catheter

under a low pressure of water is often one of the more effective means of combating the effects of colitis and intestinal putrefaction.

In all cases of symptomatic diarrhœa the primary condition must receive appropriate attention. In tuberculous disease small and increasing doses of creosote, combined with cod-liver oil and hypophosphate of calcium, are useful. In the treatment of lenteric diarrhœa of nervous origin, the nervous system should be braced up by arsenic, phosphorus or strychnine in small and continued doses. In chronic diarrhœa of a dysenteric character Dover's powder will be found invaluable, while diarrhœa due to ulceration of the mucous membrane in the rectum, sigmoid or lower part of the descending colon is often effectually controlled by the injection of weak solution of nitrate of silver.

E. P.

BILIOUS ATTACKS

The terms "bilious attacks" or biliousness are loosely applied to such conditions as hypersensitiveness of the stomach to certain articles of food which results in vomiting, or to loose actions of the bowel which contain an undue amount of bile-stained mucus. These terms, however, in our opinion should be reserved for recurrent attacks of headache, vomiting, epigastric pain accompanied by mild degrees of fever which come on suddenly, last a comparatively short time, and represent, as it were, on a minor scale one of the following well-recognised symptom-complexes—

1. Migraine. 2. Cyclic vomiting. 3. Hepatic inadequacy. 4. Acute indigestion or auto-intoxication.

Bilious attacks generally occur in children whose nervous systems, by acquisition or hereditary transmission, are hypersensitive, unstable or explosive. They are of more frequent occurrence among the upper and well-to-do classes than among the poor. The exciting cause may be psychological or mental. Rich or excessive food, eye-strain, east winds, cold, dabbling in sea-water or a number of other forms of stimuli may excite an attack. Although the basic symptoms are definite and constant the epi-phenomena will vary with the type and with the cause. Thus in the migrainous type headache is usually the prominent symptom, and the vomiting is not necessarily severe. There may be a distinct aura premonitory of the attack, and there may be optic phenomena, or even slight aphasia. In attacks of the cyclic vomiting type the regular periodicity of their incidence, and the difficulty of discovering an adequate exciting cause, are highly characteristic. In severe cases the breath may be sweetish, or even smell of acetone. In such

cases acetone or diacetic acid will be present in the urine. A relatively high temperature may be present also. In the third class of cases (hepatic inadequacy) the large size of the stools, their light colour, as well as their greasy and offensive nature, are characteristic. The child may have a ravenous appetite or suffer from anorexia. The liver at times is enlarged and the complexion muddy. In bilious attacks of the dyspeptic type there are generally symptoms of a concomitant toxæmia. The temperature may be high and epigastric or abdominal pain a feature. Proof of indicanuria and other evidence of intestinal putrefaction may be forthcoming.

The *treatment* necessarily depends upon the cause and the type assumed. In all cases food should be suspended and the intestinal tract cleared of its contents. If there is not much vomiting and drugs can be tolerated by the stomach, a calomel purge followed by a saline aperient is generally a most efficacious line of treatment. If the stomach is sensitive a large soap-and-water enema may be substituted for drugs by the mouth. Warmth to the extremities, or even a hot bath, is often a rational resource to counteract the peripheral high arterial tension and peripheral vasomotor spasm which often complicates the condition; water or other simple diluents should be freely exhibited. In attacks of the migrainous type phenacetin or antipyrin are often most efficacious, while citrate of caffeine, amyl nitrite or sodium nitrite are also at times useful. If the attack suggests acetonæmia large doses of bicarbonate of soda or milk of magnesia are indicated, while some authorities recommend large quantities of sugar water. If the liver gives evidence of disturbed or inadequate function, abstinence from food is the chief indication, while continued small doses of calomel, grey powder, salicylate of soda or other chologogues may restore the functions of the temporarily paralysed organ. Attacks which are of the type of ordinary dyspepsias must be treated on lines which are appropriate to the particular organ or part of the digestive system involved. In all cases the diet must be simplified and adjusted and the bowels regulated. Inasmuch as bilious attacks are of short duration and recurrent, prophylactic measures are more important than the symptomatic treatment of the actual attack. Prophylactic treatment also depends on the cause. The nervous system must be protected from strain; errors of refraction, if present, must be corrected by glasses. A simple diet, with restriction of carbohydrate food and fats must be enjoined, and the child's habits of life and sleep regulated in accordance with the principles of sound hygiene.

E. P.

FEVER IN INFANCY AND CHILDHOOD

In young children the thermotaxic mechanism is not fully developed and considerable fever may follow on comparatively trivial causes such as fretting, minor chest and throat conditions, the presence of worms or undigested food in the intestine, excess of carbohydrates, mouth conditions such as stomatitis or teething, and finally emotional disturbances.

The last cause is especially marked in children of a neurotic temperament.

Fever, however, should never be attributed to trivial causes without most careful and repeated examination to exclude other more serious conditions, and in all the foregoing the high temperature is usually of short duration, while a history of previous similar attacks may be obtained.

The temperature is a very valuable indication of illness in children, because they can seldom describe their symptoms and may show high fever with little physical inconvenience.

In this article we shall only treat of cases in which fever is the salient symptom and is of obscure causation; special points in diagnosis will be dealt with, but for a full description of the symptoms of any one disease, reference must be made to other articles.

In diagnosis an accurate history is extremely important and, lest undue attention be directed to the digestive system, it should be noted that vomiting is common at the onset of acute fever in children.

Hyperpyrexia, which is not common, is especially associated with intracerebral conditions, but it may occur in septic troubles, meningitis, hysteria, chorea, pyelitis, influenza, pneumonia and typhoid fever.

High Fever of acute onset is most often due to affections of the pharynx and tonsils and to pneumonia; it should be noted here that the symptoms of many of the general affections, such as rheumatism, scarlet fever or influenza, may be limited to fever and sore throat.

Influenza is not uncommon in infants and children who have been exposed to infection, but a careful examination must always be made to exclude other conditions, and the fever should not last more than a few days unless there is some complication.

Acute rheumatism in children differs from that disease in adults in that there is not the same tendency to joint affections; the only accompaniments of rheumatic high fever and acute general illness may be sore throat, a few shooting pains and perhaps some evidence of myocardial affection.

Early acute osteomyelitis or epiphysitis may simulate acute rheumatism, and delay in treatment in such cases is so dangerous that a careful

watch must always be kept for localised swelling or tenderness.

The eruption of erythema nodosum may be preceded for several days by high fever of a remittent type (Thomson).

The early diagnosis between pneumonia, either apical or deep-seated, typhoid fever and tuberculous meningitis is often very difficult. In pneumonia the onset may be with vomiting, epigastric pain and other symptoms pointing to acute gastro-intestinal trouble while, later on, rigidity of the neck muscles, convulsions and stupor may simulate meningitis: further, careful examination of the chest may only reveal some slight dullness and loss of breath sounds. Rapid breathing and working of the *alæ nasi* are valuable signs. In tuberculous meningitis there is generally marked constipation, and other symptoms are rigidity of the neck, the presence of Kernig's sign, the *tache cérébrale*, choroid tubercles and optic neuritis. The result of lumbar puncture or, after the seventh day, of Widal's reaction also helps to establish the diagnosis. Acute appendicitis is another condition which may give rise to high fever with no very definite localising symptoms. Examination per rectum should not be overlooked.

Less Acute Fever (usually irregular) may begin gradually, often after an acute illness, which should give a clue to the diagnosis. Such fever occurs with small empyemata, localised pneumococcal conditions, otitis media or infections of the urinary tract with a bacillus of the coli type.

This last affection is common after diarrhoeal conditions, though it may be a primary disease and have an acute onset. The symptoms are those of general toxæmia with fever, restlessness and vomiting, the diagnosis resting on the discovery of the bacillus coli in the urine. The urine may also be turbid and offensive, containing albumin and pus. Treatment consists in giving potassium citrate in large doses (forty to eighty grains daily) or, this failing, vaccine therapy. One can here emphasize the importance of examining the urine in infants and children not only chemically but also microscopically.

Hodgkin's disease or blood conditions such as leukæmia may be acute or show exacerbations, in either case giving rise to alarming feverish attacks. Examination of the liver, spleen and blood establishes the diagnosis.

When the fever begins more or less gradually and is of an irregular nature, one should first examine for tuberculosis, either of the mediastinal, bronchial or abdominal glands, or of the lungs or intestine. The family history relating to the opportunity for infection is very important, while the von Pirquet skin reaction to tuberculin and the X-ray examination may help to diagnose glandular mischief.

Cases of intestinal trouble, colitis, inflammation of the biliary passages without jaundice and low enteric may cause obscure fever.

Chronic tonsillitis and septic conditions of the mouth, nose or ear may be present and, amongst the causes of chronic tonsillitis, rheumatism must be mentioned. Chronic rheumatism often gives rise to irregular pyrexia without many other symptoms except perhaps growing-pains, headaches and slight heart trouble. Such heart trouble is not necessarily valvular, but a slow ulcerative endocarditis may cause obscure chronic fever.

Finally, mention should be made of certain other causes of fever, such as acidosis and other auto-intoxications, idiosyncrasies for certain drugs, chronic joint affections, inanition fever in infants, poliomyelitis, glandular fever and recurrent fever.

Treatment. It is obviously better to pay chief attention to the underlying cause rather than to the fever, but when unfavourable signs such as drowsiness, delirium, restlessness or sleeplessness are present, hydrotherapy gives the best results. Either the tepid sponge or pack or the injection of a few ounces of warm water into the colon are usually efficient and are not likely to cause collapse.

Of drugs, quinine, quinine salicylate, sodium salicylate, phenacetin and Dover's powder are the best. The diet and the state of the bowels must be watched, and brandy is often indicated in doses of five, ten or fifteen or more minims every three hours, according to age.

C. P. L.

INTESTINAL WORMS IN CHILDREN

The certain diagnosis rests on the discovery of ova or worms in the stools, but all ova found in the stools are not necessarily those of worms, whilst particles of mucus or vegetable fibres may resemble worms or segments very closely.

Symptoms common to all cases of worms are (1) intestinal, such as anorexia, colic and nausea, (2) general, such as anæmia, wasting and debility, and (3) reflex, nervous signs, such as irritability, habit-spasms, a frequent short cough, loss of sleep, night-terrors, teeth-grinding and feverish attacks.

Thread-worms (*Oxyuris vermicularis*) resemble small bits of white thread and usually inhabit the large intestine. Much irritation and scratching, especially at night-time, may be caused by the worm coming out of the anus to deposit its ova. The ova (Fig. 1) white and characteristically asymmetrical, may be conveyed to the mouth and thus cause reinfection, but multiplication also takes place inside the intestine. Vulvo-vaginitis, nocturnal incontinence, frequency of micturition, mastur-

bation, priapism and tenesmus may also be caused.

Treatment consists in expelling the worms, preventing reinfection and improving the general health. Poor general health is an important factor in preventing recovery and in allowing multiplication of the parasites. To expel the worms castor oil, santonin and calomel are useful, while a rhubarb, gentian and soda mixture forms a good stomachic and tonic.



Parasitic Worms.

1-5. Ova, shown more or less diagrammatically, of (1) Thread-worm $\times 250$; (2) Tape-worm $\times 250$; (3) Whip-worm $\times 200$; (4) Round-worm $\times 200$; and (5) Cheese-mite (after Emerson) $\times 150$. 6. Round-worm, about half the natural size. 7. Thread-worms, double the natural size. 8. Whip-worms (after Cobbold), rather smaller than the natural size. 9-13. Tape-worms; (9) Head slightly magnified; (10) Immature segments; and (11) a mature segment; (12 and 13) Segments to show the difference in shape and branching of the uterus in (12) the beef and (13) the pork Tape-worm.

The colon, previously emptied, should be thoroughly and repeatedly irrigated. Salt and water, infusion of quassia, and perchloride of mercury (1 in 10,000) are suitable, and the injection, heated to 100° F., should be given slowly through a long tube, five to twelve ounces being used according to age.

It is not uncommon to meet with intractable cases in which there is probably a breeding-place high up in the intestine or in the appendix. Reinfection is prevented by attention to general habits, to the finger-nails and to smearing the parts with a weak mercurial ointment.

The Whip-worm (*Trichocephalus dispar*), is not very rare, but it is usually present with thread-worm and is very hard to dislodge. The ova (see Fig. 3) are characteristic.

The Round-worm (*Ascaris lumbricoides*) re-

sembles the earth-worm, but is paler, smoother and thinner. The ova (Fig. 4) are swallowed with vegetables or water, and the worms, usually few in number, inhabit the small intestine, but may migrate to almost any accessible part.

Associated conditions are fever and irritation, which may even simulate meningitis, serious mechanical intestinal obstruction from ball-like masses of worms, and choreic attacks.

Treatment consists in giving santonin after emptying the bowel. A useful powder is santonin gr. ii, pulv. scammon co. gr. ii, calomel gr. i, for a child of three years. This can be repeated on the next day. To prevent absorption a purgative should be given after santonin.

Tape-worms (Cestoda), easily diagnosed from the passage of segments are not very common. *Tænia mediocanellata* (beef) is most commonly found, and *tænia solium* (pork) is rare.

Treatment, though not entirely free from danger in debilitated patients, must be thorough and systematic. The child should be put to bed, and the bowel emptied by laxatives and dieting for two or three days with eggs, broths and other light foods. A final purgative (calomel) is given, and on the following morning, before food, extract of filix mas can be given either at a single dose or in four parts at half-hour intervals, but it is unpleasant. Ext. filicis liq. $\bar{3}$ i, syrupus $\bar{3}$ ii, mucilag. acaciæ $\bar{3}$ ii, aquam menthæ piperitæ ad. $\bar{3}$ i.

One hour after the last dose, mist sennæ co. $\bar{3}$ ss is given. Retention of the filix mas may give rise to toxic symptoms, so an enema should be given if necessary. The child can have a light meal at dinner-time. If no head is found another dose can be given after a day's interval.

Although many cases are cured without the head being found, a watch must always be kept for the reappearance of segments, and if they reappear treatment should be repeated in three months' time. The head is a thin white filament about the size of a large pin. To find it the stools should be shaken up several times with fluid (the upper part being decanted each time after a few moments have been allowed for the heavy head to settle to the bottom) and finally filtered through black muslin. The same process of shaking up a small portion of the stools with fluid in a test-tube and decanting the supernatant fluid can be used in looking for ova.

C. P. L.

JAUNDICE (syn. *Icterus*).

Jaundice in childhood may be divided into (1) that present at or shortly after birth; (2) that which occurs in older children.

1. Jaundice present at or shortly after birth.
 - (a) *Icterus neonatorum*, the so-called **physio-**

logical jaundice, occurs in from forty per cent. to eighty per cent. of all infants. It appears on the second or third day, lasts three to ten days, is slight in degree, afebrile, and makes no difference to the child's progress. Bile-pigments seldom appear in the urine, and are rarely absent from the fæces. No treatment is necessary.

In rare instances icterus neonatorum is more severe; causing deep discoloration of the skin, mucous membranes, and urine, and some decolorization of the fæces; it may last even into the third month. The recognition of these cases is important, because the more usual causes of persistent jaundice are of grave prognosis; here the prognosis is good, but progress is often delayed. Feeding should be carefully regulated, and small doses (℥ ii ss) of ol. ricini. should be given.

(b) Jaundice **symptomatic** of an infection at birth may be (i) due to syphilis; it is a rare symptom and usually accompanied with other manifestations; (ii) due to septic conditions of the umbilical cord, with or without suppurative pyelphlebitis; (iii) epidemic hæmoglobinuric jaundice (Winckel's disease); very rare; (iv) a family jaundice attacking successive infants without evidence of syphilitic infection or pyæmia; almost invariably fatal.

(c) Jaundice due to **congenital abnormalities of the bile-ducts**. The jaundice is not usually present at birth, but supervenes in the first week, becoming progressively deeper to an olive tint, and accompanied by subcutaneous and submucous hæmorrhages. The urine is deeply stained; the fæces white; the liver and often the spleen enlarged and hard. These features serve to distinguish these rare cases from syphilitic hepatitis and prolonged physiological jaundice. The only possible treatment is surgical, and since the common lesion is an absence of the bile-ducts, the prospects of success are remote. Death usually occurs in from six to eight weeks, but has been delayed till the ninth month.

(d) Congenital acholuric family jaundice.

2. Jaundice in older children.

(a) The jaundice of older children is usually **catarrhal**. The pathology is disputed, but the seasonal incidence, and the occurrence of small epidemics, suggest that it may be infective. It is most frequent between the ages of three and eight years. The onset is usually preceded by a day or two of malaise, with headache, vomiting, diarrhoea, or constipation, and often fever rising to 102°. The urine contains much bile-pigment, and the fæces are often a paler yellow than usual, but seldom wholly decolorized. The liver is nearly always enlarged, and often tender to palpation. The illness lasts for several days, and then slow improvement begins. The pigmentation seldom lasts more than three weeks,

usually less, but recurrent attacks at short intervals are known. The symptoms met with in adults, bradycardia, pruritus, etc., are absent in children.

Treatment consists in rest in bed, bland food with diminished consumption of fats and carbohydrates, and the administration of gr. ss to ii of calomel twice a day, or of a rhubarb and soda draught.

(b) **Mechanical obstruction** to the flow of the bile is met with due to enlargement of the glands at the hilum of the liver in tuberculosis, lymphadenoma, or very rarely new growth. Multilobular cirrhosis is a rare cause; syphilitic cirrhosis is very uncommon. Other mechanical causes are obstruction by a round-worm, by biliary calculi, and by chronic mediastinitis, whether simple or tuberculous.

(c) Jaundice as a **complication** of pneumonia and typhoid fever increases the gravity of the prognosis; occurring in chronic heart disease it is usually a sign of failing circulation; in septicæmia and pyæmia it marks the last stage.

(d) A few cases of acute yellow atrophy have been described in children. H. T.

CROUP

The term "Croup" is given by the laity to any condition in which there appears a cough of the peculiar brassy character associated with laryngeal obstruction, and stridor. The common causes of such a cough are four: (1) Diphtheria, (2) Simple Laryngitis, (3) Laryngitis stridulosa, (4) Laryngismus stridulus. Besides these there are other conditions of rarer occurrence in which there is a cough and stridor of a "croupy" character; such as Congenital Laryngeal stridor, Laryngeal spasm, Tuberculosis of the Larynx, and Papilloma of the Larynx.

(1) See the article *Diphtheria*.

(2) **Simple Acute Laryngitis** occurs principally as the initial symptom in acute bronchopneumonia, in measles and in whooping-cough. It is most frequent in young infants, and always arouses anxiety because of the severity of the dyspnoea and the difficulty of excluding the presence of diphtheritic membrane. The chief points on which to rely in making the diagnosis are the absence of faucial membrane, the height of the fever, and in the case of measles the presence of "Koplik's spots."

The condition rarely calls for intubation or tracheotomy, but if it does intubation is greatly to be preferred. The severity of the symptom usually gives way to simple counter-irritation with hot sponges or turpentine stupes applied to the larynx.

(3) **Laryngitis stridulosa** is an affection peculiar to children between the third and sixth

years of life; it is very rarely seen in older children and only in its slightest form. The child goes to bed in perfect health and an hour or two later wakes with "croup"; its respiration is difficult and accompanied by inspiratory stridor; there is marked recession of the ribs and a variable degree of cyanosis; in a short time the difficulty of breathing passes away and the child falls asleep, to wake in the morning quite well. The attack is often repeated the next night and for several succeeding nights, usually, however, in a less severe form. The diagnosis of this form of "croup" from diphtheria is sometimes difficult. The chief reliance must be placed on the absence of membrane, the absence of fever, and the disappearance of the symptoms with a few simple measures of counter-irritation, amongst which may be noticed the use of a steam kettle, a hot mustard bath, and more especially the administration by the mouth of 1 to 2 drops of adrenalin chloride (1 in 1000) in a little water. As regards prophylaxis the presence of adenoids must of course be excluded, and if these are absent a small dose of potassium bromide (gr. iii to v) at bedtime usually suffices to prevent a repetition of the attack. The attacks are never fatal and the tendency to them as a rule soon disappears with the growth of the child.

4. *Laryngismus stridulus* is, properly speaking, not "croup" at all, but is popularly so-called. It is really a momentary spasm of the glottis occurring in rickety children in the first three years of life; the spasm lasts about three to five seconds and terminates in a loud crow. It is often associated with tetany and a tendency to convulsions; it occurs at frequent intervals, but always in the child's waking moments, often at the end of a cry. It is not a symptom of danger, and treatment directed to the accompanying rickets quickly puts a stop to the phenomenon.

Of the rarer causes of "croup" it should never be forgotten that *paroxysmal laryngeal spasm* may be due to the presence of a foreign body in the larynx; while the continuous clucking character of the stridor, even in sleep, and the age of the patient makes *congenital laryngeal stridor* easily recognisable. Papilloma of the larynx and tuberculosis usually call for tracheotomy.

One other cause of croup still remains—that is *Retropharyngeal Abscess*. Here the presence of enlarged glands in the neck, some amount of fixation of the head, with perhaps even retraction, and dribbling from the mouth, should arouse suspicion; a boggy swelling will be found in the pharynx, and the suppuration should be dealt with surgically at once, for delay may cause suffocation through rupture of the abscess.

H. T.

BRONCHITIS

The actual cause of an inflammation of the bronchi is but seldom identified, but the predisposing causes are well known. Chief among them must be placed the infections of the nose, pharynx and fauces; and the prevalence during the years of childhood of rickets, measles and pertussis, three diseases almost invariably accompanied by bronchitis. In young infants, who are especially liable to attacks, exposure to cold, fogs or irritating vapours certainly plays an important part. Among the older children perhaps the most important factor is the presence of carious teeth, and of hypertrophy of the tonsils and adenoid tissue of the nasopharynx.

Symptoms. An attack of *Acute Bronchitis* often begins as a cold in the nose; but in some cases the onset is more violent, the first manifestation being the high fever, sometimes rising to 102° or even more. Such patients are naturally supposed to have some more serious condition than bronchitis, but the physical signs and the course of the illness confirm the diagnosis. In the milder attacks the temperature is but little raised, there is no dyspnoea, a troublesome and persistent cough, and some disturbance of the general health, shown in the loss of appetite, furred tongue and restlessness. The physical signs are limited to the presence of scattered rhonchi in the lungs, without any loss of percussion resonance. In very young infants and in the more severe attacks the general disturbance is much greater; the respiration-rate is increased, there is cyanosis, recession of the ribs, and exaggerated efforts both of inspiration and expiration; the percussion resonance remains unaltered or even becomes hyper-resonant owing to the development of an acute emphysema, and on auscultation the lungs are filled with bubbling mucous râles, and snoring, whistling and creaking sounds.

Such attacks in healthy children as a rule pass away in a week or ten days and leave no after-effects, but in some infants there is a marked tendency to recurrence, and in these the chest assumes an emphysematous shape, the difficulty of respiration becomes greater with each attack, and with the consequent dilatation of the right ventricle a vicious circle is established resulting in chronic bronchitis.

Chronic Bronchitis is more frequent in older children than in infants, and is most often due to an infectious condition of the mouth, fauces or naso-pharynx. The chief symptom is cough especially at night, and the physical signs are limited to a few scattered rhonchi, with some mucous râles heard intermittently.

Prognosis. The outlook in the case of young infants is determined entirely by the presence

or absence of complications: in severe attacks there is always the danger that the inflammation may spread to the smaller bronchioles and to the alveoli, thus causing a broncho-pneumonic consolidation: further there is the danger of collapse of the lung, leading to grave embarrassment of the heart. In older infants an acute bronchitis is often the herald or the companion of measles or whooping-cough, and where there is in addition rickets a fatal result is common. In a few instances an acute military tuberculosis of the lungs sets in with the symptoms and signs of a simple bronchitis, and the gravity of the condition is only realized by the course of the disease. In chronic bronchitis the prognosis will depend on the recognition and the removal of the cause; contrary to what has been sometimes stated, chronic bronchitis is rarely of tuberculous origin. The danger in such cases is the development of bronchiectasis. Lastly, there is one condition in which the prognosis should always be guarded; that is, bronchitis associated with a widespread eczema in young infants.

Treatment. The two essentials in the treatment of acute bronchitis are **efficient ventilation and sufficient warmth**. The common practice of enveloping the baby's cot in a tent, into which a bronchitis-kettle pours a constant stream of hot steam, is to be condemned, because it infringes the first of these essential rules; free ventilation with a constant temperature of 65° F. is desirable. In the first stages a purge is often necessary; calomel gr. ii in divided doses, or syr. sennæ 3 ss. A mixture containing vin. ipecac. ℥ v with an alkali such as ammon. citrat. is useful at this stage, given every four hours. If there is much cyanosis two leeches applied over the heart often do much to relieve it; and where the cough is harassing frequent sips of warm citrated milk allay the irritation. Later in the illness, when there is a great deal of secretion, a few minims of tinct. belladonnæ e. g. ℥ v in a mixture with vin. antimonalis ℥ x serve to prevent an excessive accumulation. Poultices are seldom desirable, and if it is wished to use counter-irritation rubbing the chest with linim. terebinth is preferable. Other drugs which are sometimes useful are ammon. carb., squills and senega. After the acute attack has passed and in the more chronic forms the oil of creasote and cod-liver oil are perhaps the best aids to complete recovery. In older children with chronic coughs and but little secretion potas. iodid. gr. iii-v often seems to afford relief; but for these a visit to the seaside is the surest remedy.

H. T.

TUBERCULOSIS IN CHILDREN

Morbidity and Mortality.—So ubiquitous is the tubercle bacillus among crowded communities that infection may be considered unavoidable and only a matter of time. But it is, nevertheless, of the greatest possible moment in what manner and at what hour the bacillus first meets the human organism. A glance at the accompanying chart shows how the shaded area of infection rises steadily till the 100 per cent. maximum is closely approached as early as the eleventh year of life; but on the other side of the diagram appears the mortality curve of tuberculosis, and this exhibits a striking contrast.

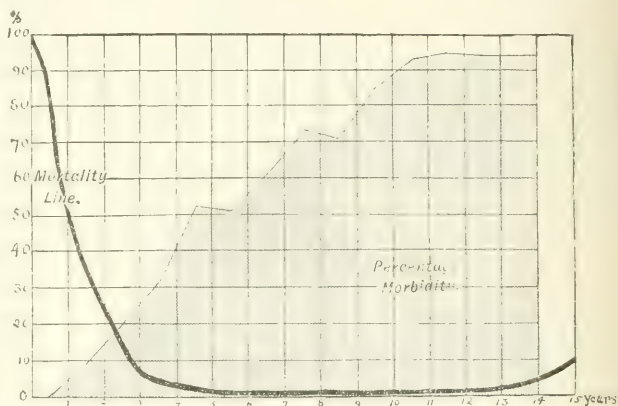


Chart (after Escherich). Shows the Percentage Morbidity (after Hamburger and Monti), and also the Percentage Mortality on these figures calculated from the Tuberculosis Mortality Tables of Vienna for the same year (1909).

Extremely fatal in the first and also markedly so in the second year of life, tuberculosis appears as a relatively mild disease after the third or fourth year, and during later childhood presents a striking contrast in this respect both to infancy and to early adult life. Infection in early infancy is of extreme danger, but once that period is passed, a mild infection, such as that obtained from a well-diluted bovine source, is probably of considerable protective value during the first two decades of life.

Classification.—In childhood the lymph glands form the main defence against the tubercle bacillus. These structures are well developed in early years and mechanically arrest the bacilli. In infancy such arrest is but temporary, and a spread to vital organs readily follows. But in later years of childhood the glands hold the infection and thus form, clinically, the primary focus, from which the disease may or may not spread to other structures. We thus have two well-marked stages of disease, a first stage in glands, manifest or occult, and a second

stage when the disease has overstepped these and appears in other parts—either comparatively resistant surface structures, or more vital internal organs.

Tubercular Glands (Manifest or Occult).	Surgical Tuberculosis. (Disease of external structures, bones, joints, skin, etc.)	General Miliary Tuberculosis.
	Medical Tuberculosis. (Disease of internal organs, lung, pleura, peritoneum, etc.)	

Diagnosis: General—

SPECIFIC.—The finding of the *tubercle bacillus* must always remain the sheet-anchor of diagnosis, but in lung disease of children, where this help is especially needed, we are unfortunately handicapped by the difficulty of obtaining sputum. Holt has, however, introduced a method for this which, in his hands, has given remarkable and even unexpected results. The pharynx is irritated with a piece of muslin held by a pressure forceps and, during the resulting paroxysm of cough, the secretion brought into view is collected on this for investigation. Among sixty-seven cases of lung disease, sixty-two of whom were under two years of age, Holt succeeded in demonstrating tubercle bacilli in the sputum of no less than eighty per cent. Among other specific methods the *opsonic index* is of some diagnostic value, especially in localised tuberculosis, but it must be performed, and to some extent interpreted, by an expert. A low *leucocyte count*, and a high percentage of lymphocytes in a *cytological* examination may both be of value in diagnosis.

The *tuberculin reaction* depends on the fact that the disease sets up in the tissues a "sensitivity" to tubercle products. In the tubercle-free large doses of tuberculin can be injected without effect, but in the tubercular similar doses will cause a reaction, which may be *local*, *general*, *focal*, or all three. Now, such reactivity to tuberculin implies tubercular infection, but this is, we have seen, so widespread when the age of infancy is past that it affords in itself but little help in diagnosis. The value of tuberculin in diagnosis is restricted at present within the following limits—

- (a) The *cutaneous test* (v. Pirquet) is of great value in the first two or three years of life. In later childhood it is only valuable when negative.
- (b) The *focal element* of the subcutaneous test is absolutely specific and marks the spot where it appears as clearly tubercular. In tuberculosis of superficial structures it is of great value in diagnosis, and far too seldom employed.

In internal tuberculosis it may also be of value, but its employment is open to risk save in the hands of the experienced.

NON-SPECIFIC.—In addition to specific tests, certain general points which help us in the diagnosis of tubercular disease may here be mentioned.

1. *Family history* is of great value in infantile cases where contact means nearly certain infection, and infection disease.

2. The *onset and course* of tubercular disease is generally gradual and progressive, but there are exceptions to this. In lung tubercle the absence of resolution, and the occurrence of cavitation if this gives rise to clinical signs, are distinctive; the middle of the lung and the right middle lobe are common centres of attack.

3. *Wasting* is rightly considered a characteristic of tubercular disease, but in childhood other causation, such as gastro-intestinal trouble, must be carefully excluded. Moreover, in acute forms of tuberculosis no visible wasting may occur before death.

4. *Other accompanying signs* are of occasional help in diagnosis, especially *tubercular skin lesions* or *tuberculides*. Marked *growth of eyelashes and body hair* is frequently observed in chronic tuberculosis, but it occurs also in non-tubercular conditions, and is probably due to the effect of prolonged slight fever on surface nutrition. *Finger clubbing* in pulmonary tuberculosis seldom amounts to more than a curving of the nails; in bronchiectasis, on the other hand, there is either marked clubbing or the finger ends entirely escape.

Diagnosis: Regional.—Diagnosis of intrathoracic glands claims our special consideration, for this is, clinically, the first stage of disease, and it is at this stage, above all, that treatment obtains the best chance of success.

INTRATHORACIC GLANDS.—*Symptoms.* These may be absent, are generally ill-defined, and amount in the main to "delicacy," accompanied by bouts of mild fever, chest pain, and always some cough, which may be paroxysmal or, in infants, of high ringing quality and accompanied by some expiratory dyspnoea. Cough may be due to pressure on the air tubes, or to irritation of the vagus or left recurrent laryngeal nerves.

The *signs* may be those of (a) *direct evidence* of glandular enlargement, and of these the only one of real value is that obtained by *X-ray examination*. The tracheal bifurcation is covered by the heart, but caseous bronchial glands may be visible as a shadow down the right side of the sternum or even the individual glands picked out. (b) *Indirect evidence* is practically that of pressure on surrounding structures. Pressure

on the *trachea* or *bronchi* rarely gives rise to signs; occasionally in young children air entry and vocal resonance may be diminished over a lobe or even a whole lung. In other cases similar signs, accompanied by sudden and severe dyspnoea, may be evidence of the rupture of a softened gland into a bronchus. Pressure on *veins* is of more frequent occurrence and causes enlargement of venous radicles over the chest, neck and temple, swelling of the external jugulars and, in rare cases, some turgidity of the face. Visible chest veins are not uncommon, but neither are tubercular intrathoracic glands. A further point in the diagnosis of tubercular chest glands is the *sign of spread* from these into other organs. Thus râles, friction and impairment over the right middle lobe or interscapular region indicate a secondary pulmonary involvement, though the disease may still be within the reach of skilled treatment.

SURGICAL TUBERCULOSIS.—When the bacilli pass out to distant structures it is curious how sharply separated the surgical and medical outcome of such a spread remain. Multiple lesions in surface structures are common, but a mixture of these with disease of lung, pleura or peritoneum are much less often seen. Attention may be called to two helpful points in the diagnosis of surgical tuberculosis: firstly, the value of the *focal hyperæmia* so readily produced in surface lesions by a suitable dose of tuberculin and so truly specific when obtained; and secondly, the value of *skiagraphic methods*, not only for bone and joint disease, but also, by the use of bismuth-vaselin, for the exact localisation of deep and tracking sinuses.

MEDICAL TUBERCULOSIS.—According to the resistance of the host, the dose of the organism, and the manner of spread, the resulting illness varies in its duration, and thus, when fatal, in the nature of the lesions found after death. These may be miliary caseous or fibro-caseous, and the disease may be conveniently described on this basis.

Miliary Tuberculosis may be general or limited in extent. (a) *General* miliary tuberculosis represents a wide discrepancy between dosage and resistance, and is commonest in the early years of life. The *marantic* form is found in infants, the diagnosis largely turning on the exclusion of other causes of wasting and the presence of a known source of infection. The *pulmonary* form occurs in somewhat older children, and presents the clinical aspect of an acute bronchitis or broncho-pneumonia, often with dyspnoea and cyanosis out of proportion to the slight stethoscopic signs. The *typhoid* form may be observed from the sixth year upwards, and, as a rule, the more gradual onset, lower temperature, less dulled mentality and absence of Widal reaction, suffice for its diag-

nosis. Leucopenia and some relative increase of lymphocytes may occur in either disease. The *meningeal* type of miliary tuberculosis is most characteristic, and may be the terminal picture of other forms.

(b) *Limited* miliary tuberculosis may occur in fatal form in the lungs and also, less commonly, in the meninges. In certain resistant and non-vital structures, as the peritoneum or pleura, a limited miliary tuberculosis is readily recoverable.

Caseous Tuberculosis generally occurs in children of poor resistance and it is best exemplified by tubercular pneumonia. This generally takes the form of a protracted *broncho-pneumonia*, and its tubercular character is marked by its slow onset and course, the distribution of lesions mainly in the middle parts of the lungs especially on the right side, the marked predominance of râles and friction, and, in rare cases, the appearance of cavity signs. Wasting and overgrowth of epidermal structures are present but not distinctive, and a confirmation of the diagnosis must be sought in sputum examination and the use of tuberculin tests. When a lobar consolidation occurs, often through rupture of a softened gland into a bronchus, its tubercular nature is suggested by the massive character of the lesion, giving rather the signs of fluid than of a solidified lung. In the peritoneum and pleura a miliary may go on to a caseous lesion but, save in very young children, reparative changes also occur and place the disease in the next category.

Fibro-caseous Tuberculosis. This occurs in older children where resistance to the tubercle bacillus is good. In the lung it is represented by the *hilus form of phthisis*, where the disease spreads slowly from the glands into the lung, and where the signs appear typically in the right middle lobe and right interscapular region, and by *apical phthisis*, where the disease is, as in adults, primary at the apex of the lung. True phthisis of children occurs after the sixth year and becomes more common as puberty is reached; it runs a more benign course than in adults, and, with suitable treatment, commonly ends in recovery, even from comparatively advanced lesions. Fibro-caseous tuberculosis of the peritoneum, *plastic peritonitis*, is characterised by abdominal distension and pain, wasting, and a blue appearance round the eyes and mouth. As a rule definite masses, matted bowel, and sometimes fluid are discovered on examination. Save in infants, where the condition is only part of a more widespread disease, the chances of recovery in uncomplicated cases, under well-planned treatment, are good.

Principles of Treatment—

PROPHYLACTIC TREATMENT is especially urgent in infancy, where infection is almost

synonymous with fatal disease. At this age a near source of infection generally exists and must be removed, and mother, nurses and, indeed, the whole household must be under suspicion till the bacillus-carrier is discovered. A possible bovine source must also be borne in mind and the milk supply investigated.

GENERAL TREATMENT is that directed to the improvement of general nutrition and nervous energy, and may be spoken of as hygienic-dietetic. The tubercular child should live in a dry and sunny spot where an outdoor life is of easy accomplishment, and for surgical tuberculosis there is no climate more suitable in this country than that of the Kent coast. In all forms of tuberculosis the removal from populous centres is desirable, since mixed infection greatly weakens resistance to the further inroads of the tubercle bacillus. The tubercular child should be adequately covered but not overclothed; the feet and legs must be kept warm, but sweating of the body should be avoided by the use of loose and porous garments. Food must be ample and digestible. Slops should be avoided and abundant supply of proteid and fats given, the latter preferably in the form of cream.

SPECIFIC TREATMENT.—All other treatment of tuberculosis does but pave the way to specific treatment, which is the true supplementing of nature's machinery for protection and cure. If a healthy animal receives an injection of tubercle bacilli no immediate result follows, but the animal dies later of tuberculosis; if, on the other hand, a tubercular animal receives a similar injection a violent "reaction" follows immediately, but no subsequent tuberculosis follows. The power of the bacilli is destroyed through the property we know as tubercular sensitiveness. Food for this sensitiveness must be supplied if our patient is to recover, and in cases of natural cure this is supplied from the patient's own lesions. In cases where a sufficient supply of autotuberculin is at hand and can be sensibly exploited no need arises for the injection of tuberculin from outside, but where the supply is insufficient, as in localised tuberculosis, or cannot be controlled, as in many cases of phthisis, the use of stock tuberculin employed on rational lines is our most valuable asset.

The A.B.C. of Tuberculin Administration.—There are three factors in the action of tuberculin which we may make use of in cases of tuberculosis of various kinds.

(a) The *increase of antibodies* against the tubercle bacillus, and of these opsonic power, about which we know most at present, may be taken as the representative. Our aim in tuberculin administration is to maintain the antibody content of the blood at a high level for as long a period as possible.

(b) That part of the tuberculin reaction which we know as the *focal reaction*. It consists in a flooding of the ill-nourished tubercular areas with blood carrying nutriment and antibodies, and is readily observed in visible lesions treated with tuberculin. This hyperæmia is a great asset to healing processes, but readily causes softening of caseous areas, and is thus, under certain conditions, an actual danger unless used with knowledge and caution.

(c) The phenomenon of *tolerance* to tuberculin, a condition which can be achieved through skilled increase of dosage at short intervals so that a heaping-up of "refractive periods" occurs. This achievement leads to a corresponding tolerance to autotuberculin, so that poisoning is overcome and immunization achieved in spite of toxin production from within.

Factors (a) and (b) are required in the treatment of all forms of tuberculosis, and in localised tuberculosis, where there is no autoinoculation, these remain the sole aims of tuberculin treatment. Doses of just sufficient size to cause a short focal response and to raise the antibody content over about a two weeks' interval are used, and the same small dose is repeated at the end of this interval.

In auto-toxic tuberculosis, on the other hand, that is tuberculosis with symptoms, such as phthisis, not only factors (a) and (b) must be studied, but, in addition, tolerance must be achieved. For where tubercle products are entering the blood stream from within, the small doses of tuberculin given for localised tuberculosis are of little avail, and neutralization of autotuberculin must be accomplished before a rational use of (a) and (b) can be attained. Tolerance is obtained by raising the dosage steadily at intervals of two or three days, auto-inoculation being meanwhile kept at a minimum by rest till large doses are reached.

Among cases of tuberculosis in children the scope of the method of immunization with tolerance is but small. In infancy the disease is too acute for tuberculin to be of any avail, and there only remain such conditions as phthisis and hilum phthisis available for the treatment with increased dosage and tolerance formation. But localised tuberculosis is very common in children and is eminently amenable to tuberculin treatment in small doses. This can generally be carried out at home, and, with the help of suitable charts, the mother or nurse can supply indications for dosage and interval, so that a long course of treatment can be successfully carried through with but little trouble to those concerned, and enormous benefit to the patient.

LOCAL AND ACCESSORY TREATMENT.—In cases of localised tuberculosis, in addition to

tuberculin, surgical measures are often required. These must include the removal of dead material, whether the coring of glands or removal of sequestra, and the aspiration or incision of collections of softened caseous material. Local applications may be required; heat in various forms or hypertonics to increase the effect of the focal reaction; bismuth-vaseline in certain cases of inaccessible sinuses. Splints and other apparatus are also needed to ensure rest and to prevent or correct deformity in tuberculosis of joints and bones. Lastly, in all cases of extensive open wounds, the treatment of mixed infections becomes an important one. This will demand the maintenance of efficient drainage, and the preparation in many cases of a vaccine for the chief micro-organism concerned, such treatment often enormously accelerating the effect of tuberculin administration.

C. R.

TUBERCULOUS MENINGITIS IN CHILDREN

Tuberculous Meningitis is so much more common in children than in adults that all descriptions of the disease cover the ground of this article to a great extent. It is proposed to deal here only with a few points of special interest in connection with the disease in children, particularly with the age-incidence and the variations in symptoms at the different ages of childhood.

Age-Incidence in Childhood. Tuberculous meningitis may be looked upon as the natural mode of death in fatal cases of tuberculosis in children. The younger the child affected with tuberculosis the greater is the tendency to tuberculous meningitis.

Under nine months of age tuberculous meningitis is rare. After this, the crawling age, it becomes much more frequent. During the second year of life it is very common, the maximum liability to the disease falling in this year. During the third and fourth years the death-rate is reduced by one-half, and in the remaining years of childhood the disease becomes much less common.

Tuberculous Meningitis in Infants.—Before the closure of the fontanelle tuberculous meningitis shows some few peculiarities of importance. The disease usually develops very quietly, little pain being apparently present. The most noticeable feature is that of gradually increasing drowsiness. This may be associated with some vomiting and constipation, and later with some rigidity of the neck and limbs, but with little, if any, head retraction; later a squint develops. The most noticeable physical sign is the bulging of the fontanelle—a sign of the greatest importance. Optic neuritis is very rare at this age.

Diagnosis. Although tuberculous meningitis is invariably secondary to some tuberculous lesion elsewhere in the body, the primary focus (usually in the bronchial glands) may not have given rise to any signs of ill-health. Thus the practitioner must not be led into error by the fact that the baby is well-nourished or even fat. Very rarely entirely breast-fed infants develop tuberculous meningitis, probably from a dust infection.

Well-marked bulging of the fontanelle (in the absence of convulsions or screaming) is a sign which cannot be discounted. It indicates organic intracranial disease and is not seen in the meningismus of diarrhoea, pneumonia, otitis media, etc. Of the acquired organic diseases present at this age, intracranial tumour and pneumococcal meningitis are uncommon possibilities. The differentiation of tuberculous from post-basic (meningococcal) meningitis gives rise to the chief difficulty in diagnosis, and the usual points of distinction are given in the following table—

TABLE SHOWING USUAL DIFFERENCES BETWEEN POST-BASIC AND TUBERCULOUS MENINGITIS. (FROM THE AUTHOR'S *The Medical Diseases of Children.*)

	Post-Basic Meningitis.	Tuberculous Meningitis.
Commonest age	First year . . .	Second year.
Eyes	Blindness . . . No fundal changes. Spasmodic staring. Squints, late . . .	Photophobia. Optic neuritis. Choroidal tubercles. Squints, early.
Mouth . . .	Champing movements . . .	No movements.
Tache cerebrale . .	Slight or absent . .	Marked.
Head retraction . .	Marked . . .	Absent or slight.
Other organs . .	Initial bronchitis or pneumonia . .	Spleen often enlarged; possibly other signs of tuberculosis.
Cerebro-spinal fluid	Turbid Polynuclear cells . . Meningococci . .	Clear or flaky. Mainly lymphocytes. Tubercle bacilli.

Tuberculous Meningitis in Children in Second to Fifth Year.—At this, the commonest age for tuberculous meningitis, the disease corresponds with the classical descriptions. With the closure of the fontanelle, pain in the head becomes a more prominent symptom, and optic neuritis almost invariable. The older the child the more painful the disease and the longer the period preceding the comatose stage.

Diagnosis. The earliest symptoms of tuberculous meningitis at this age are usually headache, vomiting, constipation and some change in disposition. These may easily be mistaken for a "bilious attack," cyclical vomiting or hysteria. Again, such causes of meningismus as pneumonia, otitis media, influenza or enteric fever are common sources of serious difficulty in diagnosis. Intracranial abscess very rarely occurs in children under five years of age.

Meningococcal meningitis has been considered above.

In difficult cases the presence of optic neuritis and typical changes in the cerebro-spinal fluid (*vide* table, *supra*) are of the greatest diagnostic importance: the latter in particular indicating the exact nature of the disease without doubt. Choroidal tubercles are hardly ever present sufficiently early in the disease to be of help in diagnosis.

Tuberculous Meningitis in Older Children.—The picture of the disease is here the same as in adults. The pain in the head is a most prominent and distressing symptom, necessitating very large doses of morphia.

Diagnosis. The difficulties here are those met with in adults and require no special mention.

R. M.

BRONCHO-PNEUMONIA IN CHILDREN

Synonym: Catarrhal or lobular pneumonia.

Definition: An acute inflammation involving the bronchioles and alveoli of the lungs.

There are two forms of the disease. Both occur more especially in infants and are particularly common in the second year of life.

Primary. The infection in this form is a pure pneumococcal one, and the etiology is that of lobar-pneumonia.

Secondary. In this form the disease is always consecutive to bronchitis, which in turn may have been simple or secondary to measles, whooping-cough, diphtheria or influenza.

Insanitary surroundings, improper feeding, rickets and summer diarrhoea are all important etiological factors. The pneumococcus is present in about half the cases, but is commonly associated with streptococci.

Symptoms—Primary. In the primary form the symptoms are those of a lobar pneumonia (see p. 364), but the physical signs have a lobular distribution. Clinically the course of the disease is more protracted, often lasting ten or fourteen days. The diurnal variation in temperature shows a slightly wider range, but the cough is less frequently painful and termination by crisis not so invariable.

Secondary. In the secondary form there is always a history of antecedent bronchitis of varying intensity, and the onset of the disease is marked by an aggravation of the existing symptoms. The change for the worse in the child's condition often occurs rapidly, but the onset is never so sudden as in pneumonia and is rarely associated with early nervous symptoms. The temperature rises to 103–104° F., but is not sustained as in pneumonia. The chart is very irregular, showing a difference of three or more degrees between morning and

evening temperature. The skin is moist and with the fall of temperature in the morning there is often free sweating. Pulse and respiration are much hurried, but the ratio is not so markedly disturbed as in pneumonia.

Laboured respiration is a prominent feature. Dilatation of the *alæ nasi* and less frequently incurving of the lower lip are to be noted during inspiration, while a short grunt is very commonly heard during expiration. Pallor of the face is a striking symptom, while cyanosis and restlessness are observed in severe cases and are to be regarded as signals of cardiac distress. Cough is never absent and is usually very troublesome. At first it is dry and hacking, but later it becomes more loose. Occasionally the cough is paroxysmal and causes vomiting, but in many of these cases whooping-cough is an associated condition.

The course of the disease is extremely variable. In some cases after two or three weeks of intermittent temperature the symptoms gradually subside and recovery ensues. In other cases death from exhaustion or heart failure occurs in from one to three or more weeks, according to the severity of the infection and the resistance of the patient. After measles or whooping-cough the course of the disease is often very protracted and may last two or even three months. Relapses are not uncommon, and more than one may occur in the same patient. In these cases the temperature falls to normal and the child appears to be convalescent. Three or four days later the temperature gradually rises again and remains high with daily remissions for a week or so and then again gradually falls.

Physical Signs. In addition to the physical signs of bronchitis we find one or more of those distinctive of pulmonary consolidation, viz. dullness, bronchial breathing, bronchophony and fine, hard consonating râles. The bases are most frequently affected, and there is commonly more than one area of consolidation. Percussion rarely reveals definite dullness, unless several patches are confluent. Auscultation reveals weak distant respiratory murmur in the early stages. As consolidation proceeds the breath sounds acquire a bronchial character and increased vocal resonance or bronchophony may be heard.

The quality of the râles is the most important feature, and in a few cases this is the only recognizable sign of consolidation. They are typically fine, sharp and crackling or consonating in character, and they appear to be very superficial, as if generated immediately under the stethoscope.

The physical signs frequently alter in the course of the disease, some patches clearing up, while fresh areas become involved. The con-

solidation is due in most cases to acute inflammation of the alveolar tissue, but it may also be due to collapse of the lobule resulting from inflammatory obstruction of the bronchiole.

Areas of dullness due to collapse may disappear rapidly after cough and inspiratory effort which effect a re-entry of air.

In primary and secondary broncho-pneu-

monia the symptoms differ but the physical signs are very similar, except that in the latter the accompanying bronchitis is as a rule more severe. (See *Diagnosis*.)

The diagnosis between the two forms of broncho-pneumonia and between each of these and lobar pneumonia is conveniently shown in the accompanying table—

Secondary Broncho-Pneumonia.

Child usually under two.

Preceded by bronchitis, measles, whooping-cough or other illness.

Onset insidious as a rule, but exacerbation of existing symptoms may be acute.

Temperature rises less suddenly, and is typically not so high 102·5–103·5° F. Course very irregular, with marked remissions of 3–4° or more.

Face usually pale. Skin hot but not dry. Sweating not infrequent.

Breathing rapid and almost invariably laborious. Dyspnoea common.

Pulse-respiration ratio 1 to 3 or 1 to 2·5.

Small discrete patches of consolidation in both lungs, usually in the lower lobes.

Dullness little marked. Fine and medium râles, which are sharp and consonating in character over consolidated areas. Distant bronchial breathing.

General bronchitis present as a rule and frequently severe.

Duration indefinite: usually two to four weeks, but may last two to three months.

Ends by lysis.

Prognosis grave. Recovery is usually associated with impairment of health.

Primary Pneumonia.

Lobar Pneumonia.

Child usually over two.

Immediately preceded by good health as a rule.

Onset typically sudden with vomiting, headache and abdominal or thoracic pain.

Temperature rises very suddenly to 104–105° F.; maintained at high level with slight remissions 1–2°.

Face usually flushed. Skin typically dry and burning. Sweating only at the time of the crisis.

Breathing rapid but not laborious. Dyspnoea uncommon.

Pulse-respiration ratio 1 to 2 or 1 to 1·5.

One large patch of consolidation found in one of the lungs as a rule. Apex involved in twenty-five per cent. of cases.

Marked dullness over a large area. Fine crepitations at the edges of consolidation. Bronchial breathing and bronchophony.

Slight bronchitis not uncommon.

Duration six to nine days.

Ends by crisis.

Prognosis good. Recovery complete.

Primary Broncho-Pneumonia.

Especially common in second year.

Small discrete patches of consolidation in both lungs, which show a tendency to coalesce.

Physical signs as in secondary broncho-pneumonia, but tend to be better marked.

Duration seven to fourteen days.

Ends by crisis or lysis.

From Bronchitis. This is an antecedent condition in most cases of secondary broncho-pneumonia and in severe cases it may be difficult to decide when the inflammatory process has reached the alveoli of the lung. The higher range of temperature, the dyspnoea and the increasing gravity of the general symptoms are more than suggestive; but it may be necessary to wait a few days, for the development of definite physical signs before making a diagnosis. Special significance is to be attached to the altered character of the râles.

From Tuberculous Broncho-Pneumonia. The physical signs in this condition are not distinguishable from those of broncho-pneumonia, and the diagnosis is often only possible at the necropsy. A protracted course, especially if associated with evidence of tuberculosis elsewhere and with progressive extension and coalescence of the original areas of consolidation, is very suggestive of a tuberculous origin. It may be possible on rare occasions to establish the diagnosis by microscopical examination of sputum collected from the back of the throat.

From Empyema. (See p. 369.)

Prognosis. Primary broncho-pneumonia is rarely fatal in children over two years of age, but in infancy the mortality may be as high as thirty per cent. In secondary broncho-pneumonia the prognosis is very grave at all ages, but particularly so in the first two years of life, when the mortality reaches sixty-five to seventy per cent.

Treatment. The child should be put to bed in a well-ventilated room in which the temperature is maintained at 62° to 65° F. Efficient ventilation with avoidance of draughts is essential, and to this end a half tent may in some cases be advisable. As few persons as possible should be allowed in the room so as not to vitiate the atmosphere unnecessarily. When the weather is fine and warm a maximal amount of open air is recommended, but, on the other hand, in the winter months, particularly when easterly winds prevail or the weather is cold and foggy, too much raw fresh air must be guarded against.

The bed clothing should be sufficiently warm, but it is most important that it should not be oppressively heavy, as this will only increase respiratory embarrassment.

The diet should consist of milk diluted with barley water or peptonized if necessary. Virol in suitable doses, or light chicken and veal broth, are valuable additions to the diet, and if the appetite is good, bread and milk, Benger's Food or light milk puddings may be allowed.

The temperature as a rule calls for no treatment, but daily sponging with hot or warm water is a valuable means of promoting comfort and is especially useful when restlessness

is a feature. Apart from this the patient should be disturbed as little as possible, as this tends to increase the dyspnoea and to exhaust the strength. In the case of infants, however, it is advisable to change the position from time to time, owing to the liability of these patients to collapse of the lungs if the same position be maintained for a prolonged period.

A free action of the bowels should be secured. In view of the tendency to diarrhoea castor oil ʒ i-ii is the most satisfactory drug and may be repeated in smaller doses, as required.

In the early stages, when there is much bronchial irritation with little secretion, thin jacket poultices of mustard and linseed (in the proportion of one to seven) give great relief. They should be left on for three or four hours and repeated until marked reddening or even slight blistering of the skin results. Hot turpentine stupes or the application of anti-phlogistine are effective alternatives. Steam inhalations or the intermittent use of the bronchitis kettle to moisten the atmosphere are useful at this stage of the disease. A mixture containing

R Vini. Ipecac. ℥ iii
Liq. Ammon. Citrat. ℥ xxiv
Syr. Tolutani. ℥ x
Aq. Anethi. ad ʒ i

should be given every three hours for a child of one year when the cough is dry and the secretion scanty. As the cough becomes loose and secretion free the following prescription should be substituted—

R Ammon. Carb. gr. $\frac{1}{4}$
Tinct. Nuc. Vom. ℥ ss
Syr. Scillæ ℥ x
Aq. Anethi. ad ʒ ii

and to this may be added tinct. strophanth., minims one to two, if there be cardiac distress. In the case of robust children with severe bronchitis and excessive secretion leading to blocking of the tubes and pronounced dyspnoea, an emetic may be useful. Mechanical means such as tickling the fauces should be tried in the first instance, but if these fail repeated one-drachm doses of ipecacuanha may be given until vomiting is induced.

In this condition, however, belladonna in sufficient doses acts almost as a specific. The drug should be exhibited in the form of ext. bellad. virid. gr. $\frac{1}{4}$, or liquor atropinæ ℥ $\frac{3}{4}$, combined in each case with half a minim of the tincture of nux vomica. The dose is independent of the age of the patient and should be administered every three hours until signs of toxæmia are produced, viz. dilatation of the pupil, flushing of the skin, or commencing

delirium. The dose should then be reduced or the following mixture substituted—

R Liq. Strychninæ Hydrochl. ℥ $\frac{1}{6}$
 Quinin. Sulphat. gr. $\frac{1}{2}$
 Acid Hydrochl. dil. ℥ $\frac{3}{4}$
 Glycerini Pepsini ℥ viii
 Aqua ad 3 i

which should be given every four hours, after food, for an infant of one year.

For older children proportionately larger doses should be exhibited. The symptomatic treatment of sleeplessness, diarrhœa, hyperpyrexia, and cardiac dilatation is dealt with under treatment of pneumonia (see p. 367); but emphasis is laid here on the value of leeching in the latter condition.

In the majority of cases of secondary bronchopneumonia brandy is advantageous throughout the disease, both as a cardiac and as a general stimulant.

For an infant of one year one to two teaspoonfuls in the twenty-four hours will usually suffice, but in exceptional cases the quantity may be increased to one or even two table-spoonfuls. In conditions of collapse a mustard bath at a temperature of 104° F. for four minutes is extremely valuable, and should be followed by wrapping in hot blankets. During convalescence a change to the seaside is advocated and cod-liver oil or a tonic mixture containing iron and quinine in suitable doses should be prescribed.

A. M.

PNEUMONIA IN CHILDREN

(*Synonym* : Lobar or croupous pneumonia.)

Definition : An acute infectious disease, commonly associated with inflammation of the alveolar tissue of the lung.

Etiology : *Predisposing Causes*. Exposure to cold and wet, particularly when easterly winds prevail. Robust children are frequently attacked, but the disease may appear as a complication or sequela of other illness.

The *exciting* cause is in the majority of cases the pneumococcus of Fraenkel. The disease is rare under two years, but after this age a primary pneumonia in children is just as likely to be lobar as lobular in distribution. An epidemic variety is occasionally met with, but it is doubtful whether the disease is ever, strictly speaking, contagious.

Symptoms. The onset is sudden and invariably accompanied by vomiting. Convulsions, on the other hand, are unexpectedly rare, even in young children. The temperature rises rapidly to 103°–105° F., and remains at a high level, with a diurnal variation of one to two degrees, until the crisis at the end of six to nine days.

The cheeks are flushed and the skin feels dry and burning to the hand. Drowsiness is a very common feature, and early delirium is not infrequent, especially when the disease is apical.

Headache and pain in the side are often complained of; the former is sometimes referred to the ear, and the latter to the abdomen, and these symptoms may, therefore, prove misleading.

The pulse-rate and breathing are both rapid, but there is no actual dyspnoea in an uncomplicated case.

A very important symptom is the alteration of the pulse-respiration ratio, which is reduced from the normal 3.5 : 1 to 2 : 1 or exceptionally 1.5 : 1.

A short, dry cough is present, and in older children there may be a little rusty sputum. Grunting at the beginning of expiration is frequently observed. As the disease progresses, true dyspnoea associated with incurving of the lower lip in inspiration may supervene, but this is uncommon. The tongue is dry and brown, and herpetic vesicles may be found on the lips. The bowels are usually constipated, but diarrhœa and symptoms of gastro-enteritis may be met with at the time of onset and again after the crisis.

Epistaxis is an occasional early symptom.

The urine is high-coloured and scanty and shows a marked diminution of chlorides.

These symptoms continue as a rule for six to nine days, when a sudden fall of temperature announces the crisis. Within twelve to twenty-four hours the temperature reaches normal, the pulse-rate and respiration-rate fall, and the tongue becomes moist. The patient sweats and there may be diarrhœa.

Termination by lysis is very rare, but a pseudo-crisis—*i. e.* a sudden fall of temperature followed by another rise before the true crisis—is much commoner in children than in adults.

Physical Signs. It is important to remember that the appearance of physical signs in the lungs may be delayed two to three days, and in exceptional cases even a week.

Any part of the lung may be involved, and the physical signs will vary according to the site and size of the affected area. In the majority of cases there is definite impairment of the percussion note over some part of the lung. Apical pneumonia is much commoner in children than in adults and accounts for twenty-five to thirty per cent. of all cases. The commonest situations for the early detection of dullness are in front just below the clavicle and behind at the base of the lungs or in the region of the scapula, whilst signs of commencing consolidation, high up in the axilla, may easily be overlooked unless sought for.

On auscultation diminished breath sounds

or distant tubular breathing are heard, and these are often the first physical signs.

Later on the breathing assumes a more definitely bronchial character and is associated with increased vocal resonance and bronchophony.

Fine crepitations, so characteristic of pneumonia in the adult, are frequently absent or confined to the edge of the consolidated area. On the other hand scattered râles, suggestive of bronchitis, are occasionally found associated with lobar pneumonia in young children, a condition not found in the adult. Pleural friction may be present. When a large portion of one lung is involved the breath sounds on the sound side are accentuated, and occasionally a small area of tubular breathing may be detected near the angle of the scapula.

Leucocytosis is always present in favourable cases.

The physical signs begin to disappear after the crisis in uncomplicated cases. Recovery is almost always perfect, but the time required for complete resolution is variable.

Diagnosis. In a typical case there is seldom much difficulty in establishing the diagnosis.

From Scarlet Fever. In the earliest stages the high fever, rapid pulse, vomiting and hot flushed skin may suggest other acute illness, such as scarlet fever; the disturbance of the pulse-respiration ratio, presence of cough and pain in the side, absence of sore throat and other symptoms should enable a diagnosis to be made before the development of physical signs in the lungs.

From Enteric Fever. Diarrhoea associated with high temperature, drowsiness and bronchitis may simulate enteric fever, but the history of sudden onset, early headache, disturbance of pulse-respiration ratio and subsequent signs of consolidation in the lungs should indicate the nature of the disease.

An examination of the blood may assist. In pneumonia a leucocytosis is usually found, whereas in enteric fever there is commonly a leucopenia. Further, in the latter disease a positive Widal reaction, when obtained, is diagnostic. Pneumonia may rarely be a complication of enteric fever.

From Broncho-Pneumonia. (See *Broncho-Pneumonia*, p. 364.)

From Acute Meningitis. Severe headache with well-marked cerebral symptoms may simulate acute meningitis, but it is unwise to diagnose this condition when definite symptoms of pneumonia are present. Pneumococcal meningitis may rarely occur as a complication.

The onset of tuberculous meningitis is always insidious in infants, but in older children the disease may begin acutely. Diagnosis may be impossible in the early stages, but the subsequent course of the disease and

the results of lumbar puncture will in most cases render differentiation possible.

From Acute Otitis Media. Pain referred to the ear may suggest acute otitis media, and this in a certain number of cases may be an associated condition of pneumococcal origin. The membrana tympana should be examined in doubtful cases.

From Pleural Effusion. The diagnosis of pneumonia from pleural effusion may present considerable difficulty, but in the latter condition the onset is more insidious, the temperature lower and the pungent heat of the skin absent. The dullness is much more absolute, but the character of the breath-sounds affords little assistance, for in children typically loud bronchial breathing is heard over a pleural effusion. (See *Pleurisy*, p. 147.)

Friction sounds are usually to be heard over some part of the affected area and, if the fluid be considerable, there will be displacement of the heart. Finally, exploratory puncture is indicated in all cases of doubt.

From Acute Appendicitis. Slight local signs in the right iliac fossa associated with disturbance of the pulse-respiration ratio and presence of cough point towards pneumonia, and the discovery of commencing consolidation at the base of the right lung will confirm the diagnosis. On the other hand, marked rigidity and tenderness, persistent vomiting, etc., are in favour of appendicitis. (See *Appendicitis*.)

Complications and Sequelæ. Empyema, suppurative meningitis, purulent pericarditis and acute otitis media, which occur as complications, are all of pneumococcal origin. Jaundice is occasionally seen.

Delayed resolution is not uncommon, but the supervention of fibrosis of the lung as a sequela is extremely rare.

Prognosis. In children over two years the prognosis is extremely good, ninety-seven per cent. making perfect recoveries.

In infants the mortality is between twenty-five and thirty per cent. Death from pneumonia *per se* is much rarer in children than in adults, and a fatal termination is far more often due to complications, particularly empyema, suppurative meningitis or pericarditis, than to the primary disease.

Treatment. The child should be put to bed in a well-ventilated room in which the temperature is maintained at 65° F.

Fluid nourishment, such as light soups and milk, plain or diluted with barley water. The yolk of an egg may be given in milk, and Virol in suitable doses is a valuable addition to the diet.

The body should be sponged once daily with warm water, and frequent sponging of face and hands may be resorted to if there is a tendency to restlessness.

An initial dose of calomel, gr. ss-i, is useful, and subsequently hyd. c. creta, gr. ii-iv, may be given as required.

The medicinal treatment is expectant and symptomatic, but the following febrifuge mixture may be administered for the first few days with a view to promoting comfort.

R Liq. Ammon. Citrat. ℥ xxv
Potassii Citrat. gr. viii
Spt. Ætheris Nitrosi ℥ v
Glycerini ℥ xii
Aq. Anethi ad 3 i.

To be given every four hours for a child of three.

Symptomatic Treatment.—Pains in the Chest. Hot local applications in the form of mustard and linseed poultices or antiphlogistine suffice as a rule; but, when the pain is very severe, as in diaphragmatic pleurisy, the application of three leeches over the painful area, combined, if necessary, with strapping the side, is more likely to secure relief. In these cases tinct. camph. co., ℥ v to x, according to age, may be added to the above mixture, or a single dose of Dover's powder, gr. i-ii, may be given to a child over five.

Cough. The severity of this symptom depends on the amount of lung tissue involved, and also on the extent of the concomitant catarrh. In this condition poultices are also of use and changing the position in which the patient is lying may give relief. Here belladonna, in doses of five to ten minims of the tincture or a half to one minim of the liquor atropinæ (combined in each case with ℥ iv of tinct. camph. co.), is of the greatest value. The mixture may be given every four hours until slight toxic symptoms are noted and then less frequently.

Hyperpyrexia. Pyrexia requires no treatment other than the routine sponging described above; but if the temperature rises above 104.5°, and particularly if it is associated with restlessness and delirium, interference is called for. In infants the employment of a hot bath gradually cooled down to 85° or 80° F. will reduce the temperature. In older children frequent sponging with warm or tepid water will usually suffice; but if necessary a bath cooled down to 70° may be given; in this case, however, it is wise to order a stimulant (3 i-ii brandy) both before and after the bath. In some cases it may be advisable to cut the hair short, and this measure often relieves restlessness.

Cold applications to the head and an ice bag to the chest have many advocates, but the latter is not suitable for children under four years. Stimulants, particularly brandy, are always helpful in this condition and should never be omitted.

Hyperpyrexia and delirium are particularly seen in cases complicated by otitis media, and it is always well in such cases to examine the membrana tympana; and if bulging be present, to make a free incision.

Sleeplessness. Delirious sleep is neither uncommon nor injurious, but sleeplessness accompanied by active delirium is soon followed by marked prostration. In addition to tepid sponging and cold application to the head the free use of bromide of ammonium in five to ten grain doses combined with two to four drachms of brandy is probably the most effective and least harmful treatment. It may be repeated every three hours until sleep is induced.

Cardiac Weakness. Signs of cardiac dilatation must always be carefully watched for, and treatment to combat this condition instituted at the onset.

Clinically we find the apex beat pushed out to the left in dilatation of the left ventricle; the first sound in this situation becomes progressively weaker and is accompanied by increasing pallor.

Cyanosis, dyspnoea and gradual enlargement of the liver are the most important symptoms when the right side of the heart is affected. Dullness to the right of the sternum is variable in children and not of great diagnostic value. Three or four leeches over the hepatic region, followed by hot fomentations to encourage bleeding, will give great relief, and brandy should be given in suitable doses every two hours.

Strychnine in doses ℥ ss-i hypodermically every four hours is indicated, and it is well to remember that reaction to this drug is less easily induced in the toxæmia of pneumonia than under normal conditions. It may therefore be pushed until slight twitching is produced.

The subcutaneous injection of ether, oleum camphoratum ℥ v, or caffein citrate gr. ii (in a solution of sodium salicylate), is useful in cases of syncope or collapse. Oxygen is not very often of benefit, but it should be tried, particularly when cyanosis is a prominent symptom; and its stimulating effect may be increased by passing the gas through absolute alcohol.

Gastro-Enteritis. This may develop acutely in the course of a lobar pneumonia. Diet is very important in these cases. Milk is liable to cause meteorism, and therefore albumin water, whey, weak chicken broth or Virol in barley water should be given in small doses at frequent intervals. The following powder is usually effective:

R Hydarg. c. Creta gr. ½
Pulv. Ipecac. Co. gr. ¼-½
Pulv. Rhei. gr. i ss
Pulv. Cretæ Co. gr. v

and should be given three times a day for a child of one to three years old.

During convalescence a change to the seaside is recommended and a tonic mixture containing iron and quinine in suitable doses should be prescribed. A. M.

EMPYEMA IN CHILDREN

Definition: A collection of pus in the pleural cavity.

Etiology. In children under five pneumonia is an antecedent condition in ninety per cent. of cases. It occurs in children of all ages as a complication or sequela of the exanthemata.

Suppurative appendicitis, and in older children the tubercle bacillus, are on rare occasions responsible for the condition.

The pneumococcus is the organism most often found, often associated with streptococci and staphylococci.

The bacillus coli is found in empyemata which are secondary to appendicitis, and the pus in these cases is often extremely offensive.

Empyema is usually unilateral, and may be situated in any part of the pleural cavity. It is most commonly found at the base of the lung behind, but on rare occasions is found between the lobes—constituting the so-called interlobar variety.

Symptoms. These vary enormously in different cases. Empyema may be a late complication of pneumonia or an immediate sequela. The possibility of an empyema should always be borne in mind, in a case of pneumonia in a child, if the temperature persist and the symptoms and physical signs do not clear up in the usual way. Occasionally, however, the temperature remains normal for several days after the crisis, and then rises again either suddenly or gradually, and this recrudescence is associated with an increase of the physical signs in the chest.

Dr. Still has pointed out that, if signs of fluid at one base develop after a lobar-pneumonia, the diagnosis of an empyema follows almost as a corollary, although it may be necessary to wait a few days for the fluid to become purulent.

The commonest history is that of an acute illness, such as pneumonia or measles, some weeks or even months previously, from which recovery has been unsatisfactory.

After subsidence of the acute attack the child grows weaker, and is troubled with cough and slight dyspnoea. The complexion becomes pale and pasty-looking, and the ends of the fingers become not infrequently clubbed.

Sweating is often a marked feature, and restlessness at night is frequently noted. Fever is present in the majority of cases, but is always irregular in type. It may rise to 102–103° F., and fall again to normal.

A definitely intermittent or remittent temperature is suggestive of suppuration, but, on the other hand, this symptom is sometimes completely absent, and the temperature may remain normal.

Finally, an empyema may be entirely latent, and only discovered accidentally in the course of a routine examination or on the post-mortem table.

Physical signs and diagnosis. For the physical signs and diagnosis of fluid in the chest see section on pleurisy (p. 147). Here it will suffice to mention the modification of these signs which may be present when the fluid is purulent in character.

Bulging and oedema of the chest wall are more often met with in empyema than in serous effusion. In extremely rare instances the pulsation of the heart may be transmitted to an empyema which is pointing through the thoracic wall—the so-called *pulsating empyema*.

Well-marked and occasionally loud bronchial breathing is frequent over empyemata, but may also be heard over serous effusions in children.

Vocal resonance is transmitted less well in empyema than in serous effusion, and whispered pectoriloquy is said to be inaudible in the former. These signs are of very doubtful value in the majority of instances, and in arriving at an opinion in any given case as to the nature of the effusion, the history of the illness will furnish the safest guide. The diagnosis, however, is often only made possible by the insertion of an exploring needle in the area of greatest dullness and the examination of the fluid withdrawn in the syringe.

Persistent and confluent broncho-pneumonia, especially when of tuberculous origin, may simulate empyema very closely; and here, again, repeated puncture with the aspirating needle may be necessary to establish the diagnosis.

Interlobar empyema is suggested by persistence of the symptoms, associated with variation in the physical signs over the affected area, which is most commonly the mid-axillary.

Natural cure does occur in very rare instances by (1) absorption of fluid when the effusion is small, (2) perforation of the lung and expectoration of the purulent material, and (3) perforation of the thoracic wall—the so-called *empyema necessitatis*.

Prognosis. This depends on two factors: the nature of the infecting organism and the promptitude with which the diagnosis is made and treatment instituted.

When the infection is a pure pneumococcal one the prognosis is good, but when streptococcal or mixed it is always serious. In the tuberculous form the outlook is very grave.

Delay in operation affects the prognosis unfavourably.

Treatment: Aspiration is not recommended. As soon as the diagnosis is established surgical treatment must be resorted to without delay.

In exceptional cases, where a very large effusion is present, aspiration may be permissible, but only as a preliminary measure, with a view to reducing the shock of the operation.

A. M.

RHEUMATISM IN CHILDREN

There are notable differences in the manifestations of the rheumatic infection as it occurs in children and in adults. In children arthritis is a symptom of subsidiary importance, being to a large extent replaced by muscular pains; sweating is little seen; the fever is not so high as in adults, while hyperpyrexia is extremely rare. On the other hand, cardiac rheumatism, nodules and chorea are very much more common in the young than in older subjects, and rashes are probably more frequent in children than in adults.

The rheumatic infection in children shows the same tendency towards generalization as do all other bacterial infections at this age. Cardiac rheumatism, never to be regarded as a "complication" but always as a symptom of rheumatism, is in children of such prime importance as to be almost the essence of the disease. Rheumatism of the adult type, that is with much arthritis but little cardiac damage, is rarely seen in children, but occasionally occurs in those ten years old or over.

Further, by studying rheumatism in children, especially in its slighter forms, we are able to see that it is an infection whose onset is insidious and whose disappearance is very gradual, although it is true that its more severe symptoms develop rapidly and may pass off quickly under treatment. It is therefore a disease which tends to run a chronic course, interrupted by acute exacerbations. For this reason it is very necessary that the earliest and slightest signs of the infection, which may give valuable warning to the physician, should be carefully considered.

Etiology. The age-incidence of rheumatism in children requires mention. The infection is extremely rare in infants under the age of two years and is comparatively infrequent in children under five years. After this age the disease becomes common, and first attacks are most frequently seen between the ages of seven and ten years. Scarletina frequently, and other acute infectious fevers rarely, precede rheumatism. Season, inheritance, damp and cold predispose, as in adults.

Symptomatology. It is only necessary here

to touch upon such points as are of special significance in the rheumatism of children, the earliest symptoms being particularly emphasized.

Tonsillitis.—The relationship between the tonsillar and the other manifestations of rheumatism is more clearly traceable in children than in adults. Usually a period of a fortnight or less separates the sore throat from the onset of pains. In rheumatic children the tonsils are often persistently enlarged and in their depths are found small collections of purulent material, latent foci of reinfection.

Muscular Pains.—These constitute the most valuable early sign of the infection. They may occur in any part of the body, but have the following characteristics in common. They occur particularly in the neighbourhood of joints; they are made worse by exercise and benefited by rest; they are usually accompanied by a slight rise of temperature. They may be dull aching pains, causing the child to lie and sob for some hours, or sharp and shooting in character, provoking a sudden momentary cry. Round the hip-joint and in the neck the pains are often particularly persistent. In the legs these pains are sometimes erroneously called "growing-pains." They occur chiefly about the knees and are often referred to a spot in the middle of the popliteal space. They may be so sudden and severe as to cause the child to stumble or even fall. In the arms the pains may occur round any of the joints and are not uncommon in the fingers. They are usually quickly recognized as rheumatic here. In the neck they are very common, rheumatic torticollis being the commonest type of stiff-neck in children, excluding cases due to local adenitis. In the back rheumatism may give rise to a suspicion of spinal caries. Rheumatic pains very commonly occur in the sides or epigastrium, and may be mistaken for "stitch" or dyspepsia. These are sometimes of sufficient severity to be the cause of the child's visit to the doctor.

Arthritis (Synovitis and Peri-arthritis).—Arthritis in children is less common, less obvious and less painful than in adults. The large joints are most commonly affected, but the proximal interphalangeal joints of the fingers are more frequently attacked than in older subjects.

Nodules.—These are common in children. They are usually soft, consisting of fibrinous exudate, but if persistent they become hard and fibrosed. Rarely they are hæmorrhagic. In children they are pathognomonic of rheumatism. They are invariably associated with endocarditis and often with pericarditis. As they consist of material similar to that of the valvular vegetations their behaviour gives a clue to what is happening in the endocardium.

Anæmia.—Rheumatic anæmia is well-marked in children. If persistent it should suggest that a sub-acute infection is still present.

Nervous Symptoms.—Rheumatic headache is very common. In many cases of rheumatism actual chorea develops, but in practically no case does the nervous system entirely escape. Almost always there is a condition of general nervous instability (latent chorea, *q.v.*), with depression, irritability or excitement. Engrafted on this may be such "functional" disorders as habit-spasm, night-terrors, somnambulism, acquired enuresis, lenteric diarrhoea, etc. Rheumatic children are often first brought to the doctor for some such complaint.

Fever.—The temperature is usually nearer 102° than 104° F. Pericarditis, tonsillitis and, in older children, arthritis may raise the temperature to the higher point. At first sustained, the temperature breaks, becomes remittent and, later, intermittent. It is important to recognize that a regular nocturnal rise of temperature during "convalescence" usually indicates that the infection is not ended and that there is a danger of recrudescences. Hyperpyrexia is extremely rare in children.

Cardiac Rheumatism (vide *Heart Disease in Children*).—The frequency of this has already been emphasized. Some degree of dilatation is present in all cases of acute or subacute rheumatism in children. Many cases are first brought to the doctor for symptoms of this, such as lassitude, exhaustion or shortness of breath.

Cutaneous Manifestations.—Profuse sweating is rare. The palms and soles are usually moist, occasionally the face sweats. Rheumatic erythema is usually of the type erythema marginatum. Erythema nodosum is almost certainly, and "peliosis rheumatica" is probably, not of rheumatic origin.

Renal Symptoms.—Transient albuminuria is common; hæmaturia is rare.

Rare Manifestations.—Pleurisy, always associated with pericarditis, may originate friction or effusion. Pneumonia, doubtfully rheumatic, may occur in the same connection. Acute bursitis is rare. Iritis does not occur in the rheumatism of childhood.

Diagnosis. The chief danger here is of overlooking rheumatism. Tonsillitis can hardly be recognized as rheumatic in the absence of a history of previous attacks. Rheumatic pains are easily recognizable if they are fully investigated, but are frequently disregarded by parents. Other common conditions for which a rheumatic child is brought to the doctor are anæmia, headache, "indigestion" (epigastric rheumatic pain), lassitude and shortness of breath (slight cardiac dilatation), nervous symptoms, as fidgetiness, fretfulness, night-terrors, habit-spasm, enuresis, etc. (latent

chorea). Such conditions can only be recognized as rheumatic by careful inquiry for characteristic symptoms or signs, coupled with a search for nodules and examination of the heart.

Syphilitic epiphysitis and infantile scurvy should never be mistaken for rheumatic arthritis, as they occur during the first year of life, when rheumatism is unknown. Acute poliomyelitis with hyperæsthesia may be mistaken at first for rheumatism. Suppurative arthritis and acute osteo-myelitis may be distinguished by the intense toxæmia, high leucocytosis and absence of other rheumatic signs.

Course. Acute tonsillitis, pains, arthritis, albuminuria, headache and bursitis are quickly amenable to treatment. Nodules usually disappear gradually, but may persist for months—a bad sign. Cardiac rheumatism and anæmia are the most chronic symptoms, and with these and a persistent intermittent fever chronicity is assured and recrudescences likely. The immediate and ultimate prognosis depends upon the degree of affection of the heart.

Treatment. Rheumatism with fever requires rest and salicylate.

Keep the child warm in bed between soft blankets. Apply wool to the affected joints. Have the throat sprayed regularly with antiseptic lotion. Allow only a slightly varied milk diet.

Give sufficient sodium salicylate to lower the temperature and to keep it as near normal as possible; a daily dose of sixty to one hundred and fifty grains is usually required. Give the drug frequently (six, eight or ten times in the twenty-four hours), since it is rapidly excreted. Combine it with an equal or double quantity of sodium bicarbonate and flavour with glycerine, syrup of ginger or orange.

Salicylate does not in children cause headache or tinnitus; mental and cardiac depression are only produced if it be allowed to cause nausea and vomiting. Acid intoxication (vomiting, acetone in the breath and urine, delirium and coma) is the real danger of salicylic acid poisoning. This must be avoided by (1) keeping the bowels open, (2) giving enough soda with the salicylate to keep the urine alkaline, (3) avoiding or treating vomiting. Should vomiting occur, stop the salicylate for twelve or twenty-four hours, and then recommence with half-doses. These can usually be rapidly increased, if necessary, without the recurrence of the sickness.

Persistent pain, rare in children, may yield best to aspirin. This, however, cannot be combined with alkalies, and hence is unsuitable for full doses. Quinine and potassium iodide are much inferior to salicylate in the treatment of rheumatism.

Watch convalescence carefully, being guided by the state of the heart and temperature-chart. Reduce the salicylate gradually. Give a full diet with extra milk, eggs, cream or flavoured Sanatogen. Iron, cod-liver oil or arsenic may be required.

R. M.

HEART DISEASE IN CHILDREN

Organic Heart Disease.—Of the infections which produce heart disease in children the rheumatic is vastly the most important, and in the following article must claim most attention. Other infections, although less common, are often extremely serious. Of these diphtheria and influenza both produce a severe myocarditis which may give rise to critical symptoms or sudden death.

Acute myocarditis is most commonly due to the rheumatic infection. The diphtheritic, influenzal, and occasionally other infections, such as typhoid, may produce it. The pneumococcus is peculiar in that it tends to spare the myocardium.

Acute non-purulent pericarditis is usually due to rheumatism. A few cases, distinguishable by the very large pericardial effusion present, are due to tuberculous pericarditis.

Acute purulent pericarditis is generally due to the pneumococcus and associated with pneumonia or empyema. Occasionally it is due to streptococcal or staphylococcal infection, in the latter case usually secondary to acute osteo-myelitis.

Acute endocarditis is in the vast majority of cases due to rheumatic infection. Malignant non-rheumatic endocarditis requires special mention. Tuberculous endocarditis is very rare.

Rheumatic Heart Disease.—Rheumatism accounts for the great majority of all cases of heart disease, both transient and persistent, in children. In the absence, therefore, of signs pointing definitely to some other cause, rheumatism should always be suspected. In children the development of cardiac symptoms, even in the presence of heart disease of old standing, almost invariably signifies fresh cardiac rheumatism; in them the heart does not break down merely from mechanical causes. This fact colours the clinical picture and treatment of heart disease in young subjects.

Acute Rheumatic Myocarditis.—This is present in all cases of definite acute rheumatism. In the mildest it is probably the only cardiac lesion present; in the more severe, it is associated with endocarditis, while in the worst the valves and pericardium are affected (pancarditis). In all cases, however, the condition of the myocardium is of most immediate importance.

In the mildest cases the heart is just outside

the nipple line on the left side, the pulse-rate is quickened, especially on exertion, the first apical sound frequently reduplicated; there is, however, no murmur at the apex. The child is pale, languid, easily exhausted, and seems out of sorts. It may be brought to the doctor for mild rheumatic symptoms, such as tonsillitis, pains in the limbs, trunk or neck; or for various slight nervous ailments as have been described under "latent chorea" (v. *Chorea*).

In more severe cases the heart is dilated an inch or more to the left and right, and an apical systolic bruit may be present, although it is not invariably audible. The symptoms are more marked and the evidence of rheumatism is usually distinctive.

In the worst cases the heart is dilated two or three inches to left and right, and pericarditis is often present. There are intense pallor, dyspnoea, orthopnoea and signs and symptoms of heart failure. This is the condition said to be typical of pericarditis, but is due to the associated severe myocarditis.

Diagnosis. The chief danger is that of overlooking slight attacks. These are only to be recognized by accurate percussion, and a familiarity with the earliest symptoms of rheumatism in children.

Prognosis. The immediate prognosis in children follows the same lines as in adults. Many slight cases last for months, and probably for years. A persistent apical systolic bruit does not necessarily foretell a permanent lesion. The murmur frequently disappears in time, as the myocardium recovers. Care should, therefore, be taken not to give too serious a prognosis in a slight recent case of mitral regurgitation in a child.

Treatment. The only special point to be insisted upon here is that as cardiac symptoms in children are practically invariably due to active cardiac rheumatism, the main medicinal treatment will consist in the administration of salicylates. These have a good action if given in sufficient amount when the heart is not extremely affected; where, however, there is great dilatation with heart failure and vomiting, their efficacy is much impaired (v. *Treatment of Rheumatic Pericarditis*). Owing to the active infection of the heart, digitalis has much less influence in children than in adults and rarely produces benefit.

Valvular Disease.—This is of great interest in children, since it is in them that we are able to study the development of the lesions seen in adults.

Mitral regurgitation is the most common lesion. It has already been mentioned that there are many cases in which, although appearing to be due to valvular disease, the incompetence disappears as the myocardium recovers.

Excluding extreme cases, there is a large group in which we cannot be sure if recovery will ensue or not.

Mitral stenosis is rare in children under twelve years of age, because its development is a matter of time; the valve must become fibrosed and the mitral ring must recover from excessive dilatation before actual stenosis is present. In children the developmental stages are seen. The stages of thickening of the mitral valve such as will in time develop into stenosis are shown (1) by the development of the pseudo-reduplication of the second apical sound, and (2) later by the development of the mid-diastolic apical bruit. Both these abnormal sounds are heard over a small area internal to the apex-beat. Where a mid-diastolic bruit is heard distinctly over a period of some weeks the later development of mitral stenosis is almost certain.

Aortic lesions are rare. Roughening of the valves may give rise to an aortic systolic murmur, but true stenosis is very exceptional. Aortic regurgitation is seen in older children. The diastolic bruit is often best heard over the valve in the third left interspace next the sternum. Sometimes it is very audible at the outer part of the apex-beat. The "aortic facies" is rarely recognizable in children.

Tricuspid valvulitis is not uncommon in fatal cases, but it is exceptional for it to be distinctly recognizable during life.

Prognosis. Accurate prognosis in childhood is largely vitiated by the great liability to fresh attacks of cardiac rheumatism. In children the diseased heart is also handicapped by the ease with which its nutrition is impaired through any failure in the general nutrition, and by having to provide for the growth of the body. On the other hand, the coronary arteries being always free from disease, and the child not having to earn his living, are favourable factors assisting in the establishment of good compensation. The possibility of mistaking myocardial for valvular disease has been emphasized. The presence of external pericardial adhesions adds greatly to the work of the heart, and prevents its proper growth. Such a condition leads to stunting of the body, while death often takes place during puberty or adolescence.

In any particular case, attention should be paid to the extent of the lesion, the degree of compensatory change, the general nutrition of the child, and the life for which he is destined.

Treatment. Failure of compensation denotes active cardiac rheumatism, and should be treated as such (*v. Myocarditis, supra*).

With good compensation the aims of treatment are to ward off further attacks of rheumatism, to prevent overstrain, and to attend to the general nutrition, and thus to that of the

heart. The milder outdoor games are permissible in most cases; where these must be prohibited the patient is better taught at home or at a private rather than at a public school.

Rheumatic Pericarditis (*v. infra*).

Malignant Endocarditis.—This is rare in childhood. It is usually closely associated with rheumatic endocarditis, owing to the ease with which the damaged tonsils of the rheumatic subject allow of a secondary infection, and to the vascularity of the injured valves, which renders them liable to infection by any circulating organism.

The malignant type of endocarditis is with difficulty separable from the rheumatic in children, if indeed it is always of non-rheumatic origin. Usually the most suggestive signs are lack of response to treatment, increasing pallor and weakness and enlargement of the spleen. Rashes may develop. Usually the case terminates with cerebral embolism followed by hæmorrhage.

An erroneous diagnosis of malignant endocarditis is often made from a failure to realize how severe and prolonged may be an attack of rheumatic carditis. Marked enlargement of the spleen is always most suggestive of a non-rheumatic endocarditis.

Disorders of Rhythm.—Irregularity of the heart's action is common in nervous, anæmic or ailing children. It is found in rheumatic, diphtheritic and influenzal myocarditis. A marked, persistent, but apparently harmless type follows measles. It is an early sign, of little importance, in tuberculous meningitis. The causes of cardiac irregularity in adults may be responsible for it in children.

Tachycardia is usually found in the conditions mentioned.

Bradycardia occurs in diphtheritic heart disease, and occasionally in influenzal and rheumatic cases. It occurs in the second stage of tuberculous meningitis and other conditions where raised intracranial pressure exists.

R. M.

RHEUMATIC PERICARDITIS IN CHILDREN

Acute Rheumatic Pericarditis always denotes severe rheumatism. Thus the heart also shows endocarditis and severe myocarditis (pancarditis), and the other manifestations of the infection are of the same grade, severe chorea, numerous nodules and high fever, very rarely hyperpyrexia. Pericarditis is not seldom the terminal event in a chronic rheumatic infection.

Acute pericarditis is found most frequently in children at the ages at which rheumatic attacks are commonest, namely, from eight to twelve years.

Symptomatology. Rheumatic pericarditis

usually passes through a stage of plastic inflammation to a stage of effusion, but in both stages practically all the symptoms are due, not to the pericarditis, but to the associated inflammation of the cardiac muscle. It is because in pericarditis the myocarditis is certain to be severe that the condition is so dangerous.

The chief symptoms, then, are those of dilatation of the heart. Occasionally these are so slight that the practitioner is surprised to find pericardial friction in the routine examination of a rheumatic child. More often the symptoms are obvious: pallor, slight cyanosis, dyspnoea and rapid pulse. Usually at some period of the attack these symptoms are increased, the child becomes severely ill with orthopnoea, cough, pulmonary oedema and enlargement and tenderness of the liver. In the worst cases the condition is one of utmost danger, persistent vomiting, intense dyspnoea, precordial distress, delirium and occasionally general oedema developing.

There is a possibility of sudden death following slight exertion in either the stage of friction or effusion. It depends upon the myocardial changes.

Pleurisy is frequent; it is more common on the left side than the right. The lower lobe of the left lung is usually compressed or collapsed by the enlarged heart; occasionally pneumonia develops here.

The symptoms proper to pericarditis, as opposed to myocarditis, are of subsidiary importance. They consist of oedema of the eyelids, often a suggestive early sign, and precordial pain due to the friction. The latter is uncommon. It may cause the patient to lie on his right side or even on his face.

Physical Signs. In the early stages pericardial friction is present in nearly all cases, the only exceptions being where there have been repeated previous attacks of pericarditis. The friction is usually loud and rough, but is occasionally soft and indistinct. In rhythm it may be single, double, or occasionally triple from the addition of a presystolic friction. It may be localised, often best heard over the base of the heart, but commonly it is universally present over the precordial area.

Pleuro-pericardial friction (external pericarditis), forming a ring round the cardiac area, should be carefully examined for.

During the stage of effusion the friction disappears. There are no signs by which the small effusion can with certainty be diagnosed from the severe cardiac dilatation which is always present. Suggestive points are: disappearance of the friction without diminution in the fever, symptoms or extent of the deep cardiac dullness; marked increase of the cardiac dullness in an upward direction; distant

character of the heart's sounds; and a lack of correlation between the feeble cardiac sounds and the strength of the radial pulse.

With the disappearance of the effusion friction may again become audible.

Diagnosis. In the stage of friction rheumatic pericarditis is usually easily recognized. A loud rasping pericardial friction is practically always rheumatic, purulent pericarditis being very rarely associated with any rub, and tuberculous cases rarely giving more than a soft friction. In cases of doubt the other signs of rheumatism will decide. A soft rheumatic friction has to be distinguished from an endocardial bruit. This can usually be done by careful study of the localisation, time and conduction of the sound.

The stage of effusion is difficult to diagnose, unless friction is known to have previously existed, owing to the associated cardiac dilatation. The suggestive signs have been enumerated. The diagnosis of effusion is here of comparatively slight importance, as the dilatation is the cause of the symptoms.

Prognosis. The immediate prognosis depends upon the state of the myocardium: bad signs are great dilatation, vomiting and delirium. Old-standing valvular disease makes the outlook worse, but it is by no means rare for a first attack of carditis to prove fatal in a child. Even the most desperate cases will sometimes be saved. Recovery is rarely complete. Sudden death may occur.

The ultimate prognosis depends upon the formation of serious external adhesions, the extent of the valvular damage, and the degree of recovery of the myocardium. External pericarditis increases the liability to serious adhesions.

Treatment. Absolute rest in bed must be insisted upon in all cases. The diet must be light but nourishing and given in as large quantities as digestion permits. Milk and eggs are of most value; the former may usefully be citrated by the addition of two grains of sodium citrate to each ounce.

For local treatment the ice-bag is most effective. A small bag should be filled with thoroughly broken-up ice, placed next the skin, covered over with wool, and kept in position by a binder with shoulder-straps. It will require refilling two-hourly. If properly applied it produces cutaneous hyperæmia. Hot-water bottles must be applied to the patient's feet. His temperature should be taken two-hourly and the ice-bag temporarily removed should it fall to 100° F.

Leeches also relieve precordial pain; poultices are of less value.

Salicylate of soda should be given, with sodium bicarbonate. It acts best when given early in the attack; with great cardiac dilatation

it is less successful, and with much cardiac vomiting it should be given very carefully, if at all. The method of administering it has been detailed elsewhere (v. *Rheumatism in Children: Treatment*). The aim should be to give sufficient salicylate to reduce the temperature to normal.

Rest must be assured and pain relieved. Opium is the best drug here and often acts most beneficially. With pulmonary oedema its administration is risky. Morphine given hypodermically may be necessary for severe delirium. Alkalies often relieve precordial distress.

The heart will require symptomatic treatment. Dyspnoea, cyanosis and other symptoms of right-heart failure call for the application of three or four leeches. Strychnine, atropine and digitalin may be given hypodermically. Brandy is useful as a stimulant and soporific.

Paracentesis for the removal of the pericardial effusion is never necessary in rheumatic cases.

Convalescence must be prolonged and carefully watched. R. M.

CHOREA.

Chorea is a disease in which there are disordered movements, associated usually with some degree of muscular weakness and very constantly with slight or profound mental disturbances.

A distinction must be drawn between the symptom of choreiform movement which occurs in many conditions (v. *Diagnosis*) and the disease chorea, sometimes known as acute or Sydenham's chorea.

Etiology. The rheumatic infection is now regarded as the essential factor in the production of chorea, for the following reasons:—(1) Rheumatic symptoms may be traced in ninety-four per cent. of cases before, during, or shortly after an attack of chorea (Coombs); (2) Choreic symptoms may be traced in nearly every case of rheumatism in children; (3) Did "functional" (non-rheumatic) cases occur, they should be common, whereas failure to trace rheumatism in a choreic patient is exceptional.

Given the rheumatic infection, an unstable nervous system, inherited or acquired, predisposes to chorea. Thus fright, overwork, over-worry and pregnancy predispose to or aggravate chorea. The sex-incidence establishes the same point: the disease is thrice as common in females as in males, and in adult males is extremely rare. Chorea is much commoner in children than in adults, being most frequent in the later years of childhood.

Pathogenesis. To treat chorea rationally two points in its pathogenesis must be grasped. Firstly, that the symptoms originate from the toxic changes in the cells of the cerebral cortex,

changes due either to the circulation of the rheumatic poison or to an actual rheumatic infection of the cerebrum. Secondly, that the symptoms persist long after the active bacterial processes are ended, being now dependent upon the damaged state of the nerve-cells which have not yet recovered. No case is truly "functional."

Symptomatology. Chorea shows much more than disordered muscular movements. Its symptoms may be described as mental, motor and atonic.

Mental Symptoms. These are always present. Early they consist of general signs of nervous instability; fearfulness, excitability, irritability. During the disease these increase in severity, the child is much depressed, very excitable and passionate. Insomnia may be troublesome. During convalescence mental exaltation is the rule; the child is happy, but still excitable and mentally restless.

In some cases the mental symptoms are the most prominent of all. Acute delirious mania (chorea insanien) is very rare in children, but occasionally occurs in adults. In others melancholic symptoms develop; even suicide may be threatened. The most common severe mental symptom in choreic children is stupor, deepening to coma; with it are usually aphasia and choreic paralysis, with wasting and incontinence.

Delayed cerebration is very common; the memory is affected in many cases.

Crying is frequent during chorea, usually in passionate outbursts. In bad cases a howling sound is made which is very characteristic.

Motor Symptoms. At their earliest these consist of slight fidgetiness and clumsiness in fine voluntary movements (e.g. sewing). The fully developed movements are very familiar. They are those of "exaggerated fidgetiness"; they are quite irregular, so that the next movement cannot be foretold; they are made worse by observation, emotion or excitement. At first they can to some extent be voluntarily restrained, later this power is lost.

In the face changing expressions of pleasure, fear, surprise, etc., are seen. The smile of welcome is very characteristic. Clicking sounds are made by the tongue and lips. The pupils may show eccentricity, inequality, hippus and abnormality of shape. Nystagmus is very rare.

The movements of the limbs need no special description. It should be noted that combined with the restlessness is a good deal of ataxia. This is well seen in the gait. When the hands are held out spasmodic extension at the wrists is seen.

In the trunk squirming movements occur. Choreic or dissociated breathing consists of irregularly alternating thoracic, abdominal and combined respirations.

The speech is hesitating, indistinct and spluttering. Aphasia is the severest speech defect. It is usually associated with choreic paralysis and may remain absolute for many (nine) months. It invariably clears up in time.

Sensory changes are very rare. The extreme irregularity of the heart, sometimes known as "chorea cordis," is probably not dependent upon chorea of the heart-muscle.

The deep reflexes are usually difficult to elicit, but brisk when obtained. The response may be unduly sustained (choreic response) or double. In a few cases, usually of the paralytic type, the deep reflexes disappear. The superficial reflexes are usually unaltered, but in comatose cases the abdominal reflexes may disappear. Definite Babinski signs are very rare.

Incontinence may occur at any time during chorea, the sphincters being "forced." In the comatose cases with aphasia and paralysis, persistent double incontinence occurs.

Atonic Symptoms. Usually as the movements decrease in severity some degree of muscular enfeeblement is noticeable. Occasionally this proceeds to actual flaccid paralysis (chorea paralytica), associated with rapid wasting and often with aphasia.

Rheumatic Symptoms. Any symptoms of rheumatism may coexist with chorea. Severe arthritis is rare; anæmia is common; the condition of the heart is the most important. The temperature chart gives good evidence of the activity or quiescence of the rheumatic infection (v. *Rheumatism in Children*).

Residual Chorea.—This term is given to cases in which symptoms remain after the acute stage has passed. In it are usually seen some movement, anæmia and muscular flabbiness.

Latent Chorea.—This term may be used for a condition of nervous instability due to rheumatism, but not of sufficient severity to be obvious as chorea. It is thus seen in the development and disappearance of chorea and in nearly all children showing any of the manifestations of rheumatism. The clinical picture is one of a highly neurotic child; irritable, fidgety, inattentive, fearful and passionate. To these symptoms may be added such disorders as habit-spasm, night-terrors, somnambulism, acquired enuresis, lenteric diarrhœa and others.

Diagnosis. Choreiform movements are seen in other conditions than chorea; hysteria, lesions of the optic thalamus (including lifelong cases of cerebral diplegia), very rarely in tuberculous meningitis and iodoform poisoning. Such conditions are usually easily differentiated if their possibility be remembered. Acute

delirium in children is most commonly due to pneumonia. Chorea paralytica can be recognized by a history of past movements or by the persistence of facial movements.

More difficulty is experienced in recognizing the very earliest signs of chorea, which simulate the nervous symptoms of any neurotic subject. It must be remembered, therefore, that rheumatism is a cause of various nervous phenomena (v. *Latent Chorea*). In cases of doubt reliance may be placed on the presence or absence of definite rheumatic symptoms.

Prognosis. Rheumatic heart disease causes death in about one per cent. of cases. Very severe movements and insomnia predispose to a fatal issue by producing exhaustion.

Apart from heart disease all cases of chorea recover, and none of the symptoms are permanent. Even severe paralysis and aphasia pass off. The duration of the symptoms is very variable, from three weeks to many months. Relapses and recrudescence are common. Symptoms pointing to a prolonged attack are insomnia, anorexia, anæmia, muscular weakness and aphasia.

Treatment. There is and can be no routine or specific treatment. The facts given under "pathogenesis" must be applied to get the best results.

Acute Cases.—The patient must be kept in bed and protected from hurting himself. Isolation is usually beneficial at this stage. Nursing by a trained nurse is better than by a relation. The diet should be as plentiful as the digestion permits: milk, milk-foods, eggs, cream, chicken, white fish may be given.

Anti-rheumatic drugs influence the cause of the disease. Sodium salicylate and bicarbonate (v. *Rheumatism in Children: Treatment*) are therefore indicated where active symptoms of rheumatism are recent or present, or where the temperature is raised. Sufficient should be given to keep the temperature normal. This treatment may be combined with sedative measures if necessary.

Sedative measures are needed for insomnia, extreme restlessness or excitement. Of these the hot-pack is the best. Blankets are wrung out in very hot water, the child enveloped in them and covered over with mackintosh and warm blankets. This rarely fails to produce sleep. The child is left in the pack until it awakes, when it is dried with hot towels. For drugs the best are trional, chloral and bromide, the dose of each being from five to ten grains for a child of ten years. Brandy at night may promote sleep. Sedatives are contra-indicated in paralytic cases.

Large doses of arsenic, as formerly employed, should not be given.

Chronic, Atonic and Convalescent Cases.—

Different treatment is here required. Tonics, iron, arsenic, occasionally even strychnine, are useful. A very full diet should be given, with added milk, cream, cod-liver oil or Sanatogen. In atonic cases nothing is better than massage combined with re-education of the limbs by exercises, games or crochet.

The last traces of chorea are hard to banish, care must, therefore, be taken that convalescence is prolonged and thorough. The child should not as a rule return to school for at least six months, except in the case of the very poor with bad homes. Lessons should be given regularly at home by a kind but firm disciplinarian.

R. M.

CONGENITAL HEART DISEASE

Etiology. Congenital heart disease may be due to developmental errors, or to foetal endocarditis, but the large majority of cases are ascribable to the former cause. Congenital heart disease is frequently associated with other congenital defects, and it has been observed that Mongolian idiots frequently are the subjects of some form of cardiac malformation.

Syphilis and alcoholism in the parents have probably little, if any influence upon the condition; it has been said, however, that a family history of acute rheumatism may be a predisposing cause.

Varieties. The four common varieties met with are, in order of frequency, stenosis of the pulmonary orifice, combined with a deficient septum between the ventricles, or the latter occurring alone, a patent foramen ovale and a patent ductus arteriosus.

Rare conditions, such as a single auricle and ventricle, and one ventricle and two auricles are occasionally seen, but with these latter the lesions are so gross as to be almost incompatible with life.

Symptoms.—Cyanosis. This is extremely variable; it may be deep and permanent, whence the term *morbus cœruleus*, which is usually applied to congenital heart affections, and it is often indicative of stenosis of the pulmonary orifice; in other cases it may be quite transient, only appearing after exertion such as crying, or it may be absent altogether. The cause of cyanosis is not fully understood and cannot well be entirely accounted for by deficient aeration of the blood alone, probably the chief cause is to be sought in the narrowing of the pulmonary orifice, as it is in these cases that the cyanosis is most marked, being usually associated with some degree of clubbing in the tips of the fingers and toes.

Polycythæmia accompanies cyanosis in most cases; there being an increase both of the hæmoglobin and of the red cells.

Physical Signs. The heart may be slightly enlarged, especially to the right, a systolic thrill may be felt over the pulmonary area, probably indicating some stenosis of this orifice, and an endocardial murmur is nearly always present. Usually this is a loud systolic bruit, audible over the whole præcordium and the back of the chest.

In cases of patent interventricular septum, cyanosis may be absent and the murmur be best heard somewhat lower down the sternum, at the level of the third or fourth intercostal space on the left side.

The murmur associated with a patent ductus arteriosus is interesting: it is heard throughout the cardiac cycle, being loudest during systole and dying away during diastole. If the lesion is present alone it may give rise to no symptoms, and the child may reach adult life. Patency of the foramen ovale rarely gives rise to any murmur, and thus remains unrecognized during life.

Prognosis. In the severer forms this is, naturally, very bad; at the same time the slighter malformations, even when combined, are compatible with many years of life. The causes of death are usually syncopal attacks, convulsions or an intercurrent attack of bronchitis.

Treatment is entirely symptomatic. Cold must be avoided, as owing to the unusually congested state of the lungs the patients are apt to develop bronchial catarrh, with the result that further strain is put upon an already overtaxed heart; exertion must also be guarded against. The diet should be regulated, and, in addition, tonics or cod-liver oil and malt administered.

G. DE B. T.

NEPHRITIS IN CHILDHOOD

Each of the several forms of nephritis recognized in adults occurs also in the earlier years of life. The most frequent variety, by far, is Acute Parenchymatous (Tubular or Glomerular) Nephritis, and the same disease in a chronic form (Large White Kidney) is not very uncommon. Chronic Interstitial Nephritis (Granular Kidney) is rare, but it is occasionally seen even in very young children.

The clinical evidences of nephritis in childhood include alterations in the quantity of the urine, the presence in the urine of albumin, blood and tube-casts, œdema, dropsies of the serous cavities, cardio-vascular changes, and retinitis and optic neuritis. Most, if not all, of these symptoms, however, may exist apart from nephritis, and hence it will be well at the outset to consider briefly the clinical possibilities which they severally create.

Alterations in the Quantity of the Urine. The daily amount of urine excreted during childhood, and especially during early childhood, is much less constant than is the case in the adult. Hence, unless extreme, an abnormality in this respect, either in one direction or the other, is apt to be overlooked. Considerable diminution is often an early fact in acute nephritis, and such an event, and, still more, complete suppression of urine, when occurring in the course of this disease, is a development of evil omen. On the other hand, a new-born infant may pass very little urine, during even two or three days, and yet be none the worse for the defect; and irregularities of the same order, though less extreme, may sometimes be noted in older children. Increase in the quantity of the urine is generally observed in the shape of excessive frequency of micturition, and not uncommonly as enuresis. The meaning of this latter may be comparatively trivial (see *Enuresis*, p. 362) but there are also more anxious possibilities. One of these is diabetes insipidus, another, diabetes mellitus, and a third, chronic interstitial nephritis. Hence the practical lesson that in every case in which there is either increased frequency of micturition or incontinence of urine, both patient and urine should be thoroughly examined.

Albuminuria. The existence of albuminuria, *per se*, is not sufficient to justify a diagnosis of nephritis. In the newly born albumin is often present in the urine, and the amount may be considerable. Again, in children who appear in other respects to be in perfect health, functional albuminuria (p. 382) is fairly frequent. On the other hand, albuminuria is not detected in every case of nephritis. In the chronic interstitial form of the disease the amount may be very small, and at times there may be none; and even in parenchymatous nephritis an occasional specimen of urine is found free from albumin. Thus a single or even a repeated negative experience with the tests for albuminuria does not absolutely exclude nephritis—certainly not the interstitial variety.

There is some difficulty in speaking, at least in absolute terms, of the significance of albuminuria in the febrile disorders of childhood. Almost every one of these may be attended by an albuminuria unaccompanied by other evidences of renal disease and of merely transitory duration. Equally, almost every one may number a definite nephritis among its anxious and serious complications. The difficulty is, at least in words, to draw a clear line of distinction between these two groups. This point finds frequent illustration in the course of an attack of scarlet fever. Certainly in this disease it is not uncommon during the early febrile period, say during the first week, to find

albumin in the urine, and even occasionally blood, and yet in the course of a few days the urine is again normal and no further trouble on this score appears. On the other hand, it is notorious that during the desquamation period of scarlet fever, nephritis, evidenced by albuminuria, by hæmaturia, and usually, but not invariably, by dropsy, is the commonest complication of the disease. It may be convenient to speak of the early albuminuria as febrile or toxic, and to regard the later manifestations as evidences of definite inflammatory changes in the renal tissues. The difficulty is to frame a rule which will in every instance distinguish a mere febrile albuminuria from an albuminuria due to nephritis. Certainly if, together with albuminous urine, there is also more or less œdema, the question is settled, and the case may be pronounced to be one of acute Bright's Disease. But the absence of œdema by no means excludes nephritis. Indeed, there are not a few severe cases of acute nephritis in children, scarlatinal and other, from which at the onset, and even during the course of the disease, œdema is entirely absent. Neither is it correct to conclude that albuminuria in the early stage of scarlet fever is invariably of little importance; on the contrary, it is sometimes the first of a series of symptoms indicative of serious renal disease. These statements illustrate the debate which may be raised by the appearance of albuminuria in a child suffering from one or other of the specific febrile diseases, for what is true of scarlet fever in this respect is true also, though in less measure, of many of the other pyrexial disorders of childhood. Thus in many cases of diphtheria, probably in a majority, albumin is present in the urine, and sometimes there is, without question, nephritis; while, less frequently, the issue here discussed is raised in cases of measles, enteric fever, chicken-pox, smallpox, mumps, congenital syphilis, pneumonia and influenza.

The practical moral of all this seems to be (1) to examine the urine frequently in all forms of febrile disease, (2) to recognize that albuminuria occurring early in the disease is usually of trivial importance, and (3) that later albuminuria is a more anxious event, and this more especially when there is also hæmaturia, or numerous epithelial or granular tube casts, or œdema, or manifest symptoms (*e. g.* pallor, vomiting, scanty urine, pyrexia) of some serious constitutional disturbance.

Hæmaturia. Blood in the urine is common in acute parenchymatous nephritis, especially in the glomerulo-nephritis of scarlet fever. Attacks of hæmaturia sometimes mark the course of chronic interstitial nephritis, just as in this disease epistaxis not infrequently

occurs, presumably as the result of raised arterial tension. But many conditions other than nephritis lead to hæmaturia (see p. 382). In infants it may be due to scurvy, and in older children hæmaturia now and again occurs without any discoverable cause, and without, also, any appreciable ill effect.

Tube Casts. These may be present with almost any form of albuminuria, and of course with hæmaturia, if of renal origin, blood casts are to be expected. The presence of tube casts in the urine does not demonstrate conclusively the existence of nephritis. Numerous fatty casts, however, carry a strong suggestion of nephritis and indicate also that the disease is not of recent origin.

Edema and Dropsies. Edema occurs in early life apart from nephritis, and even apart from any obvious organic change. Thus there is an edema of new-born infants, and in older children also there is sometimes seen a general anasarca entirely without albuminuria. A similar state of matters is occasionally observed in scarlet fever, and with it there may be scantiness of urine. Apart from these peculiarities, edema in the form of puffiness of the face and eyelids, or as a general anasarca, is one of the earliest signs in many cases of acute nephritis, though, as already stated, in occasional cases it may be altogether absent. In chronic parenchymatous nephritis edema is apt to be very persistent, and both here and in acute nephritis there may also be dropsies of the serous cavities. Chronic interstitial nephritis is not accompanied by edema, unless, as may be the case in the later stages, there is also cardiac failure.

Cardio-Vascular Changes. These are most conspicuous in the chronic interstitial form of nephritis. Here there may be hypertrophy of the left ventricle, accentuated aortic sound, a hard tense artery, and a high sphygmomanometric record, exactly as, in the same disease, these facts are observed in adults. In parenchymatous nephritis, both acute and chronic, some evidence of cardiac dilatation and irregularity is not uncommon, but not the extreme cardio-vascular changes just described.

Retinitis and Optic Neuritis. It is in the chronic interstitial form of nephritis that ophthalmoscopic evidences of renal disease are most frequently present. They include glistening dots and patches, indicative of retinitis and often having a star-like arrangement at the macula, retinal hæmorrhages and sometimes, together with the retinitis, optic neuritis (neuro-retinitis). Such appearances are of considerable value in diagnosis, though it must not be forgotten that an intra-cranial tumour sometimes produces a similar ophthalmoscopic picture, including even the stellate

arrangement at the macula. In interstitial nephritis these changes are of bad omen. In chronic parenchymatous nephritis retinal changes are uncommon, and the same is true of the acute disease. Sometimes, in the latter, bilateral optic neuritis occurs, and this, it should be noted, does not carry any serious prognostic significance.

The individual forms of nephritis will now be considered.

Acute Parenchymatous Nephritis (Acute Nephritis).—The most frequent cause of acute nephritis in childhood is scarlet fever (see p. 69). The febrile attack need not necessarily have been severe, and sometimes it is overlooked. So generally is this recognized, that the detection of acute nephritis in a child at once prompts inquiry in the direction of scarlet fever and suggests a search for signs of desquamation. Less frequently one of the other specific fevers is responsible for an acute nephritis (see above). Another association of the disease is with tonsillitis. Not frequently, but every now and again, what seems at first sight to be merely an attack of follicular tonsillitis is found to be combined with evidences of acute nephritis, and the nephritis may be of a very severe order. Certainly in every case of tonsillitis there should be a careful examination of the urine.

Apart from these more or less definite causes of the disease, there are many cases of acute nephritis of quite obscure or uncertain origin. Some of these, without question, follow exposure to cold and wet, and there is a general belief that these agents may cause the disease. Toxins produced in gastro-intestinal disorders are also suggested causes, and it is certain that the severe inflammatory diarrhoea of infants is sometimes accompanied by evidences of parenchymatous nephritis. Acute nephritis is occasionally seen in infancy, even in very early infancy, but it is more frequent after the second or third year.

Symptoms. The first event to attract attention may be either puffiness of the face and eyelids or a more widely spread edema. In other instances it is pallor, scantiness of urine or hæmaturia which excites alarm. There may or may not be more or less febrile disturbance, and sometimes vomiting or even convulsions is an early event. In not a few cases, more especially in those of uncertain causation, the onset is free from any very striking incident, and there may be neither fever nor dropsy. It is in these cases that the diagnosis is apt to be missed, that is unless the urine is examined.

The urine in acute nephritis is scanty in quantity, contains albumin generally in large amount and commonly blood, and the deposit shows red blood cells, renal epithelium and epithelial and blood casts. Suppression of urine

is an ominous symptom and may be associated with severe headache, amaurosis, convulsions, coma or other evidences of acute uræmia; but happily such a condition often yields to suitable treatment.

With a favourable course—and this is the usual experience in acute nephritis—the urine increases in quantity, hæmaturia ceases, the albumin diminishes in amount, and the dropsy gradually recedes and disappears. The albuminuria is usually the most persistent symptom, and it is not uncommon for this to continue for several weeks and even for months, and yet in the end the child may make a good recovery. Convulsions, uræmia, broncho-pneumonia, cardiac dilatation and failure, and inflammations of the serous membranes—pericarditis, for example—are dangerous complications, and may prove fatal. Another source of danger, and one that exceptionally appears early in the disease, is acute oedema of the larynx or lungs, or rapid effusion of fluid into the pleural sacs.

Apart from complete recovery, which is the usual course, and from the risk of fatal complications, there is the chance that the acute disease may pass into a chronic parenchymatous nephritis. Persistent dropsies of the subcutaneous tissues or serous sacs, and continuing albuminuria and scantiness of urine, with manifest lack of improvement in the child's general condition, suggest such a development, and are, therefore, causes of anxiety. Occasionally, though the dropsy disappears and the urine increases in amount, albuminuria in greater or less measure remains, and the case takes on, in greater or less degree, the general characters of a chronic interstitial nephritis.

Treatment. The indications are to relieve the renal congestion and to promote the action of the skin, bowels and kidneys. The first of these may be met by dry cupping of the loins or by poultices; and at the onset a few leeches to the loins have often a very good effect. The patient should, of course, be kept in bed and preferably between blankets. Warm baths and packs are useful, especially if the urine is scanty; and ammonium acetate, potassium citrate and spirit of nitrous ether will act both as diaphoretics and non-irritating diuretics.

After the more acute stage, digitalis or caffeine may be ordered if the urine continues to be scanty. To act on the bowels any simple aperient may be prescribed, but it is well at the outset to give a few doses of compound jalap or scammony powder, and these should be used freely if uræmia threatens. The child should be encouraged to drink copiously of water, barley water, whey or other diluent, and these, mixed with milk, some simple farinaceous food and a little cream, will provide ample nourishment; to give large quantities

of undiluted milk is a mistake. As already indicated, the most frequent difficulty is the persistence of albuminuria in spite of the disappearance of the other symptoms. Speaking generally, this must be met by strict confinement to bed and by the forms of diet above indicated. It is, however, necessary to watch the general nutrition of the child, and there comes a time when the diet should be enlarged and when iron should be prescribed. Under such a régime, an albuminuria which has perhaps long resisted the more strict diet may not infrequently be found gradually to disappear. In every case the child, during convalescence, needs special care against the risk of chill and against excess of nitrogenous foods; relapses are not uncommon, and the reappearance of albuminuria or of dropsy demands a return to the stricter methods of treatment. Signs of the onset of uræmia call for free purgation and packs, and sometimes pilocarpine may be necessary, though the use of this is not to be encouraged in the case of young children; in some cases lumbar puncture has appeared to have a good effect. In the event of convulsions, should the measures just mentioned not act promptly, bromide of ammonium or chloral hydrate may be given by enema, and sometimes chloroform inhalation is necessary.

Chronic Parenchymatous Nephritis (Large White Kidney).—An acute nephritis may, as already indicated, fail to resolve, and dropsies and albuminuria may persist in spite of treatment. In such cases anæmia becomes a marked feature, and the general nutrition and vitality of the child are impaired. In other cases there is no acute onset, but the symptoms just mentioned gradually develop, and for the most part without any apparent cause. The course of the disease is usually marked by alternate periods of improvement and relapse, and this state of matters may continue for several years. The outlook in all these cases is an anxious one. There is always a risk of uræmia, or of such complications as pneumonia or inflammation of one or other of the serous membranes. Occasionally, however, the patient, to the surprise of all concerned, and in spite of many alarms, makes a complete recovery.

The treatment must be on the lines already indicated. Protection from chill, if possible a warm and equable climate, and attention to the action of the skin and bowels are of obvious importance. An occasional week in bed with very simple diet is advisable, but for the most part the child should be fairly liberally fed, avoiding, however, meat broths, soups and meat extract, as excessive in regard to nitrogenous extractives. Iron is generally prescribed, and the perchloride is often recommended as specially suitable.

Chronic Interstitial Nephritis.—This form of nephritis, so common in adult life, is rare in children. The clinical and the pathological facts of the condition are, however, the same at all ages. Thus, polyuria with slight albuminuria, a few hyaline and granular tube casts, cardiac hypertrophy, arterial thickening, a high sphygmomanometric reading, and retinitis and retinal hæmorrhages, with absence of dropsy, may all be found in the very early years of life; and the necropsy in such a case will reveal kidneys shrunken, granular and fibrosed. There is nothing acute to attract attention, and the complaint is usually rather of wasting, thirst, headache, epistaxis and sometimes of failure of sight, than of any symptoms directly associated with the kidney, though frequency of micturition or enuresis may attract attention. In most instances, probably, the disease is well established when the patient comes under observation. The prognosis is decidedly bad, the patient rarely living longer than one to two years after the disease is recognized. Death from uræmia, coma or convulsions may, however, occur much earlier; in some instances cerebral hæmorrhage is the cause of death. Retinal changes are of bad omen, but the outlook is unhelpful whether they are or are not present. The etiology is very obscure. Rarely, as already mentioned, a case of unresolved acute nephritis develops in the direction above described, but in most instances the patient with chronic interstitial nephritis gives no history of dropsy or other suggestion of acute renal disease. It has been said that congenital syphilis is the cause of the disease, but the evidence is not conclusive.

The treatment is directed towards maintaining the action of the skin and bowels and preventing complications. Too rigorous a diet, by prejudicing the general nutrition, may do more harm than good. In other respects the treatment is much the same as in chronic parenchymatous nephritis. C. O. H.

SOME URINARY DISORDERS OF CHILDREN

The urine in infancy and childhood shows some peculiarities which are worthy of note.

The quantity passed is, of course, much less than by the adult. For children over four years of age the average amount in ounces can be calculated with sufficient accuracy for practical purposes by multiplying the age by 2.5; thus a child of four and a half years passes, on the average, 4.5×2.5 oz. *i. e.* 11.25 oz. per diem, and a child of ten years passes 25 oz. per diem. Infants, owing to their fluid diet, pass relatively more; during the suckling period and until the end of the first year the amount is about 12 oz. per diem; it is slightly less in the second year,

and then increases gradually. Naturally the amount of urine passed will vary considerably according to the amount of fluid taken, the freedom of perspiration, the amount of exercise taken, etc. But, apart from these causes of variability, children, especially during the earlier years of childhood, show a degree of variation in this respect which is probably a physiological peculiarity of this period of life. It is not uncommon for a child in perfect health to go twelve hours or more without passing any urine and then to pass only two or three ounces.

The character of the urine differs somewhat in infancy from that in later life. Except during the first few days, when the urine is concentrated and consequently of comparatively high colour and specific gravity, the colour is pale throughout the bottle or breast-feeding period, the percentage of urea is low, often less than one per cent., and the specific gravity 1005 or even less.

Abnormal Colour of Urine.—The urine of some infants is found to stain the diapers a blackish-brown, although the urine is normal in colour when passed. If it be allowed to stand in a glass, exposed to the air, it gradually darkens and becomes almost black. This rare congenital peculiarity, known as alkaptonuria, has been specially studied by Dr. A. E. Garrod, who found about fifty cases on record. The urine reduces Fehling's solution but does not give the fermentation test for sugar.

This condition is dependent upon a congenital abnormality of metabolism. It persists through life and does not in any way interfere with the child's health.

Pink urine with a green fluorescence is produced in the urine by eating red sweets stained with eosin, and is seen therefore chiefly in children. Green and blue urines may be produced by aniline dyes taken by the mouth, *e. g.* a child wearing a bright green dress which she had apparently sucked passed a green urine of exactly similar grass-green tint. Rhubarb, senna and santolin, drugs which are frequently given to children, deepen the yellow colour of the urine, which on addition of an alkali becomes red.

Albuminuria.—Amongst the abnormal constituents of the urine which may be found in childhood, albumin is one of the commonest, and it is often found apart from organic disease of the kidney.

During the first few days of life albumin is sometimes present in the urine in considerable amount as a purely transient phenomenon, which may be related to the so-called "uric acid infarcts" which are commonly found as pinkish-white crystalline-looking streaks in the straight tubules of the kidney in infants who have died during the first few weeks after birth; these infarcts are found to consist of urates and uric acid.

In later infancy and throughout childhood, but especially during its earlier years, any deviation from health, particularly any which affects the gastro-intestinal tract, is apt to be associated with the temporary appearance of a small trace of albumin, and this apart from fever, which in childhood, as at any other period of life, may cause a transient albuminuria.

The mere finding, therefore, of a small amount of albumin in the urine at a single examination may be of little importance.

The presence of crystals in the urine is sometimes sufficient cause for a slight albuminuria. Calcium oxalate and uric acid crystals are sometimes present. The former are due particularly to certain foods, such as rhubarb, asparagus and tomatoes; the latter are particularly frequent in the urine of children and are much more obscure in their causation; carbohydrate dyspepsia seems to be the cause in many cases, excess of proteid food, particularly of red meat, seems to produce them in others.

Cyclic Albuminuria.—One variety of innocent albuminuria is that known as cyclic, orthostatic, postural or functional albuminuria.

This condition is found usually in children past the age of infancy, and perhaps more often in boys than in girls.

Generally the urine is free from albumin when the child rises in the morning, but as the day progresses albumin appears, and in some cases shows a diurnal cycle, increasing until some hour about midday or early afternoon, and then gradually diminishing, so that very little or none may be found in the evening. In some cases the time of appearance of albumin appears to be related to meals, but more often it seems to be related to the position of the child, and on this account has been called orthostatic or postural albuminuria. Some have thought that certain children are more prone to it than others, namely those who show marked antero-posterior curves of the spine, particularly with a lordotic position of the lumbar spine. In boys at the school age a transient albuminuria is sometimes caused by violent exertion, *e. g.* at football or in rowing.

Symptoms. Cyclic albuminuria is associated with but vague symptoms, nervousness, headaches, nausea, pains in the abdomen, puffiness under the eyes, and sometimes attacks of faintness. Usually the child is pale, lacking in vivacity and, without being ill, is not perfectly well.

The outlook is quite good. In some cases the albuminuria disappears altogether at some time after puberty. There is no special liability to nephritis in these cases.

Treatment. No special treatment is called for. Symptoms must be dealt with as they arise. In particular there is no need to diet the

child as if it were peculiarly liable to nephritis. Probably some iron tonic or arsenic, perhaps combined with phenazone for the relief of the nervous symptoms, will be the most suitable treatment. Calcium lactate and calcium chloride have been given, but seem to have little, if any, effect in checking the occurrence of the albuminuria.

Hæmaturia.—Blood in the urine, when found in an infant under the age of twelve months, is usually a symptom of infantile scurvy; it may indeed be the only symptom, and the proof of the cause may then rest upon the very striking effect of antiscorbutic treatment.

After the end of the first year tubercle of the kidney sometimes shows itself by hæmaturia with or without pyuria.

At any age calculus may occur in the urinary tract; even in early infancy calculi have been found in the renal pelvis, and in later childhood they are not very rare.

Oxalate crystals are also sufficient cause for hæmaturia in some children, so that a liberal indulgence in rhubarb may cause this symptom. An affection which sometimes produces hæmaturia, and which is most frequent in early childhood, is malignant growth, usually sarcoma of the kidney.

There are cases in childhood, as in later life, where no explanation whatever is forthcoming of blood in the urine, and the term "renal epistaxis" makes a provisional label for this group of idiopathic hæmaturia.

Drugs are responsible for hæmaturia occasionally, *e. g.* cantharides, which is sometimes given for enuresis, and urotropin in large doses.

Probably toxins of a more obscure nature may be responsible for the hæmaturia which occurs with purpura; occasionally some general blood infection seems to underlie the hæmaturia, as in Winckel's disease of the new-born.

The possibility of traumatism may also have to be considered, and allied to the traumatic cases are those in which hæmaturia results from whooping-cough, the hæmaturia in these cases being simply due to rupture of vessels produced by the forcible congestion during the violent cough.

Lastly, in children who have lived in certain parts abroad, *e. g.* in Egypt or South Africa, bilharziosis may be the cause of hæmaturia.

Hæmoglobinuria.—Hæmoglobinuria is occasionally seen in children and is liable to be mistaken for hæmaturia. The brown or reddish-brown urine is common to both, but they are easily distinguished by the microscope, which in cases of hæmoglobinuria shows no blood corpuscles, or at any rate only a stray one here and there, which would not be sufficient to account for the colour; whereas in hæmaturia

a large number of red cells are seen, corresponding to the colour of the urine.

In childhood, at any rate, hæmoglobinuria is most frequently due to congenital syphilis, but it occurs rarely with scarlet fever, and in newborn infants is found in the epidemic disease known as Winckel's disease, where jaundice and cyanosis, with hæmaturia or hæmoglobinuria, lead speedily to a fatal ending.

Hæmoglobinuria in older children is generally associated with definite evidence of congenital syphilis, particularly with such tertiary manifestations as gummata, bone disease or cirrhosis.

The onset of the urinary affection may be determined by exposure to cold, and may be accompanied by some pallor and lassitude, but otherwise does not usually cause any symptoms.

Pyuria.—Pus in the urine may come from various sources. In girls a vulvo-vaginitis may contaminate the urine with pus. Cystitis occurs in children, as in older patients, and may be due in some cases to infection travelling upward from soiled underclothing. This appears to happen in cases of diurnal enuresis.

The writer has recently had two children under his care in whom the presence of pus in the urine proved to be due to perforation of an appendix abscess into the bladder. More often, however, the pyuria of childhood is of renal origin and is due to some form of pyelitis, whether calculous, tubercular or arising from some other bacillary infection.

Pyelitis.—Pyelitis is apt to take an extremely acute form in childhood, especially in infancy, when it is usually due to infection of the urinary tract with bacillus coli, rarely with the bacillus proteus.

This acute pyelitis occurs much more commonly in girls than in boys, and quite two-thirds of the cases are under the age of eighteen months. The sex and age incidence has suggested that the infection may travel upward from soiled diapers and that the rarity of bladder symptoms may be due to some special liability of the renal pelvis rather than the bladder to infection with the bacillus coli. There is, however, much in the symptoms to suggest that in some cases at least the infection is transmitted to the kidney either via the blood or possibly by direct passage from the adjoining bowel. It is noteworthy that there has usually been some gastro-intestinal disturbance, whether diarrhoea, constipation or abnormal stools, preceding the onset of the pyelitis.

The symptoms of pyelitis begin suddenly. Often shivering and blueness mark the onset, rarely there is a convulsion. The mother can usually date the beginning of the illness from a particular day and even a particular hour. The temperature is found to be about 103° F. or

higher, and continues for many days or even weeks if the cause be not discovered. Its course is usually irregular, but remittent rather than intermittent, and frequently reaches 105° F., sometimes even 106° F. Its long continuance where the condition of the urine was undiscovered has suggested in some cases typhoid. It is, in fact, the severe and continued fever without any physical signs to explain it which makes this affection so often a pitfall for diagnosis.

With this high fever the infant is restless and miserable and not infrequently has occasional attacks of faintness or collapse and sometimes definite rigors which are very characteristic of this affection. Sometimes the abdomen is slightly full and there may be a little tenderness on palpation. Nervous symptoms are prominent in some cases. Drowsiness, stiffness of the neck and even squint may be present, so that a diagnosis of meningitis has often been made.

Examination of the urine is of course the only possible way to make sure of the diagnosis, and in an infant some tact may be necessary to obtain a specimen for this purpose. A mackintosh placed under the child is perhaps the readiest method of obtaining a specimen, as only a few drops are necessary for microscopic investigation. The number of pus cells found is often by no means large—for instance, six to twelve per field under a one-sixth objective. Usually the colon bacilli, some stuck together in clumps, can also be seen with this power. The urine shows only a trace of albumin, corresponding to the small amount of pus present. It is generally highly acid and has the curious stale odour which goes with the presence of colon bacillus. The pus may not be sufficient to produce any deposit visible to the naked eye and turbidity may be so slight as to be barely appreciable. The outlook is not so serious as it might seem, provided the diagnosis is correctly made and proper treatment applied. There are rarely any complications. In the few cases which have proved fatal streaks of suppuration have been found in the substance of the pyramids of the kidney and small foci of suppuration in the cortex.

The writer has had under his observation one case in which the kidney apparently became distended with pus, forming a large pyonephrosis. This, however, gradually subsided and the infant slowly improved. Such occurrences are fortunately rare and under proper treatment recovery is the rule.

Treatment. Alkalinization of the urine is the one thing needful in most cases. Dr. J. Thomson has drawn special attention to the value of potassium citrate in large doses for this purpose. It must be given at frequent intervals—*e. g.*

every two or three hours throughout both day and night—to ensure a persistently alkaline condition of the urine, the reaction of which must be frequently tested with litmus. The potassium citrate should be continued for at least ten days after the temperature has fallen to normal, which usually happens within two or three days after this treatment is begun.

In rare cases, perhaps especially those in which the condition is due to the proteus bacillus, the alkaline treatment fails, and then urotropin or helmitol may be tried.

The former drug may be given in doses of two grains every four hours to an infant of six months, and five grains may be given four times daily to an infant one year old, but watch must be kept for strangury and hæmaturia, which may be produced by urotropin when given in large doses.

Salol also is certainly useful in some cases, perhaps partly by its effect upon the stools, which are often unhealthy and may be encouraging the persistent infection.

If oral administration of drugs fails, a vaccine is worthy of trial. It should be autogenous. The writer has used five to fifteen millions of bacillus coli at intervals of three or four days for infants. Older children may have the dose increased even up to a hundred millions.

Stimulants are usually necessary, especially when the attacks of shivering or collapse occur and sedatives may be necessary if there is any convulsive twitching.

G. F. S.

MONGOLS

This name is applied to a group of imbecile children whose features resemble those of certain Mongolian races.

In the case of the baby mongol the skull is small, rounded and flattened before and behind. The palpebral fissures slope downwards and inwards, but the degree of obliquity varies in different cases. Epicanthus and squint are common. The ears are small and simply convoluted. The nose is flattened and the nostrils look directly forwards. Owing to the small size of the nasopharynx, and the not infrequent presence of adenoids, these infants sometimes make an unpleasant snorting noise on respiration. The tongue is protruded, but rarely occupies that position permanently. The skin is smooth and white, or mottled. Except when there is a marked cardiac lesion the Mongolian infant is usually unduly fat and the subcutaneous tissues present an cedematous appearance, but do not pit on pressure. The little fingers are exceedingly short and curve inwards; congenital heart disease is not uncommon.

As the child grows older high-coloured

cheeks, a rough, dry skin, transverse fissuring of the tongue, blepharitis, indications of a bad circulation, a liability to catarrh and constant grimacing are marked features. Walking and talking are delayed in their onset. Speech, when it occurs, is hoarse and indistinct, and all movements are clumsily performed.

The baby mongol is often a happy smiling infant, sometimes seemingly intelligent. The older mongols are usually stolid, contented children with affectionate and often jealous dispositions; a few, however, are emotional, vivacious and mischievous creatures.

Prognosis. Infants with well-marked heart disease usually die within the first two years of life. Others succumb to diarrhoea, bronchopneumonia and infective disorders. Some, generally those of a higher grade of intelligence, survive to puberty and later die of tuberculosis; only a few reach adult age.

Careful training may evolve a child competent to talk a little, read a little, and capable, under supervision, of performing simple duties in house or garden.

Diagnosis. These children are occasionally confused with cretins. Below are some distinguishing features—

	MONGOL.	UNTREATED CRETIN.
	Cheerful, often vivacious.	Sullen, lethargic
Skull . . .	Small, brachycephalic	Large, dolichocephalic
Eyes . . .	Oblique, close together	Horizontal, wide apart
Skin . . .	Smooth, mottled	Wrinkled, sallow and dry
Temp. . . .	Normal	Subnormal
Bowels . . .	Normal	Constipated
Thyroid Mcd.	Useless	Rapid improvement

Mistakes arise from ascribing the snorting respiration to congenital syphilis, or the general backwardness to rickets; differentiation is established by the absence of other syphilitic or rickety symptoms. Both may complicate Mongolian imbecility, but neither can produce the typical features described above.

Treatment. Drugs are of no avail. Education is all-important. Bad habits, like uncleanness and tongue-protruding, should be corrected. Nasal catarrh may be improved by the removal of adenoids when present. Chills must be guarded against, but fresh air is not on that account contra-indicated. Sight, hearing and touch should be stimulated in every way possible. Interest exhibited in any healthy direction should be encouraged. The musical ear and powers of mimicry possessed by these children may be turned to useful account in singing and musical drill.

Progress will be slow under the best conditions, and great patience is demanded from every one concerned. Where home treatment is impracticable, institution treatment can be tried.

E. B. S.

FUNCTIONAL NERVOUS DISORDERS IN CHILDHOOD

Functional nervous disorders are those which are not due to destructive lesions of any part of the nervous system. They are recognized as functional when the symptoms and physical signs are not altogether in accordance with those produced by organic lesions of the nervous system.

They are generally characterized by variety and mutability of the symptoms; by a certain histrionic exaggeration, and by the sudden and often dramatic or tragic manner in which they come and go. Inconsistency between the physical signs and symptoms, or between the symptoms themselves is often a guide to diagnosis.

The apparent paralysis of a limb is inconsistent with the degree of muscular tone, nutrition and condition of reflexes and tendon-jerks found on manipulation. Contractures far exceeding in extent those of organic disease yield to chloroform or coxing. Anæsthesia is not anatomical or segmental in its distribution. In hysterical amaurosis the pupils react to light and the discs are normal. In hysterical adductor paralysis of the vocal cords the patient can cough though unable to vocalize. Tremors, spasms, convulsions and choreiform movements may closely simulate such symptoms of organic disease, epilepsy and chorea, but the copy is usually an imperfect caricature of the original.

A clue to the functional nature of nervous disorders is often provided by peculiar traits of disposition and temperament in the individual who exhibits them.

It should not be assumed that functional nervous disorders have no physical or anatomical basis because their history, course and character are incompatible with the existence of organic disease. Even the fact that a functional paralysis may be cured by suggestion does not disprove that some physical alteration has taken place in the cerebro-spinal nervous system. Physical changes doubtless occur in the neurones in association with physiological action, and morbid modifications of such changes may account for disordered function.

How far they are chemical, bio-chemical or cytological is unknown. But the definite cytological changes which have been found in the nerve-cells of pigeons and honey bees as the result of fatigue suggest that nervous exhaustion and neurasthenia in human beings may be attended by similar changes.

As all nervous and vital functions depend on the blood supply of the organs concerned, and as the circulation is governed by the vasomotor system, the part played by the sympathetic in the etiology of functional neuroses

must be important. Few, if any, functional neuroses are unattended by evidence of sympathetic disturbance in the shape of circulatory, secretory, absorptive, metabolic and nutritional abnormalities.

The condition of the blood itself must also be an important factor. Toxæmia of one kind or another accounts for such "functional" neuroses as tetany, laryngismus, eclampsia, chorea, spasms, tremors, delirium and coma, and may be responsible for many so-called hysterical and functional nervous disorders. Auto-intoxication from septic absorption, intestinal or otherwise, is a recognized cause of profound neurasthenia. Recent investigations into the physiological action of the secretion of ductless and other glands, and of their influence on physical and sexual development, and also on mental and nervous activity in general suggest that in some cases disordered glandular activity may underlie the phenomena of functional neuroses.

As regards the anatomical site of such neuroses as hysteria and neurasthenia, the advances made in recent years in the regional allocation of organic disease based on symptoms and physical signs are equally important in respect to functional disorders. The knowledge which we possess enables us to distinguish symptoms of functional from those of organic disease, but it should not therefore be assumed that only the latter have a focal origin.

The symptoms of functional and organic lesions necessarily differ in detail, but are as significant of local cerebro-spinal disorder in the one case as in the other. Perhaps the most striking corroboration of this view is afforded by recent investigation of the function of the optic thalamus.

An organic lesion of the lateral nucleus of this organ produces not only disorders of sensation; anæsthesia, paræsthesia, hyperæsthesia and severe pain, atropognosis, astereognosis, tremors and athetosis; but also local disorders of circulation; erythema and cedema, alteration in temperature on the affected side, and, more important still, emotional hyperæsthesia; intensification of "feeling tone" pleasurable and the reverse, produced by stimuli.

It seems superfluous to point out that all the symptoms and physical signs mentioned, especially emotional hyperæsthesia and intensification of "feeling tone" associated with disease of the thalamic connections with the cortex, are equally characteristic of hysteria and neurasthenia.

We can no longer regard the hysterical person as one who voluntarily *simulates* disease. Many of the manifestations of hysteria are evidence of thalamic physiological function unrestrained by cortical action.

L. G.

THE NEUROTIC TEMPERAMENT

All nervous tissues are irritable. Vitality, including reflex action, consciousness, mental and emotional capacities, depends on the degree of nervous irritability which prevails in the individual.

From the moment of birth irritant stimuli pour incessantly upon our brains through the medium of the organs of special and common sensation. Temperament results from the mode in which stimuli are perceived, responded to in the form of motor reactions, emotional and otherwise, and from the capacity of storing experiences of past stimuli, recalling them to consciousness, comparing them and formulating ideas, judgments and conduct based thereon.

The *neurotic temperament* is characterized by hyperæsthesia and unduly active response to all forms of stimuli, both physical and mental. Hyperæsthesia on the physical side is shown in exaggerated reflexes and tendon-jerks, in the readiness with which spasmodic affections, tremors, fits, spasms and convulsions are induced by trivial causes; in abnormal severity of the symptoms attending any ordinary ailment, and in the ease with which cardio-respiratory and digestive functions—secretory, excretory, absorptive and metabolic—are impaired.

Hyperæsthesia is shown in cutaneous irritability, itching discomfort, and frequent appearance of eruptions of erythematous, urticarial and eczematous type. It affects also the special senses. The neurotic child often shows marked dislike or intolerance of certain colours, sounds, tastes and odours, and anything which he dislikes usually violently disagrees with him. He is also as sensitive as a barometer to changes of temperature and climate.

On the mental side *emotional hyperæsthesia* is characteristic of the neurotic temperament.

Emotions, like instincts, are involuntary motor responses to sensations, percepts and ideas. Without the involuntary motor response or expression the intensity and even the existence of an emotion cannot be gauged or surmised by an observer. Some maintain that it is the expression which gives rise to an emotion and not the emotion which causes the expression.

Darwin said: "Most of our emotions are so closely connected with their expression that they hardly exist if the body remains passive." (*Expression of Emotions*, 1892, p. 249.)

Prof. James traces emotions to sensations derived from the activities of certain muscles (voluntary and involuntary) and glands (sudorific, lachrymal, intestinal, etc.). Under a stimulus, pleasurable or otherwise, voluntary muscles are thrown into activity, and the characteristic attitudes expressive of emotion

are involuntarily assumed. The stimulus also excites activity in involuntary muscles, giving rise to certain circulatory changes such as increased or diminished frequency of the pulse, local flushings and pallor, and also to increased or diminished activity of sudorific, lachrymal, intestinal and other glands.

The various sensations produced by attitudes, gestures, circulatory, secretory and other changes give rise to the different kinds of emotions.

The neurotic or emotional individual is the one in whom such physical changes are most readily induced by insignificant internal or external stimuli. Both sensitiveness and reaction to stimuli are exaggerated.

Control of Emotions. Although neurotic persons are said to be lacking in self-control, the emotions are not under direct control by the will. We can work up an emotion by assuming the attitude which characterizes it, as every actor knows, and we can partly counteract an emotion by assuming a contrary attitude. For instance, we can combat a desire to laugh by putting on an air of preternatural solemnity.

But although the outward expression of an emotion may be voluntarily suppressed, and the emotion itself dulled by such suppression, it is impossible to stifle the effects of a stimulus or shock to the nervous mechanism of circulation, respiration and secretion. We cannot prevent our eyes from filling, our face from flushing or turning pale, our heart from throbbing, our respiratory rhythm from altering, our mouth from watering or our flesh from creeping at a sight, or sound, or thought. All these conditions are essential, whereas the characteristic attitudes are only adjuncts to the expression of our emotion.

Hence, persons whose emotions are most readily excited by internal disturbance may show them least by outward manifestation.

L. G.

TICS AND HABIT SPASMS

Tics are motor manifestations of psychical instability and excitability. Their presence implies supersensitiveness and abnormally active response to all external and internal stimuli. They are more common in the *unrestrained* than in the *restrained* type of neurotic children, and are usually first noticed between the fifth and tenth year. They may persist indefinitely, and are slightly more common in girls than in boys.

Predisposing causes are a neuropathic inheritance and unsuitable environment. Emotional excitement, pleasurable or otherwise, mental and physical shock, strain or exhaustion, and any condition which lowers general health, such

as chronic indigestion, may induce the psychic and nervous instability which is responsible for tics.

Exciting causes are local and peripheral irritation of any kind, and are usually of slight or trivial nature. Tics are not conclusive evidence of masturbation or of worms, but of an unstable neurotic temperament.

Characteristics of Tics. Tics are sudden paroxysmal movements of face, limbs or body. They begin as defensive and protective, half reflex and half purposive reactions against some irritating peripheral sensation. A blink, a sniff, a cough or a wriggle, for instance, are natural protests against irritation of the eye naso-pharynx or skin. But instead of ceasing after having served their purpose, they are repeated over and over again in obedience to a strong desire to perform them.

Moreover they lose their original purposive character and are perverted into purposeless, ineffective or exaggerated caricatures of ordinary defensive acts and gestures. They then become "tics."

An occasional blink is replaced by a series of futile flickerings of the eyelids, an effective sniff by a constant succession of little useless ones. Clearing the throat is represented by weird grunts, snorts, barks or yelps. An ordinary gesture of dislike or distaste is repeated as a hideous grimace. An original effort to keep on a loose cap, or hair out of the eyes or from tickling the neck, is represented by violent contractions of the frontalis muscles, or the child shakes his head at intervals as though he would shake it off. Any discomfort or irritation arising from ill-fitting clothes may be responsible for elaborate writhes and intricate movements of the body or limbs.

The curious abdominal tics in which the diaphragm descends five or six times in quick succession and the abdominal walls bulge, may be similarly explained.

Locomotor tics, in which sudden hops, twists, skips, jumps and stamping on the ground are practised, probably originate in some defensive or protective action or gesture.

Tics are commonly divided, in order of severity, into *simple*, in which isolated muscular movements are practised; *co-ordinated*, in which the movements are more elaborate and complicated; *convulsive* when particularly violent, and *psychical* when associated with explosive utterances, often of obscene words (coprolalia), or imitation of bystanders' actions and words (echokinesis, echolalia). The last variety (Gille de la Tourette's tic) is the most serious of all. It is a form of masked epilepsy and commonly ends in insanity.

Tics and Spasms.—Tics are not spasms. Spasms are motor reactions to local irrita-

tion somewhere in a spinal or bulbo-spinal arc. A spasm is purely anatomical in distribution. It is confined to muscles supplied by the efferent nerve of the arc in which irritation is present. It does not produce co-ordinated action of muscles outside the arc affected. It cannot be produced or controlled by act of will. It is not expressive of an emotion nor preceded by a desire to produce it. It ceases when the local irritation which causes it subsides or is removed.

In all these respects tics differ from spasms. A supposed tic (*e.g.* convulsive contraction of facial muscles) which ceases at once on removal of a carious tooth is a spasm and not a tic at all.

Tics and Habit Spasms are commonly used as synonymous terms. But tics in their early stages are not habits, nor are they spasms at any time. Habits are acquired by practice but tics arise suddenly, yet in time tics do become habits, and this has an important bearing on their treatment.

At first, tics are semi-consciously performed as a protest against some passing local irritation. They continue in obedience to an overwhelming impulse to repeat them, and their performance is followed by a sense of satisfaction. But in time the impulse ceases and they are produced unconsciously. At this stage they are habits which may be continued indefinitely, but can be controlled by will.

In the first stage they are increased and in the second lessened by drawing the patient's attention to them.

Variability of Tics. It is seldom that more than one tic is practised at a time. Some special kind of grimace, *e.g.* an apparent attempt to twist the mouth round the ear, may persist for days or weeks and then cease as suddenly as it began, only to give place to other forms of tic in succession. An isolated form of tic does not always become a habit. More commonly a "tic status" is developed, in which one kind of tic replaces another.

Diagnosis between Tics and Chorea. The facial movements in chorea are normal, though exaggerated expressions of ordinary emotions of every kind, quickly passing, alternating and coinciding with each other. Frowns and grins, expressions of grief, terror, anger, mirth and so forth, come and go in ceaseless sequence. In tics the facial movements are not those expressive of ordinary emotions, but are meaningless and unvarying grimaces, repeated at short intervals.

So also the bodily movements in chorea are normal simple acts of flexion, extension and rotation; purposeless, counteracting and alternating with each other; whereas the bodily movements in tics are co-ordinated complicated motor tricks, gestures and antics which only

parody normal actions. As in facial tics, the bodily tics are stereotyped, and each continues for a varying period until supplanted by another.

Myoclonus (*Paramyoclonus Multiplex*, *Myokymia*) differs from tics and from chorea in affecting individual muscles and not groups of muscles. Many muscles may contract spasmodically and simultaneously on both sides of the body. The contractions are clonic, they do not resemble volitional movements, and are not apparently under control of the will. Myoclonus is a rare affection, but is sometimes seen in children upwards of five years of age. The etiology is obscure, the prognosis is usually favourable.

Treatment of Tics. The treatment of tics must be based on consideration of the patient's temperament and environment, and on the detection of local or general causes of ill-health.

Tics are psycho-motor manifestations of nervous excitability and instability. Neurotic children of the unrestrained type are always liable to tics if their environment is unsuitable, whether inside or outside the family circle. Some only exhibit tics at home, others only when at school. Educational over-pressure, fear, worry and anxiety, teasing, nagging and bullying on the one hand; emotional excitement through over-indulgence in parties, pantomimes, noisy games and romps on the other, may be responsible. The "only child" who shares all his parents' domestic infelicities is specially apt to develop tics and all other functional neuroses.

In all cases the first principle of treatment is to secure by plain speaking or diplomacy a quiet, unexciting and generally wholesome mode of life for the patient.

The "tic status" in which, for lengthy periods, endless varieties of tics make their appearance one after another, should be regarded as a sign of impending neurasthenia and exhaustion. Physical and mental rest, freedom from worry, excitement and fatigue should be enjoined.

Treatment of the motor manifestations themselves differs in accordance with the stage at which the complaint has arrived. Treatment appropriate for early stages is inappropriate for the later.

So long as tics are performed in obedience to an overwhelming impulse it is worse than useless to try to check them by admonition or by attempts to cultivate "will power." Their occurrence is always increased by drawing attention to them and lessened by distracting it. It is better to attend to the causes which have led to nervous irritability than to endeavour to check its manifestations.

In later stages, however, when tics become,

strictly speaking, habits, unconsciously practised and no longer in obedience to an impulse, they may be arrested by drawing the patient's attention to them and encouraging his power of control. They then occur only when he is off his guard and believes himself to be unobserved or at moments of excitement.

In such cases, when tics have become habitual and it has been ascertained that mere attention is sufficient to control them, drills and exercises are useful. Porot advises training the child to stand like a statue before a looking-glass and teaching it not to wince when pricked or tickled or when bright objects are suddenly brought close to the eyes. Such procedures are harmful in early stages, and in later stages it is usually sufficient to encourage self-control by gentle reminders of the existence of "habit spasms" and by rewards for overcoming them.

Barking or yelping tics, in which some neurotic and hysterical children indulge, usually subside after a few days' isolation and confinement to bed. When the habit seems to be kept up solely in order to cause annoyance or to attract attention, a hint that electrical treatment is very painful may be found effective.

Imitative Tics.—In schools and institutions a genuine "ticqueur" sometimes finds a host of imitators until an epidemic appears to rage, but the imitations are always poor copies and easily detected as such. The originator should be isolated and the followers treated with firmness and cold shower baths.

Treatment of Local Causes of Irritation. Tics are suggested, not caused by local irritation in the sense that spasms are so caused. A spasm is cured by removal of the local irritant which caused it, but a tic may long outlast the irritation which suggested it. A facial twitch or blepharospasm which is cured by removal of a decayed tooth or by treatment of follicular conjunctivitis or blepharitis, is not a tic at all. Treatment, therefore, of tics which aims at detection and removal of every possible source of irritation and minor abnormality of eyes, nose, throat, mouth or prepuce is often unsuccessful. A child may cease to blink or pull faces not because some infinitesimal error of refraction has been corrected or because a decayed tooth has been stopped, but because some vague bodily discomfort has suggested another form of tic. The variability of tics and their tendency to replace each other discount the value of local treatment.

At the same time any serious defect in the shape of ametropia, conjunctivitis, nasopharyngeal obstruction and dental caries, which reasonably may be held to lower general health and so predispose to the development of tics, should on no account be neglected.

In many cases neurasthenia following acute

or prolonged illness is attended by tics, and so also are digestive troubles such as constipation, mucous colic, lenteric diarrhoea, gastric atony and catarrh, and in rare cases intestinal parasites. Some authorities regard tics as evidence of subacute or "latent" rheumatism, but care should be taken not to impute to rheumatism the aches and pains to which all neurasthenic children are liable.

Ticqueurs commonly suffer from functional cardiac disorders, but very rarely from rheumatic endocarditis or from definite articular rheumatism, or from genuine chorea. It is important, both as regards prognosis and treatment, to discriminate between tics and Sydenham's chorea. Almost as much harm may be done by assuming the danger of heart disease in the one case as by ignoring it in the other.

Treatment of Tics by Drugs. Drugs do not cure tics. When much mental excitement and emotional irritability are present bromides in eight- to ten-grain doses may be given at bedtime to secure sleep and to prevent night terrors. Antipyrin in three to five-grain doses is also a useful nerve sedative. Arsenic in doses of one to two minims with alkalies and gentian, or with the hypophosphites, is regarded as a digestive and nerve tonic. Salicylate of sodium or aspirin undoubtedly relieve aches and pains. Cod-liver oil, or one or other of the many emulsions containing it, may supplement the deficiency in fat, which most neurotic children would exclude from their dietary, and may stay their craving for pickles, cold salt-beef and cheese.

But many children loathe cod-liver oil in any shape, and it is cruel and harmful to force them to consume it. An ounce of butter and half this quantity of cream taken in the course of the day may be substituted.

The parents of neurotic children will often dose them with patent preparations of iron, because their faces are pale. It is necessary to explain that pallor of the conjunctivæ and mucous membranes, rather than of the face, indicates anæmia. The citrate of iron and ammonia is the best preparation for anæmic children.

Fresh infusion of senna pods is an excellent remedy for constipation.

Caution is always necessary in prescribing medicine for neurotic children. Idiosyncrasy may exist in regard to drugs as well as articles of food. Invaluable advice on general management may be wasted should the medicine prescribed happen to disagree. L. G.

INFANTILE PARALYSIS

(Acute Poliomyelitis)

This is a disease due to an ultramicroscopic virus which can affect all parts of the brain,

cord and spinal ganglia; the grey matter receiving the brunt of the attack. The symptoms are due to hyperæmia and oedema of the infected area, its infiltration with small round cells and the resulting destruction of the nerve-cells. Symptoms due to destruction of the nerve-cells are permanent, *e.g.* the permanent palsies; those due solely to oedema are recovered from.

The disease occurs chiefly in the warmer months, July to October, and usually affects well-nourished healthy children of one to three years, but adults are not exempt. It may assume an epidemic form, when the percentage of adults is increased and the mortality rate raised. Monkeys have been experimentally infected, and the nasal mucous membrane of one animal is capable of infecting another.

The mode of infection is unknown. Several members of a family may be attacked. Here the source of infection is probably a common one, since the disease appears to be but rarely spread by contact. There is evidence that the saliva and nasal discharges are infective. Dust, flies, bathing in contaminated water, epidemics of similar diseases in animals, have all been suggested as means by which infection has occurred.

Clinical Features. These differ widely with the parts of the brain or cord involved. Two main types occur—poliomyelitis and poliomyelitis. Both forms usually show a preliminary constitutional disturbance. Most commonly this consists of symptoms of a gastro-intestinal character or of an acute febrile disorder; but it may be an acute coryza and bronchitis, or the onset may suggest meningitis, *e.g.* drowsiness, twitching, sometimes rigidity in the neck and back, occasionally unconsciousness; soon followed by some paresis of the neck muscles and falling-back of the head, a pseudo-retraction. More rarely a child in perfect health is suddenly seized with a flaccid palsy of a limb.

Poliomyelitis.—During the constitutional disturbance there is often headache and severe pain in the limbs, back or neck. The limbs in the early stages are frequently extremely tender on manipulation, and some degree of tenderness may persist as long as eight weeks. The pain is not necessarily limited to the limbs that are eventually paralysed. On the second or third day after the onset some weakness of a limb is noticed, and within the following twenty-four hours the paralysis is complete. This paralysis is of the flaccid, lower motor-neurone type; the limbs hang helpless in a characteristic fashion and show no deep reflexes. It may affect one or more limbs and abdominal, thoracic, back or neck muscles. The legs are attacked six times as frequently as the arms. If the abdominal

and intercostal muscles are paralysed imperfect expansion of the lungs occurs and predisposes to broncho-pneumonia, which is a not infrequent cause of death. Incontinence of urine and fæces is rare, as are sensory changes. The temperature falls to normal on the fourth or fifth day.

Improvement begins at the end of seven to fourteen days and is slowly progressive for weeks, months or even years. The paralytic symptoms due to œdema of the cord clear up, leaving the permanent palsies, which affect whole limbs or groups of muscles. Certain muscle groups are more frequently paralysed than others, *e. g.* extensors and peronei in the leg, deltoid and brachialis anticus in the arm. These muscles show the "reaction of degeneration." The paralysed limb becomes thinner and colder than normal. Its growth may be stunted, and contractures from the unopposed traction of antagonistic muscles are frequent. The neck and back muscles usually recover, and sometimes absolute recovery occurs after widespread initial paralyses.

Acute poliomyelitis does not always conform to the foregoing description. For instance, there are abortive cases which show constitutional symptoms, but no paralysis; again, severe cases occur simulating Landry's Paralysis, *i. e.* a paralysis involving first the legs, and then, in rapid succession, the abdomen, thorax, arms, neck and vital centres in the medulla. The "meningeal type" has already been described. There is also a mild variety in which, with few constitutional symptoms, a local paralysis, usually in the neighbourhood of the shoulder or hip joint, develops. Finally, in any form relapse may occur about the seventh day of the disease.

Polioencephalitis.—The constitutional symptoms are often more severe, unconsciousness and convulsions being more frequent. The special symptoms vary with the part of the brain involved, thus—

Cerebral Cortex. If the frontal area is involved, mental and moral deterioration may result. The part most frequently affected is the motor cortex, and this accounts for some cases of infantile hemiplegia. Bilateral damage of the occipital cortex produces blindness—often temporary—with active pupils and no fundal changes.

Cerebellum. These cases show a pronounced ataxia ("acute ataxia") and hypotonia of the limbs, with which may be associated nystagmus and scanning speech. The whole shows a marked tendency to improvement, and even complete recovery. Ataxia may be the only symptom.

Mid-brain. Polioencephalitis of this region may show a palsy of the third or fourth nerve;

or, should the damage affect the red nucleus or its connections, a slow rhythmic tremor (three to five per second) develops. This tremor, more marked in the upper than lower parts of the limb and on voluntary movement, tends to improve and disappear. It may be continuous, except during sleep, and when it affects the whole body resembles "shivering." Combined with the tremor is some hypertonus of the limbs.

Pons and Medulla. Here the nuclei of the various cranial nerves from the fifth to the twelfth may be implicated and produce characteristic symptoms. The sixth, causing an internal squint, and the seventh, causing facial paralysis, are perhaps most frequently affected. Polioencephalitis of the bulb shows the symptoms of a sudden bulbar palsy, which often proves fatal from involvement of the vital centres.

Diagnosis. In the early stages it is extremely difficult, and often impossible, to realise that the condition is something more than a simple febrile disorder. The type of child affected, the seasonal incidence of the disease and a knowledge of its prevalence are useful helps. The diagnosis may have to be made from—

1. **Meningitis.** The non-recognition of the meningeal type of poliomyelitis is the cause of many mistakes. The onset in poliomyelitis is more sudden and the symptoms more pronounced. True rigidity of the neck is usually absent, and the head retraction is due rather to muscular weakness than spasm. The cerebrospinal fluid removed by lumbar puncture shows neither polymorphonuclear leucocytes nor organisms. The fever lasts a few days only, and by the third or fourth day the characteristic paralyses are evident.

2. **Extensive Peripheral Neuritis, most commonly the post-diphtheritic.** Extensive poliomyelitis may be very difficult to separate from this condition. There is no history of sore throat followed by a gradual onset of paralysis; instead, there is one of sudden illness and rapid development of paralysis. Absence of pain, the presence of palatal palsy, reflex cycloplegia and evidence of myocarditis are of great importance in diphtheria.

3. **Acute Rheumatism.** The intense pain and fever of the early stages frequently lead to this mistake in diagnosis. Two facts should, however, rouse suspicion:—Firstly—rheumatism is uncommon under five years of age, and under three is a curiosity, whereas poliomyelitis is commonest between the ages of one and three years. Secondly—extreme pain and tenderness in the limbs and joints is not a characteristic of acute rheumatism in children. Other important points are the absence of cardiac dilatation, choreiform movements, rheumatic nodules, etc.

When the paralysis is fully developed it can scarcely be mistaken for anything else, but occasionally it may be necessary to diagnose it from injury to a nerve or joint, an acute joint disease, infantile scurvy, rickets, Erb's obstetric palsy, etc.

In the case of a pure polioencephalitis diagnosis can only be arrived at by the exclusion of all other possibilities of nuclear palsies, etc., such as tuberculous masses. Lumbar puncture, ophthalmoscopic examination, the history of an acute onset, the course, the type of child, and the time of year, all help in arriving at the correct diagnosis. The differentiation of the condition from meningitis has been considered.

Treatment. If the disease be suspected the child should be isolated, put to bed, kept absolutely at rest and any nasal discharges destroyed. A preliminary purge and milk diet are given. Nasal feeding is necessary if there are any signs of bulbar palsy. We know no drug which will certainly arrest or cure the condition. Urotropin is excreted as formaldehyde into the cerebro-spinal fluid, and will neutralize the virus experimentally. It should, therefore, be given in two or three grain doses thrice a day, and a similar dose of potassium iodide may be given in the hope of diminishing the vascular phenomena of the disease. An important preventative of broncho-pneumonia is to ensure the cleanliness of the mouth. If the legs are involved the weight of the bedclothes should be borne by cradles to diminish the liability to foot-drop. The limbs should not be moved much in the early stages, because of the extreme pain caused. Passive movements and massage should be started as soon as the pain permits and be continued for months.

When improvement begins the patient must be encouraged to use the weakened limb. The diet should be nourishing, and iron and strychnine should be administered. Electrical treatment is less useful than massage, but it has the advantage of making the child use the limb. A rough estimate of the amount of ultimate recovery can be made at this stage; the prognosis is good if there is no "reaction of degeneration" in the paralysed muscles at the end of two weeks. Great care must be taken to prevent deformities, light splints being used when necessary.

In the final stages the limb must be protected against cold and injury. In the lower limb some form of orthopaedic apparatus may be necessary for support and to allow walking. Lightness is an essential feature in all such instruments. If one leg becomes shortened, carefully made and frequently altered boots must be worn to prevent scoliosis. Other purely surgical procedures may be necessary

to improve the power of the limb, etc., *e.g.* tenotomies, tendon grafting and nerve transplantation. Arthrodesis is sometimes necessary before any form of instrument can be worn. Very rarely amputation of a limb is required.

L. P.

CEREBRAL PALSIES

These palsies are divided into two groups—congenital and acquired.

Congenital Cerebral Palsies.—The majority are due to an atrophic sclerosis of the cerebrum and not to injuries during labour. Other causes are cysts, vascular disease, and absence of a part of the cerebrum.

The distribution of the palsy is usually diplegic, but it may be paraplegic (Little's disease), even hemiplegic or monoplegic. The face is very little affected, but the limbs are characterized by weakness and marked rigidity; they may show athetosis or tremor, and all their reflexes are exaggerated. The rigidity may affect the back and neck muscles, causing opisthotonus and head retraction. The power of sitting up and of walking is very much delayed; indeed, spasticity may be so extreme as to render the latter impossible. When walking is possible the gait is very spastic, the toes are pointed, and often "cross-legged" or "scissor gait" is seen. Contractures are common and some wasting is frequent.

Combined with the paralysis there is mental deficiency varying from a slight degree to absolute idiocy; speech is defective or absent, and fits are frequent occurrences.

Prognosis. Some mental and physical improvement always occurs, but nothing like complete recovery is ever seen. Fits may cause a fatal termination at any time.

Diagnosis. This has to be made from—

1. *Acquired Cerebral Palsies.* There is little difficulty when the disease is noticed soon after birth, but in mild cases, which are not noticed until the child should show signs of walking, the diagnosis may be difficult. A diplegia, the presence of mental defect and the absence of a history of an acute illness are points in favour of a congenital palsy.

2. *Spastic Paraplegia from Spinal Caries.* The spasticity may be very marked, but there is an absence of mental defect, and a history of normal walking before the onset of the paralysis.

3. *Poliomyelitis.* The palsies in this disease are always flaccid and not spastic.

Treatment. This must be undertaken in two directions—

1. *Mental.* By careful training quite fair results may be obtained, and the children can be taught to do some useful work. With this improvement in the mental condition there is

a corresponding diminution in the degree of spasticity.

2. *Physical.* Massage and exercises are useful in the mild cases. Attempts should be made to prevent contractures; if these have already developed, tenotomies may be necessary. Sometimes, when the toes are so pointed that walking is impossible, a tenotomy will enable the child to become plantigrade, and thus learn to walk. Division of the posterior nerve-roots has given good results in cases of extreme spasticity with little mental defect.

Acquired Cerebral Palsies.—These palsies appear after a period of normal development, and are usually hemiplegic in type. The causes of "infantile hemiplegia" are rather obscure, they probably include vascular disease, syphilis, post-infective thromboses, acute polioencephalitis, small hæmorrhages following convulsions, emboli, etc. Acquired cerebral diplegia is generally a symptom of more obvious brain disease, as meningitis or tumour.

The onset is usually with malaise, fever and a single convulsion or a series of convulsions, which may be more severe on, or even limited to, the side eventually paralysed. After consciousness returns a hemiplegic weakness is discovered. The face recovers more than the leg, and the leg than the arm. Later spasticity develops in the leg and arm, and there may be some degree of athetosis. Contractures giving rise to talipes may appear in the leg. Marked mental defect is unusual.

Prognosis. The degree of improvement that occurs has been indicated. Epileptiform attacks may supervene and be the cause of death.

Diagnosis. This is usually easy. The separation from the congenital form has been discussed; diagnosis from poliomyelitis and the paraplegia of spinal caries may also be required, as in the case of the congenital palsies. Other causes of hemiplegia in children, *e. g.* meningitis, tumour, abscess, etc., are not often a stumbling-block, since they frequently give characteristic signs—optic neuritis, headache, wasting, otorrhœa, etc. It is worth while remembering that chorea is the most frequent cause of hemiplegic weakness in childhood.

Treatment. This should follow the lines laid down for the congenital cases. Antisyphilitic treatment should be adopted if there is any suspicion of the disease being of syphilitic origin.

There is a special variety of acquired cerebral palsy to which a few words must be devoted.

Amaurotic Family Idiocy.—A family disease which appears to be limited to the Jewish race. The first symptom is a progressive weakness of the neck muscles, appearing from the third to the sixth month, and followed by spasticity of the limbs. Blindness then gradually develops.

On examination of the retina double optic atrophy is seen, and a cherry-red spot occupies the position of the macula. This appearance is absolutely characteristic of the disease. Death occurs at about the second year, and the brain then shows characteristic histological changes. L. P.

ENURESIS

Enuresis, or incontinence of urine, may be regarded as a symptom of: (1) some general disease; (2) an organic lesion of the urinary tract; (3) as a manifestation of a general nervous instability, which may be either inherited or acquired.

In this article we are not concerned with the first two headings, but, in so far as enuresis is occasionally the earliest and most prominent symptom of certain diseases in early life, it is essential for purposes of diagnosis that such diseases should receive some mention.

Thus enuresis may be the first indication of diabetes or nocturnal epilepsy. It sometimes ushers in tuberculous meningitis, and it is a prominent feature in the compression myelitis of spinal caries. Late control of the bladder is one symptom of mental deficiency.

Under the second heading are included such conditions as balanitis, vulvovaginitis, cystitis, whether catarrhal in nature or due to infection, tuberculous disease of the bladder and kidneys, vesical calculus and chronic interstitial nephritis.

Congenital malformations and atony of the sphincter may rarely be causes.

Chronic diarrhœa, constipation, chronic intestinal dyspepsia and threadworms are not infrequently associated with enuresis. In some of these cases the urine is exceedingly acid in reaction, in others the *B. coli* may be detected; in many no change is apparent.

Abnormal states of the urine, such as hyperacidity, phosphaturia and excess of uric acid are held to be causes of enuresis; while phimosis, adenoids, errors of refraction, and other peripheral irritative lesions have also been blamed.

These two latter groups can scarcely be regarded as direct causes of enuresis. They act either by producing a general weakening of the nervous system, or they tend to upset the balance where nervous instability already exists. In either case any functional nervous disorder, not necessarily enuresis, may be the result.

When all these causes have been dismissed there still remains a large group of cases in which no symptoms of organic disease are evident and in which no local or peripheral irritation can be called into account. These cases constitute nervous enuresis proper.

The subjects of this type of enuresis are usually emotional, nervous children, the off-

spring of neurotic parents, sufferers from migraine, habit-spasm, night-terrors, and somnambulism. In some cases one or more of these functional disorders may complicate the enuresis.

Others come of a rheumatic stock or have suffered from rheumatism or chorea. Occasionally enuresis may herald an attack of rheumatism.

This functional enuresis may date from birth or be of recent origin. It may be nocturnal alone, or both nocturnal and diurnal—more often there is enuresis by night and frequency by day. Very rarely it is accompanied by incontinence of fæces.

Treatment. For the treatment of the diseases included under the first two headings reference must be made to the special articles on those subjects.

That of functional enuresis, to be successful, must be both general and local. General treatment must aim at removing all causes which may intensify or perpetuate the nervous instability already present. Thus dyspepsia, diarrhoea, constipation and thread-worms can all be cured by careful regulation of the diet and the administration of suitable drugs. Adenoids, phimosis and errors of refraction, when giving rise to symptoms, may be removed or corrected as the case may be. Cure of enuresis should not be promised, however, from such measures; no operation is beneficial to the highly nervous child, while unnecessary circumcision has aggravated or been the starting-point of enuresis. Careful inquiry should be made as to hours of sleep, exercise, work and regularity of mealtimes. Sufficient rest and a fair quota of outdoor exercise should be insisted upon. Excess of food of any one variety, especially starchy, should be corrected. Fluids may be given freely during the day, but not after five o'clock at night.

The child should always be made to pass water before going to bed, and he may be roused again when his parents retire. Raising the end of the bed, a hard mattress and light bedclothes are recommended.

Boarding-school is out of the question, it exposes the child to the ridicule of his school-mates and the sometimes thoughtless cruelty of a teacher. With nocturnal enuresis, day-school is permitted, but over-pressure must be guarded against. Change of air and scene, and removal from unsuitable home-surroundings are sometimes beneficial. Punishment should always be avoided.

When general measures fail they may be supplemented by local treatment with drugs. Of these belladonna is still the most valuable. It should be given in a preliminary small dose of \mathfrak{M} v t.d.s. to ensure that no idiosyncrasy exists,

and it can then be rapidly increased until fifteen to twenty minims are being administered four times a day. When the latter quantity is reached but little benefit will accrue from larger doses. Under this treatment enuresis may suddenly or gradually cease. When it has quite ceased the drug should be continued for a further period to ensure permanency of cure. In some cases belladonna fails, or only decreases the number of occasions. Other drugs may then be tried apart from, or in combination with it. Such are: tinct. lycopodii (\mathfrak{M} v-xv); ext. rhus arom. liq. (\mathfrak{M} v-xv), or ext. ergotæ liq. (\mathfrak{M} xv-xxx), and tinct. nucis vom. (\mathfrak{M} ii-v); bromides (gr. v-x); ext. thyroid. (gr. ss-ii); phenazone (gr. ii-v); all of which may be given to children between three to twelve years of age, the dose being graduated according to age and gradually increased. Where there is frequency during the day tinct. hyoscyam. (\mathfrak{M} v-xx) and potass. citrate may be tried. Where there is possibility of infection, ammon. benzoate (gr. ii-v) and urotropin (gr. ii-v) will be found useful.

Aspirin is worthy of trial in rheumatic cases and will sometimes unexpectedly effect a cure. When this occurs, active rheumatism should be suspected and the heart be carefully examined.

Prognosis. Most cases of this complaint cease naturally between ten and fourteen years of age. A few, usually females, persist to adult life. A cure is more easily effected in cases of recent occurrence than in those where control has never existed. A recurrence is generally more difficult to suppress than the original attack.

Where general measures and belladonna have been properly applied and failed the outlook is not very good. E. B. S.

DISORDERS OF SPEECH IN CHILDHOOD

The age at which children begin to speak is very variable. In an average child comprehension of spoken words begins at the end of the first year, and at this period there is also use of words of the child's own invention, without significance. Early in the second year children imitate words without understanding them—echolalia—whilst speech proper usually begins at about eighteen months, but may be delayed until the end of the second year. Girls are said to talk earlier than boys.

Delayed Speech Development occurs under a variety of circumstances. The two factors essential for speech are perception, on the sensory side, and expression, on the motor. The main sensory functions are audition and vision, but in addition there must be, to ensure accurate reproduction, perception of the necessary

muscular movements of articulation. In cases of speech defects the auditory centres may be affected, the visual-perceptive centre, or the connections between the centres, and, in another class of cases, the intellect which co-ordinates the lower centres may be defective.

The main causes of retardation are—

1. *Simple Delay.* Here it is impossible to draw any hard and fast line between the normal and the pathological. There are some cases where the onset of speech is delayed a year or eighteen months for no obvious reason, in exceptional cases up to six or seven years of age. When the child does begin the commencement may be sudden and the progress rapid.

2. *Intellectual Deficiency.* Every variety and degree of deficiency of speech is to be heard in the case of idiots and imbeciles, from complete dumbness, through inarticulate sounds, to nearly normal speech.

3. *Deafness.* This is probably the commonest cause. The deafness may be congenital or acquired; about fifty per cent. of cases of deaf-mutism are due to acquired deafness. The underlying factor in the latter is usually otitis media; occasionally they may be the sequel of basic meningitis. The deafness need not be absolute.

4. Occasionally persistent dumbness may be followed by *Idioglossia* (*q.v.*). The writer has seen a child of five who had never spoken, and who later developed typical idioglossia.

5. *Congenital Word-deafness.* Here the child may be said to have a "deaf brain"; it hears speech but cannot understand it, whilst obviously not an idiot. There appears to be no adequate connection between the auditory centre and that part of the brain which serves the purpose of interpretation. The child, while evincing no comprehension of speech, possesses evident intelligence, and may display interest in other, *e.g.* musical, sounds. The normal visual-perceptive centres may later, and under influence of tuition, come to the child's assistance, so that it may learn to associate certain sounds—*e.g.* the names of objects of daily use—with things it can see, although remaining entirely unresponsive to auditory speech-impressions apart from their visual associations.

6. *Congenital Word-blindness.* This condition, which in various degrees is probably less uncommon than might be supposed, more often occurs as a cause of backwardness in later childhood than as a cause of retarded speech, but as it is sometimes associated with a certain degree of word-deafness and with inability to read—*alexia*—it is not out of place to consider it here. There is a congenital defect in the visual memory for words and letters, or an inability correctly to associate sounds and ideas with the written symbols of the same. There

would appear to be an inefficient intercommunication between the visual, auditory and articulatory centres.

Boys are more often affected than girls; hypermetropia, sometimes of high degree, is a common accompaniment. The children are intelligent, but have great difficulty in learning their letters or to read; although in other respects memory is good, it appears to fail in storing visual images of words. Some children can understand written words, but cannot read aloud; in such cases the defect is a motor one in rendering visual characters into sound.

Congenital word-blindness, especially in its slighter forms, is apt to be mistaken for mere stupidity and apathy on the part of the child.

The *treatment* of cases of delayed speech varies with the cause. Simple delay requires none. That due to mental deficiency or deafness is considered under *Deaf-mutism*. In congenital word-deafness and word-blindness the visual and auditory centres respectively must be educated to supply the deficiency; in the latter case constant repetitions of visual impressions may result in the right angular gyrus taking on the function of the left.

Loss of Speech is a neurosis which has been recorded as a sequel of fright, in chorea and typhoid fever.

Stammering is separately considered, see *Stammering*.

Faulty Speech.—Certain articulatory defects are normal to infancy and are familiar to all; they only need consideration when persisting into later childhood. Vowels rarely give rise to any defects; of consonantal mispronunciation only a few of the commonest need be mentioned.

Lisping or mispronunciation of the S sound is normal to childhood and a common defect in later life. The sibilant sound, mute as in S and soft C, voiced as in Z, is produced by the concentration of the expired air upon the edge of the lower teeth, the tongue being longitudinally grooved, gutterwise. The commonest fault in connection with this sound is the overprotrusion of the tongue between the teeth, whereby the S becomes Th—"interdental sigmatism." Another, not uncommon, but mostly unrecognized distortion of the sibilant sounds is the partial or complete substitution for them of the L sounds. In the L sound the tip of the tongue is placed behind the upper teeth and the air escapes on each side of it—the Welsh Ll represents a mute L followed by a voiced one, the mute L not being represented in the English language. In this form of lisping—"lateral sigmatism"—the air-stream is allowed to escape over one or both of the sides of the tongue, out of the corner of the mouth. Sometimes there is a corresponding dental

deficiency. If bilateral, an L or mute L sound results, according to whether the intended sibilant was voiced as in "Zebra" or mute as in "Sun"; if unilateral, the sound is half S, half L. One of the most peculiar forms of S distortion is the so-called "nasal sigmatism," in which the S sound is replaced by an air-blast through the nose, producing the effect of a cleft palate, the palate failing to shut off the nasal cavity. It is a purely functional disturbance. The writer has seen several instances, mostly ascribed to palatal paralysis, which is not present. The sounds of S, Sh, Z and Zh are involved.

Rarely the sibilants are replaced by the guttural Ch, as sounded in the German "ach."

Substitution of the W, or less often of the L, sound for R is a normal part of speech development, but may persist. In other cases the guttural French R is substituted for the trilled English R.

Nasal speech affecting all sounds not uncommonly follows upon diphtheritic paralysis, the disturbance of speech remaining as a habit long after the palate has resumed its proper function. The same result is by no means rare after operation for removal of tonsils and adenoids. The action of the palatal muscles is interfered with by injury during operation or inflammatory effusion afterwards, preventing occlusion of the nares. The habit then persists; the writer has seen it many months after operation.

Idioglossia.—This peculiar condition, which was first described by Dr. Hale White and Mr. Golding Bird in 1891, is unhappily named. The impression given at first to any one unfamiliar with defects of speech is that of an artificial and individual language, which is quite unintelligible to any but the child's parents. This is, however, very far from being actually the case. These children would appear to have a bad ear for speech and cannot correctly reproduce the sounds they hear. Analysis of these cases, of which the writer has seen a large number, showing that they must be fairly common, brings out one or two main points. (1) There is no mental deficiency, on the contrary most of the children are bright and intelligent. (2) There is no defect of the motor apparatus of speech. (3) Hearing is normal. (4) The speech, which sounds so unintelligible, is normal English distorted; the child attaches a definite and accurate meaning to each word; each word, if carefully analysed, is found to bear a resemblance, more or less close, to the real one; the syllables are right in number and the accentuation of the word correct. The vowel sounds are usually very nearly, if not completely, accurate, but the supply of consonants is inadequate. The only way of analys-

ing such speech is to draw up a complete schedule of common words with every sound represented as initials, medials and terminals, then make the child read them if old enough (they can read quite well), or name the objects; the letters of the alphabet afford a totally inadequate test. It will then be found that a large number of the consonant sounds are altogether missing, and that the few which are present have to do duty for all. Terminal consonants are almost always dropped. Individual cases have their peculiarities, and the same sounds are not always absent, whilst some children have a larger stock than others.

The probability is that there are all grades of faulty speech, from the exaggerated condition known as idioglossia down to mere distortion of individual consonants described above; the difference is rather one of degree than one of kind. The children learn to read and recite quite easily, and they understand their own reading if no one else can.

That idioglossia is an unfortunate term is evidenced by the fact that the children's parents and the other children of the family can usually understand the speech readily. Any detailed description of individual cases would be beyond the scope of this article. These children may be very late in commencing to talk and may be apparently mute, though not deaf.

Treatment is not easy, the ear for speech seems so bad that even protracted attempts to teach the child the proper production of the faulty sounds appears to have little effect. With the lapse of years, however, they generally improve. The writer has seen one or two cases at intervals for a number of years, and improvement, if slow, has been steady. At any rate, although the cases in childhood are not at all rare, they are not often seen in adult life, so that presumably they get well. A patient mother or governess can do much to improve the speech by constant repetition and correction. E. P.

SLEEPLESSNESS IN CHILDHOOD

Quiet, undisturbed sleep is one of the signs of perfect health; almost anything which upsets the general health of a child may give rise to disturbed sleep. A healthy child will never sleep too much; but drowsiness is an important symptom of some diseases of the brain. A newly-born baby will spend nearly nine-tenths of his time asleep, while at six months he should sleep sixteen hours in the twenty-four.

Children from about six months to three years of age, when in perfect health, almost invariably sleep with the forearms flexed and the backs of the hands resting on the pillow near the shoulders. An early sign of ill-health in such

children is frequently an alteration in this position of the arms during sleep, and a return to health will be heralded by a resumption of this habit.

Sleeplessness in infants often owes its cause to improper food, or to the manner in which the food is given. Colic is comparatively common even in breast-fed children; the child during an attack is restless, screams violently, and has an agonized expression, the thighs are drawn up against a hard and distended abdomen. The spasm is frequently relieved when wind is passed, either by the mouth or bowel. The discomfort of chronic indigestion, without actual colic, may also disturb the sleep; either may be due to (a) faulty composition of the milk mixture or unsuitable artificial food; (b) irregular or too frequent feeding—a child who is fed several times during the night is invariably a bad sleeper; (c) too rapid or too slow feeding; and (d) in bottle-fed babies, cooling of the milk during the feed.

Crying at night may result from habit, insufficient or too heavy clothing, causing irritation of the skin, cold hands or feet, a soiled napkin, want of fresh air or of darkness in the room, lack of outing and exercise during the day. Adenoids obstructing free respiration, and anything which restricts the free and easy movement of a child in bed, may interfere with peaceful sleep.

Scurvy, syphilis, earache, ulcerated mouth and teething may occasion recurrent pains, especially at night, the infant not infrequently waking with a sudden sharp cry. These night-pains in older children may be the earliest manifestation of Pott's disease, or of tuberculosis of a joint or bone. In children of more advanced years sleeplessness is wont to follow late meals or excessive mental or bodily exertion just before going to bed; it is, indeed, often the first sign that work at school is proving too much for the child's strength, or that there is some error of refraction needing suitable glasses for its correction. The possibility of irritation by intestinal parasites or phimosis must be borne in mind.

Night terrors are met with in children between the age of two and ten years. Two distinct forms may be recognized. In *nightmare*, resulting from a late meal, adenoids or excitement before going to bed, the child suddenly wakes with a cry in a state of fear; he is able to recognize those about him, and it may be some time before he will again fall asleep. These attacks, not of themselves of serious import, generally occur early in the night. In true *pavor nocturnus* the child starts suddenly from a peaceful sleep, having seen a horrible vision; he is unable at first to recognize persons about him, and he may fall asleep again without

fully regaining consciousness. Such attacks must always be taken seriously, for, according to Coutts, they may be followed by other nervous affections such as migraine, epilepsy or insanity. They are most frequently seen in children of "nervous" parents, and in those who have had convulsions in infancy. The occurrence of a nightmare will often be remembered as a bad dream by the child on the following day; a true "night terror" usually leaves no such memory.

Somnambulism is seldom met with in children under ten years of age.

Treatment. Since sleeplessness is in the vast majority of cases only a sign that the child is not in a perfect state of health, it follows that the successful treatment of the condition resolves itself into the discovery and removal of the cause of the ill-health. Thus the diet and feeding must be carefully gone into. The child must be put to bed regularly at a reasonable hour, in a well-ventilated darkened room; he must not be overloaded with bedclothes—a well-covered hot-bottle in the bed is often an excellent sedative. A warm bath or warm sponging often gives excellent results.

Sleeplessness, so often the result of bad training, bad handling or of exciting surroundings, may frequently be overcome by placing the child under the care of a quiet, sensible nurse. Under no circumstances must sleep be induced by the use of soporific drugs, except in the case of severe acute disease. When due to pain, particularly in the early stages of pneumonia or of pleurisy, two or three leeches are preferable to any opiate. An enema, or the application of warmth to the feet and abdomen, is the best immediate treatment for an attack of colic. Trional, phenacetin, and codeine are the drugs to employ during an acute febrile disease when other means fail. For the insomnia which follows the occasional visit to the pantomime or a party, ammonium bromide may be given at bedtime in a single dose of fifteen to twenty grains.

In the treatment of "night terrors" a change in the child's habits and surroundings is often imperative, while any sources of "reflex irritation," such as adenoids, enlarged tonsils, phimosis, worms or constipation, must be removed. If associated with gastro-intestinal disturbance, the carbohydrate constituents of the diet should be limited and an alkali may be prescribed two hours after meals. Where the attacks are frequent, ammonium bromide should be taken at bedtime, and a cold sponging carefully given at the same time is followed by excellent results in some cases. In the case of nervous children a sense of confidence is obtained by the knowledge that another person is sleeping close at hand. A. E. G.

HEAD NODDING (SPASMUS NUTANS, GYRO-SPASM) AND NYSTAGMUS

Spasmus Nutans is an affection commencing in early infancy (fourth to twelfth month), characterized by oscillation of the eyeballs and movements of the head, attributed to defective co-ordination between the actions of ocular and cervico-cranial muscles.

Varieties. Spasmus nutans and nystagmus may be (1) acquired, (2) congenital, familial and hereditary.

Acquired Form.—The *head movements* may be rolling, nodding or from side to side. The nystagmus may be horizontal, vertical, oblique or convergent, binocular or unocular. The movements of head and eyes usually coincide, but do not always correspond in character with each other. Vertical nystagmus, for instance, may coexist with horizontal head movements. As a rule the head and eye movements commence together, but movements of each may precede or succeed those of the other.

Nystagmus may increase, or occur only when the head is steadied. When unocular, the head movements may cease when the affected eye is covered. The child often looks sideways at objects, as though it were hemianopic.

Exciting Causes. Spasmus nutans and nystagmus are most common in the winter months. They have been attributed to darkness itself or to eyestrain and fatigue of the retina owing to the child's attempt to fix a bright light in a dark room. A large proportion, though not all, of the patients are rickety, and rickets is supposed to retard the development of co-ordination in such cases. The affection does not seem to impair general health, and there is no reason for imputing it to dentition or gastro-intestinal disorders. General nervousness and hyper-sensitiveness to noise have been noticed in some cases. Intelligence is not impaired.

Diagnosis. Nystagmus in early infancy may be due to defective visual acuity resulting from local conditions such as microphthalmos, optic atrophy, albinism, cataract, choroido-retinitis and keratitis, but in such cases movements of the head are absent. In later childhood nystagmus without head movements may result from polioencephalitis, hydrocephalus, cerebellar tumour and Friedreich's disease. Insular sclerosis is not a cause of nystagmus until after the age of puberty. Imbeciles, especially of the Mongolian type, often exhibit permanent nystagmus.

Prognosis and Treatment. The movements of the head and eyes usually subside spontaneously towards the end of the second year. Relapses are not uncommon. Special treatment as a rule is unnecessary, but attention

should be paid to diet when rickets is present, and to general principles of hygiene.

Congenital, Hereditary Nystagmus and Spasmus Nutans, like other hereditary affections, is usually transmitted through the female to the male offspring, but sometimes it descends from either parent and affects both sexes. In the latter case, according to Nettleship, movement of both head and eyes are present, in the former nystagmus exists alone. But there are exceptions to this rule.

Visual acuity is always defective, the iris is blue and the fundus pale. Nettleship therefore regards the condition as a mild form of albinism. Intelligence and physical health are as a rule unaffected.

The movements persist, but tend to decrease in adult life. Suitable glasses should be prescribed, but other treatment is useless.

Nystagmus Myoclonie.—Lenoble and Aubineau have described under this title a form of hereditary, congenital and familial nystagmus, which they attribute to an isolated myoclonus confined to ocular muscles. It is not necessarily associated with mental or other physical defect. It is, however, a minor and mono-symptomatic form of a group of diseases accompanied by generalized myoclonus and nystagmus, and including Friedreich's paramyoclonus, Morvan's fibrillary chorea, Gille de la Tourette's tic, all of which may be associated with stigmata of degeneration and defective intelligence. L. G.

MORBID HABITS IN CHILDHOOD

Head Rolling or Head Rubbing is commonly practised by children under two years of age. The back of the head is firmly pressed into the pillow and slowly rubbed from side to side until the occiput may be worn bald. The children are often rickety, and the probable explanation of the habit is that their heads sweat and contact with a hot moist pillow causes itching, which is relieved by friction. The movements only occur when the child is lying down, and are obviously voluntary, which distinguishes them from *Spasmus Nutans* (*q.v.*). Treatment consists in supplying a bran cushion with a slight depression in the centre, instead of a soft and downy pillow. Rickets should be treated in the ordinary manner.

Otitis media is occasionally the cause of head rolling, but in such cases, fretfulness, irritability and signs of pain are present.

Head Banging.—Neurotic children, sometimes when in a fit of temper and sometimes without apparent emotional disturbance, will bang their heads with their fists, or strike them against the wall or floor. They appear to derive satisfaction from this alarming habit, and the writer has never known it to result in injury.

It was, however, in one case frequently practised by a boy suffering from cerebellar tumour, and may have been an attempt to relieve headache, though as a rule "head bangers" seem to be singularly insusceptible to pain.

If the habit seems to be a pure neurosis it can be cured by prevention.

Hair Pulling and Swallowing.—Children will sometimes pull out tufts of hair because it comes out easily in consequence of alopecia or other morbid condition of the hair or scalp. But the habit may be acquired apart from such local affections.

A number of cases have been recorded in which hair has been torn out, or the ends nibbled off and swallowed until hair balls have been formed in the stomach, as in the case of Angora cats and cattle.

In some instances of hair swallowing the removal of a felted mass of hair from the stomach by operation has explained and cured mysterious wasting, vomiting, diarrhoea and severe abdominal pain. The presence of a hard mobile tumour in the epigastric area in children known to be addicted to the habit calls at once for surgical treatment. Preventive treatment consists in shaving the head.

Pica or dirt eating occurs as a neurosis in children between the first and second year and upwards. Earth, cinders, plaster from the walls, paper or wool from the blankets may be consumed with avidity. Ordinary food is refused and the patients become thin, sallow and unhealthy-looking, and suffer from colic and diarrhoea. The habit may be set up by constipation or indigestion and rarely by worms.

It is usually curable by prevention and by procuring free evacuation and supplying wholesome food and tonics to improve digestion.

The habit may be associated with mental deficiency.

Thumb Sucking.—Inveterate thumb sucking has become less common since the introduction of "comforters." Prolonged suction of either may be responsible for projecting teeth and narrowed jaws, and sometimes for "airswallowing." In addition, the thumbs may become sodden and shapeless in consequence of suction. Yet most babies require to suck something, and the practice, in moderation, no doubt promotes development of the salivary glands and stimulates digestion. The question of thumb "versus" comforter may be decided in favour of the former; for the thumb can be kept fairly clean, whereas the "comforter" cannot.

Some children enhance the soothing effect of thumb sucking by manipulating the lobe of the ear or scratching the side of the head meanwhile. Possibly in this manner they stimulate the vagus indirectly through its auricular or some other branch.

Thumb sucking has been regarded as akin to masturbation, and although the processes are not strictly analogous, thumb sucking, in accordance with Freud's views, may be an "autoerotic" manifestation. Excessive stimulation of the "oral erogenous zone" by prolonged thumb sucking may perhaps interfere with the evolution of other erogenous zones on the development of which normal sexual instincts depend.

However this may be, it is desirable on other grounds that the habit should be broken during the second year. The difficulty is often considerable in the case of neurotic children, who may keep up the practice even so late as the eighth year. Even when apparently cured for many months, any trivial illness or emotional excitement which renders them wakeful at night may cause a relapse.

In such cases, when preventive measures—such as application of aloes, muffling the hands or strapping light splints to the upper extremities—fail, or cause much mental discomfort to the child, bromide in ten-grain doses may be given half an hour before bedtime. In inveterate cases treatment by mental therapy may be useful.

A child aged eight who defied all the usual methods of treatment was cured of the habit by a dentist who supplied a gold wire regulator contrived to press painfully on the hard palate whenever the thumb was sucked. This method had also the advantage of correcting the deformity of the teeth and jaws which had resulted from the habit.

Air Swallowing ("Wind Sucking"; **Aerophagia**) is a rare cause of flatulent distension of the stomach and discomfort in young children. The air may be sucked through a perforated rubber teat, and the child's habit may be checked by depriving it of its 'comforter.'

More commonly, wind sucking is a habit acquired in later life in the effort to relieve indigestion by eructation. Neurotic dyspeptics are sometimes unaware that the air which they belch at will has been previously swallowed and is not, as they imagine, generated in the stomach. Treatment consists in explaining matters and persuading the patient to abandon attempts to "bring up wind."

Nail Biting is usually regarded as a sign of bad temper, and the habit is certainly rare in placid people. When the use of bitter aloes or gloves fails to break the habit, it may be prevented by crowning some of the back teeth, so that the incisors do not meet closely enough to allow nail nibbling. As keratin is readily soluble in the intestinal juices the danger that nail fragments when swallowed may set up irritation is remote.

Tongue Sucking is a common trick in imbeciles, especially of the Mongolian type, and is occa-

sionally practised by neurotic children of normal intelligence.

Teeth Grinding rarely occurs in waking hours except in imbeciles of the busy, restless type, who sometimes practise it until the teeth are bevelled flat. It is a common symptom in night terrors, and in disturbance of sleep from digestive disorders. It is probably therefore a manifestation of a dream in which anger or rage is the prominent feature, rather than an indication of actual pain in teeth, head or ears. It is frequent in the periods of semi-consciousness which precede the final stage of coma in meningitis, but does not occur in intervals of consciousness, although headache may be excruciating. It is a well-known symptom of "suppressed" gout in adults who sleep badly and suffer from night terrors and dyspepsia though not from toothache at the time.

Gastro-intestinal disorders are perhaps the most frequent cause in children, and the popular belief that teeth grinding is a sign of worms is occasionally correct.

Its prevalence in gouty subjects has caused it to be regarded as evidence of the "uric acid" or arthritic diathesis in children. But although the arthritic and neurotic temperaments are closely allied, the neurotic element probably has more to do with the causation of teeth-grinding than the arthritic. Children who grind their teeth in sleep are usually neurotic, but not necessarily gouty. Attention to diet and digestion and observance of the ordinary rules in the management of neurotic children will usually put a stop to teeth-grinding. Constipation should be corrected and worms evacuated if their presence has been ascertained.

Merycismus (Ruminatio; "Cud Chewing").—The curious habit of regurgitating and chewing food may date from early childhood, or may be developed between the tenth and twentieth years. In some cases it has been hereditary, and has been traced backwards through five generations in one family (Brockbank). It may be acquired by imitation or follow indigestion or some other illness. The habit is partly involuntary but may be controlled by the will. It is practised a few minutes after a meal and may continue for an hour or more, especially after ingestion of meat. Ruminators as a rule do not complain of any unpleasantness associated with their habit unless the stomach is out of order. Should treatment be desired, an easily digestible diet and slow mastication should be prescribed.

Holding the Breath (Hysterical Laryngo-Spasm).—Children aged between two and four years, when in a violent passion, will sometimes hold the breath until they become purple in the face and seem on the point of asphyxiation. But after half a minute or so the spasm of the glottis, which no doubt occurs, relaxes and

the child screams lustily. A little cold water should be dashed in the face, and all fussiness and appearance of consternation should be avoided. Otherwise the child will be encouraged to hold the breath deliberately on slight provocation. Corporal punishment is the best remedy in such cases.

The emotional condition under which hysterical laryngo-spasm occurs, and the absence of inspiratory stridor, distinguishes the attacks from those of laryngo-spasm associated with tetany.

Picking and Scratching.—The skins of neurotic children are usually irritable and hyperæsthetic. They are specially liable to urticarial, erythematous, and eczematous affections, and to formication without manifest eruption, which causes them to pick and scratch until sores are produced on the surface. Formication and pruritus and also urticaria are common in damp warm weather, especially in spring and autumn. The old custom of giving "spring" or "cooling" medicine in the shape of magnesia and rhubarb is often beneficial, and the itching may be allayed by warm alkaline lotions or by dilute solutions of liq. carbonis detergens. It is also important that the underclothing should be soft, loose and non-irritating. The presence of parasites should of course be excluded.

As mentioned elsewhere, "tics" may be the result of formication and uncomfortable clothing.

Body Rocking is a habit not uncommon in children who are queer and odd in many other ways. Whilst sitting they will rock themselves to and fro twenty to thirty times a minute, sometimes making a crooning noise meanwhile and lapsing into a dreamy mental condition. They are not necessarily deficient in intelligence, though the practice is common in imbeciles, and may be seen in bears and monkeys and other animals. Somewhat similar movements in the erect position are practised by elephants and horses, and in the latter the process is known as "weaving."

Body rocking in children is harmless as a rule, but in some cases may lead to, or be a form of, masturbation.

Masturbation is not uncommon in infants of both sexes within the first year of life. It is more frequently seen in female than in male infants, and in the former it is more frequently practised to the extent of producing orgasm than in the latter. The habit is more easily recognized in infant boys than girls, because in boys actual manipulation of the sexual organ takes place, whereas in girls the effects are usually produced by "thigh rubbing." The thighs are tightly crossed and the child rocks itself to and fro, or from side to side on its buttocks, becomes excited and flushed, holds the breath or grunts, perspiration breaks out

on the head and face and is followed by temporary exhaustion. These signs of orgasm are rarely seen in infant boys; in girls they may be mistaken for those of fits or epilepsy.

Masturbation in infancy is not a sign of mental deficiency unless practised openly and persistently after the age of three years, when habits of decency and modesty should have been acquired. Secret indulgence produces more moral than physical harm. The pathological results have been greatly exaggerated. It is, however, a potent cause of neurasthenia, and wrecks the happiness of many young lives.

Treatment. All local causes of irritation, such as vulvitis, balanitis and oxyurides should receive attention. Infants should be carefully watched while awake and checked at once when signs of practising the habit are observed. Some form of mechanical restraint should be devised and worn in bed. The feet may be tied to opposite corners of the lower end of the bed, and the arms and hands confined by a sleeveless garment with a waist-belt.

It is inadvisable to caution young children against bad habits unless they are known to exist. The warning may excite curiosity and committal of the offence itself. At the school age, however, every child should be put on guard against obscenity and evil communications.

What are called "straight talks" on sexual subjects may be useful to children of both sexes at the eve of puberty. But injudicious terrorism on the subject of immorality should be avoided. The occurrence of normal physiological events at puberty may be regarded by neurotic children as evidence that sin has found them out unless such matters are explained to them. It is usually sufficient to tell healthy boys and girls that self-pollution is filthy and degrading and will unfit them for games and other pleasures. It is unnecessary to terrify them with gleanings from the advertisements of "secret remedies."

Youthful neurasthenics who worry over past transgressions need sympathy, assurance of recovery, and encouragement to occupy mind and body in healthy pursuits and recreation. Plain diet, cold baths, hard beds, early rising, regular exercise, except climbing ropes and poles, should be prescribed. Endeavours should be made to convince them that nocturnal emissions are natural events.

Tonics such as hypophosphites, quinine and iron, if anæmia is present, should be given.

Bromides are useful for excitable infants who masturbate, but not for older children. Constipation should be corrected. Circumcision in early life is the best method of ensuring local cleanliness and thus preventing balanitis, which is perhaps the most frequent exciting cause of onanism.

L. G.

INHERITED SYPHILIS

The foetus may become infected with the virus of syphilis from the father, from the mother, or from both parents. The first is the most frequent mode of transmission. The more recent the infection in either parent, the more severe are the manifestations likely to be in the child.

Symptoms. The symptoms of inherited syphilis, as described in many textbooks, are rarely seen in such severity at the present day. Signs are but exceptionally present at birth; if a syphilitic child is born alive showing any manifestation of the disease, it usually takes the form of a bullous eruption. In such cases the infant is undersized, and the bullæ, associated with reddish-brown plaques, occur especially upon the palms and soles. In the great majority of cases the child is apparently healthy at birth, and the first signs are to be noted from four to twelve weeks later; only very exceptionally does the disease remain latent through the first few years of life.

The earliest symptom is usually a rhinitis, producing obstruction to nasal respiration—the so-called *snuffles*. The accompanying discharge may be scanty or profuse, muco-purulent or bloodstained, containing small pieces of bone. Often associated are restlessness, anæmia, loss of flesh—marasmus in a breast-fed child without indigestion is very suggestive—laryngitis, leading to hoarseness of cry, and enlargement of liver and spleen.

Very shortly afterwards the *rash* appears, and this is the most constant manifestation of the disease. The characteristic situations for the eruption are the palms and soles, where it appears commonly as red-brown circular areas with a shiny, smooth surface; elsewhere it is wont to be thickly spread, on the buttocks, thighs and lower abdomen. It is more rarely seen on the forehead and around the mouth. In these dry situations the eruption is at first discrete and red in colour; later of a coppery-brown tinge and roughly circular in shape. Eruptions, other than condylomata, are almost confined to the first six months of life. The growth of hair may be arrested, or it may be excessive. *Epiphysitis*, of which the first indication is failure to move the affected limb, is met with during the first three months. If left untreated, some thickening of the epiphysis may ensue, but suppuration rarely results. The arms are more frequently involved than the legs.

Orchitis, usually seen during the first five months, is prone to be bilateral. The testicle is enlarged, hard and painless; under treatment the inflammation rapidly subsides, and the gland may subsequently develop.

During the first year *choroiditis* or *iritis* may interfere with vision; both respond readily to treatment, but are not infrequently associated with imbecility.

As a rule the temporary *teeth* are unaffected, both as regards their date of eruption and form; the permanent upper incisors are barrel-shaped, and notched with a large segment of a small circle at the incisive edge.

Later, especially in untreated cases, *gummata* may appear in the skin, palate, liver and bones. *Chronic synovitis*, affecting chiefly the knees and ankles symmetrically, and often associated with *interstitial keratitis*, may arise after the seventh year—both may be met with as late as thirty-five years of age.

Complete *deafness* may result from a specific *otitis media*. *Endarteritis* may manifest itself with cerebral symptoms or as a *nephritis*; *paroxysmal hæmoglobinuria* in children over three years of age is generally specific. Some cases of *idiocy* and of *epilepsy* are undoubtedly syphilitic in origin; *degeneration of the central nervous system* may occur at from five to fifteen years, as juvenile general paralysis of the insane or as *tabes dorsalis*, the course of which is steadily progressive, extending over four or five years. Spastic paralysis and internal *hydrocephalus* are occasionally due to specific disease.

The value of a positive Wassermann reaction in the diagnosis of inherited syphilis can scarcely be overestimated; it is present in one hundred per cent. of cases. The *spirochæta pallida* may be easily demonstrated in *condylomata*.

Treatment. Should a pregnant woman become infected with syphilis she should receive, during the primary stage, two intravenous

injections of salvarsan. If secondary symptoms be already present, mercury must be administered in addition and continued throughout the pregnancy. If this course be adopted the child will show no signs of the disease. The case of a syphilitic mother who has borne syphilitic children should be met with three injections of salvarsan, and she must be given mercury during any succeeding pregnancy. The results of this method of treatment are hopeful, but cannot be definitely stated at the present time.

The treatment of inherited syphilis by mercury should be continued for one year at least, and, if the symptoms are severe, for double that period. The drug is given by the mouth whenever possible; in the case of infants, three-quarters of a grain of grey powder three times a day, combined, if diarrhœa be present, with *pulv. cretæ aromat.* When rapid mercurialization is imperative, as in dealing with *epiphysitis*, *orchitis*, *iritis*, etc., thirty grains of *unguentum hydrargyri* may be gently rubbed into the skin, once a day, in addition to the oral administration.

Lotio nigra should be applied to *condylomata*, and, diluted one part in four with lime water, may be dropped into the nostrils in snuffles. When the general condition of the child has improved under this treatment, an intramuscular injection of salvarsan may be given; the dose should be .001 gramme per kilo weight. For the later manifestations, such as *gummata*, *periostitis* and *keratitis*, potassium iodide, in doses of from ten to thirty grains, should be combined with the mercury; in *keratitis*, *ung. hydrarg. ox. flav.* may be the local application; salvarsan is useless in the treatment of this stage of the disease.

A. E. G.

III.—INSURANCE PROBLEMS IN PRACTICE

Assurance is the term usually applied to insurances on persons' lives, and the object of it is to guarantee the payment of a certain sum or sums of money to the assured, his representatives or assigns, at his death or at the expiration of some period of time after the policy is taken out. To qualify for the benefits of the assurance certain sums of money, or premiums, are paid at varying periods of time over varying numbers of years.

There are several forms of assurance policies, the simplest of which is that by paying annual premiums a lump sum of money, often with a bonus added, is payable on the death of the assured to his representatives. This is known as a *whole-life policy*. The premiums may be paid until the death of the assured person or for a limited number of years.

Endowment policies are terminable, and the sum assured payable, after any number of years agreed upon, generally about the age of fifty or sixty, or on the death of the proposer, if this occurs before the determined age.

Term policies are taken out for any number of days, weeks, months or years, but not as a rule for a longer time than ten years. They are often meant to cover the extra risks of a journey abroad, or to guarantee a borrowed sum of money in case of the borrower's death before payment of his debt.

Joint-life and partnership assurances generally deal with two or more lives, the sum assured being payable to the survivor or survivors on the death of the other party to the policy.

Contingent and survivorship policies are taken out to assure the life of one person or more persons against the life of another, the money being payable only in case of the death of the assured during the lifetime of the other person.

Deferred Assurance Policies. These policies provide for the risk of the assurance being deferred for a certain number of years. For instance, in the case of young children, where it is illegal to take out policies on their lives, the parent or guardian can provide for their future by taking out a policy for the child, the sum assured being payable only in event of the child dying after the age of twenty-one years has been attained. The premiums are payable from the time the policy is taken out, and may be for the whole life or limited to a certain number of payments. The policy may be either a whole life or an endowment policy.

Pure Endowment Policies. These policies are to provide for a certain sum to be payable

at the end of a certain period, only in event of the beneficiary being alive at the end of that period. There is no risk on the life of the beneficiary, and in case of his or her death before the end of the period the premiums paid are returned either with or without interest. No medical examination is necessary for these policies.

Educational Policies. A very useful policy is one which provides for a sum of money becoming payable at the time when schooling expenses commence, either as a lump sum or in annual payments extending over a certain period, say five or seven years. Thus in the case of a child aged one next birthday a sum of £500 could be made payable by five annual instalments of £100 each, the first instalment becoming payable at the end of, say, fourteen years, for an annual premium limited to fourteen payments. If the child were to die before the end of the fourteen years the policy would cease and the premiums paid be returned with or without interest. The premiums can be made to be dependent upon the father's life and cease at his death if that occurs before the period at which the payments commence, the money becoming payable at the end of fourteen years, as before, but this would necessitate the father being medically examined.

As the company which guarantees these payments takes the risk of the assured dying before it is recouped by the premiums received, it is necessary to have a thorough medical examination before any policy is issued, and only those who are likely to live as long as other healthy persons of the same age are accepted on the best terms. If there is some slight risk of the assured not living his expected number of years a small addition to the premium will be added to make it a fair bargain for the company, or the policy may be made to terminate after a certain number of years short of the average expectation of life. If the report of the medical examination is such as to render the risk too hazardous at any rate of premium, no policy at all will be issued. The lives therefore may be divided roughly into—

1. Those acceptable at ordinary rates.
2. Those weighted, or accepted with extra payment for whole life policy or terminable after a certain number of years.
3. Those which call for rejection.

Expectation of Life, or Average After-Lifetime. All insurance work is based on the so-called expectation of life of *healthy* individuals, which

has been calculated from the accumulated experience of insurance companies. A better term is average after-lifetime, and this indicates the average number of years which is lived by all persons of a common age from that age to the extremity of life. It is impossible to tell how long an *unhealthy* person will live, but here again reliable information has been collected from the experience of insurance companies which guides the actuaries in determining the value to be put on these *impaired lives* for insurance purposes. The ordinary medical examiner has none of this information at his disposal, and he will be unable to say how long any person with some constitutional defect will live. He may be able to form some approximate idea of this, and this, with his *general impression* of the healthiness or otherwise of those he examines, will be of use to those at headquarters who make the final decision.

Expectation of Life. The following table shows the years and decimal parts of a year that persons at each age may be expected to live—

Age.	Expectation of Life.	Age.	Expectation of Life.
15	46·16	40	27·39
16	45·29	41	26·67
17	44·43	42	25·95
18	43·60	43	25·23
19	42·81	44	24·51
20	42·06	45	23·79
21	41·32	46	23·07
22	40·60	47	22·37
23	39·87	48	21·67
24	39·14	49	20·98
25	38·40	50	20·30
26	37·65	51	19·62
27	36·90	52	18·95
28	36·16	53	18·28
29	35·41	54	17·61
30	34·68	55	16·96
31	33·94	56	16·31
32	33·21	57	15·67
33	32·48	58	15·05
34	31·74	59	14·43
35	31·01	60	13·83
36	30·28	61	13·23
37	29·56	62	12·65
38	28·83	63	12·09
39	28·11	64	11·54

A simple method of approximately estimating the average after-lifetime of a person is that known as *Walford's rule*. For ages between twenty and forty-five deduct the age from ninety-six, and above forty-five from ninety, and half the remainder.

Proposal Forms and Medical Reports. 1. The *proposal form*, whether filled in by the applicant or not, must be signed by him. In it he states the nature of the policy he wishes to take out, and gives information about his age, previous medical and family history, with the age and causes of death of any near deceased relatives. He also names two friends who have known him well for some years, to whom the company

can apply for confidential information as to their opinion of his eligibility or otherwise for insurance.

2. *Referee's Reports.* The questions asked of the friends are on separate forms which may or may not be seen by the doctor. They should certainly be seen if there is any information in them likely to be of use to him in his medical examination and report.

3. *The Medical Report* as a rule consists of two sections. In the first much of the information given in the proposal may be repeated, but this, as ascertained by a doctor, will generally be fuller and more reliable than the proposer's original statement. This information is generally signed by the proposer in the presence of the doctor, who often witnesses the signature. In the second part of the report the doctor gives the results of his own examination and states his opinion of the value of the life—if acceptable at ordinary rates; with an addition to the premium, and, if so, what amount of addition; or unacceptable. In the second and third classes of lives he gives reasons for his opinion.

The exact form of the doctor's report varies. Some are long and require answers to very many questions, others ask no questions, but leave the doctor to state his opinion on a blank part of the report; if the life is a good one he need say this only, if not he should state fully in what it is deficient.

Information from the Private Medical Attendant of a Proposer. Sometimes doubtful points arise in which the family doctor can give important information, especially in regard to alcoholic habits or to previous illnesses. The proposer must give the reference to his doctor and consent to his being written to, otherwise the doctor is not at liberty to reply. If the doctor, who will receive a fee for his information, accepts the reference he must answer the questions fully and disclose all information in his possession which may influence the decision of the company.

Fraud. The medical referee has a very important responsibility in helping to detect any fraud in a proposal. This may take the form of the substitution of a healthy for a diseased person, in the substitution of healthy for unhealthy urine, or in the wilful suppression of some fact in family or personal history of vital importance.

Substitution is difficult, and though it does occur in England it is very rare; it is met with more frequently in America. It is therefore very important to note any scars, birthmarks, tattoo marks or peculiarities which might lead to identification in case of legal proceedings.

Family History. This may, or may not, be very important. The influence which heredity

plays in affecting the expectation of life is accorded varying weight by different insurance experts. In my opinion, a member of a long-lived family is likely to benefit by such heredity, provided there is nothing seriously wrong with his own constitution. He is likely to weather the storms of illness, acute or chronic, better than a man with a family history of early deaths. It not uncommonly happens that several members of a family in present and past generations have died in a certain way about a certain age; for instance, of syncope or apoplexy before sixty. In such a case the recognition of any change in the blood-vessels, or the slightest trace of albumin in the urine would be very important. Then a marked family history of suicide is most important; the knowledge that other members of his family have committed suicide at a certain age not uncommonly drives a man to take his own life at about the same age. But the death of a father or mother when young need not necessarily have any effect on the children's prospects of life. But if, for instance, a parent died of diabetes, and a trace of sugar were found in a son or daughter, it would be quite unsafe to issue a policy. Parental deaths from phthisis and cancer are important, and must always play some part in estimating the value of a proposal.

The personal history, condition and habits are, however, often the most important factors in estimating values of proposals for life assurance.

Having filled in the answers to the questions on family and personal history which all companies require, the proposer must sign his name to the information as having been given to the best of his knowledge and belief. If he wilfully withholds any information which might have influenced the directors in coming to their decision as to his eligibility for assurance, the policy is liable to be rendered void should death be attributable to some disease not referred to by the proposer. The medical examiner is generally required to sign his own name as witness to the signature.

Medical Examination. Probably over seventy-five per cent. of all examinations for assurance are made by medical men who do not have the final decision as to the value of the lives, their opinion being considered, and accepted or altered, as the case may be, by the head office medical referee and the board of directors of the insuring corporation. It is therefore of the utmost importance that the medical examination should be very accurate and thorough and its result stated fully and clearly, so that those who read the report will be able to form an independent judgment of the expectation of life of the examinee.

A most important part of the medical ex-

amination is the family and personal history. This is either provided beforehand on some insurance forms, the proposer signing the information in the presence of the medical examiner, or has to be obtained by the latter himself and filled in by him on a form. In either case the examiner must find out everything he possibly can on these points by direct questions or, concerning the personal history, by hints obtained in the course of his whole interview with the proposer. This should be done, as far as possible, before the examination is made, as information may be then obtained which would lead to a specially thorough examination of one or other of the organs. For instance, a history of pleurisy will necessitate a very thorough examination of the chest.

Personal History. Even with the best of intentions some important illness may be forgotten in the personal history and only be revealed later in the interview. Thus no mention may be made of an abscess in the neck until a direct question is put in consequence of a scar being noticed on examination. Then the proposer will probably remember that he had an abscess in youth, and the nature of the abscess, whether tuberculous or after scarlet fever, etc., must be determined.

If the private medical attendant of a proposer is making the examination, and he knows that certain material information has not been given, he must have this inserted. For this reason, as well as for others, it is often inadvisable for the private attendant to report on a proposal.

Only illnesses which have occurred since childhood are of interest, as a rule, unless some manifest disability resulted from the childish ailments, such as infantile paralysis, rickets, post-scarlatinal albuminuria, etc.

The most important previous illnesses are rheumatic fever or its allied conditions, chorea, growing-pains, etc., scarlet fever (residual albuminuria), attacks of dizziness (epilepsy, petit mal), pleurisy and acute nephritis. Typhoid fever is important as a possible cause of gallstones.

A history of syphilis, gout, recurring pain in the abdominal organs, or of any serious operation is also important.

Routine Method of Examination. It is best to begin with a general inspection of the applicant, because this will give information which influences the examiner in his appreciation of the value of the life before him.

Applicants for insurance policies should always be *examined by themselves*, as they are then more likely to disclose important previous illnesses, such as syphilis, than if a third party be present. They should be examined in good daylight whenever possible, as artificial

light may mask changes of complexion, *e. g.* jaundice. Men should be stripped to the waist, or else to the vest, and the latter be well pulled up, so that the shape and movements of the chest, especially under the collar bones, can be clearly seen. With women only a more limited inspection of the chest is generally to be obtained.

The medical examiner is not likely to see any gross evidence of disease such as would be noticed by the insurance agent or the proposer himself. An insurance agent especially objects very much to have it suggested at headquarters that he took an obviously uninsurable man to be examined. Therefore the signs of disease which will be seen by the eye are generally very slight or only recognizable by a medical man.

The general appearance and carriage which indicate good health need not be described here. They are known to most people, doctors or otherwise. The question "does he look older than his stated age," so often asked, may be difficult for a newly qualified medical man to answer, but it is an important one. This is asked not only with a view to checking the statement as to age (many offices which ask it require documentary evidence on the point), but also to get information as to how the proposer has borne his years of life. A man who has had a hard and anxious struggle in life will age earlier and look older than one in easy circumstances and of few cares. Worry ages a man more rapidly than mental work.

Face. A fresh complexion, suggestive of health, is not incompatible with disease, *e. g.* diabetes mellitus, phthisis, albuminuria, heart disease, etc., and it may reveal a tendency to eat and drink too much.

On the other hand a pale face with dark "rings" under the eyes, though suggestive of some debilitating condition, need not be incompatible with good prospects of long life. It is very commonly met with in town-dwellers. The pallor of blood diseases is of a different character from the city pale face, as is also the bloated, pale, flabby face of alcoholic excess. Acne rosacea, though often met with in drinkers, may occur in total abstainers. When a proposer smells of drink he is probably a bad life. It takes more than a moderate amount of alcohol to get into the breath.

Hair. The colour or amount of hair is no useful guide to health. Hair turning grey, or baldness develops in the early twenties in some families. But these two points, taken with other facts observed, may help in forming an opinion.

Eyes. Any abnormality in the appearance of the eyes must be carefully noted. It is not likely that there will be anything very noticeable

to a lay observer, but the value of a life may be judged by changes in the eyes alone. For instance, irregular, unequal, sluggish pupils, or nystagmus, would be quite enough to hang a refusal of a policy on.

The yellow discoloration in the corners of the eyes met with in many people is of no diagnostic import. It is not jaundice.

Arcus senilis by itself affords no reliable information.

The *voice* rarely helps, but the thick husky tones of chronic laryngitis or pharyngitis of smokers and drinkers must be noted if present.

Speech. Any scanning or slurring of the speech would debar from insurance; a simple nervous stammer need not.

The *gait* may suggest to a medical man some early nervous lesion, especially tabes, but it is very unlikely that any one with a marked ataxic walk would come up for examination.

Any *skin* eruption must be noted. It is also very important to notice birth marks or *nævi* which would be used for purposes of identification afterwards if occasion arose, as, for instance in cases of substitution or when a body of a supposed policy holder who has committed suicide has to be identified.

After the general inspection the height and weight should be taken in boots and ordinary clothes; if taken in any other way a note of the fact should be made. The extra height of about one inch given by the boots is about compensated for by the weight of the clothes.

The chest should then be measured about the nipple line, either against the bare skin or over the vest, and the difference between the measurement in forced inspiration and expiration given.

Three inches is a proper minimum difference to look for, but this is frequently not found when there is corpulence, and some people do not seem to be able to make voluntary deep inspirations, although the chest is well formed and there is no disease. If no corpulence be present, or if the chest be flat and the proposer be delicate looking the restricted movements are most important and tell against the proposer.

The *pulse* should now be felt and counted, and any changes in the wall of the artery or in the tension and regularity must be noted. If the pulse rate is above eighty or ninety and the life be a good one some reason should be given, as for instance, hurrying to the examination or nervousness. If the rate be above one hundred and keep at this another visit should be asked for; and the novelty of the examination having passed off a nervous heart may be slower. In some proposers, however, with insurance hearts the pulse rate may be one hundred and twenty or even more at each examination.

After feeling the pulse the heart and lungs should be examined by percussion, palpation and auscultation, and anything abnormal noted. In examining the lungs special note must be made of the development and movements of the chest, especially under the collar bones, because it is there that changes consequent to phthisis are first to be seen. The resonance and breath sounds should be investigated carefully. It is also necessary to listen over the bases of the lungs posteriorly to see if air is entering well.

The tongue and pharynx should now be examined, and this should always be done, as important changes such as leukoplakia or ulceration or scars will be made out which otherwise would escape notice. Any tremors also are important.

After examining the tongue the abdomen should be palpated, so that no gross lesion there be overlooked and no hernia be unrecognized. In women it is often difficult to examine for hernia. The nervous system must be tested by noting the condition and movements of the pupils, and the state of the knee reflex. If the pupils and knee reflex are normal it is not necessary to try any other reflexes, but if the latter is lively, ankle clonus and the extensor reflex should be looked for. Excessive kneejerks are often due to nervousness and mean nothing unless other abnormal signs are present. The condition of sight and hearing must be noted.

Finally, the urine must be carefully examined after being passed in the room. If, as not uncommonly happens, the proposer is unable to pass water at the rooms he must send a specimen with a note saying he has passed it. This guards against substitution of healthy for albuminous urine.

The whole of the questions to be answered by the medical examination should be filled in before the proposer leaves the room, otherwise some important point, requiring another visit from him, may be left unsettled.

Such a routine examination, when carefully carried out, covers all the ground, and if its results are all negative, that is, if nothing abnormal be found, it does not take long. The filling in of the answers to the questions occupies the time.

Female lives form a small percentage of assurance business, and any proposals for insuring a woman are considered with special care. A woman is not infrequently insured by other parties who have an interest in her property which ceases at her death, and the knowledge that she is not very healthy may determine the proposal with or without honesty of purpose. On the other hand a healthy woman in comfortable circumstances is probably a

better risk for an insurance company than a man similarly situated. She takes better care of herself and runs less risk from alcohol.

In the medical report the following special points are of importance. The regularity of the menstrual functions. The number, if any, of confinements; their nature, whether natural or involving instrumental help or followed by complications; whether pregnant at the time of the examination. If there have been any miscarriages the question of syphilis must be considered, but many abortions are due to non-syphilitic causes. Other points to be settled are: whether there have been any pelvic operations; whether the menopause has been passed; whether a hernia exists. A history of gallstones is more likely to exist in a woman than a man.

Women are less liable to succumb to phthisis after the age of twenty years than men, but decidedly more liable to cancer, malignant disease of the uterus, breast and ovary being frequent. The cancer rate for males at all ages for the three years ending 1901-3 was 706 per million living of that sex, and for females 991.

Heart disease in a woman has a special interest in view of the possibility of child-bearing, and the effect this may have on the heart. It is only a very moderate cardiac lesion that would be accepted for assurance under the most favourable circumstances, recognizing the fact that repeated pregnancies will almost certainly break down an otherwise useful heart.

Female proposals seem to excite suspicion with insurance offices, as a thorough examination is more difficult than in males, and possibilities of suppression of information about pelvic disease are many.

It is not advisable for the examiner to tell the proposer the nature of the medical report, and many companies expressly request this, because their decision may rest on the information obtained in reports from the personal friends given as references by the proposer; if the latter knows that the doctor has passed him and yet his insurance has been refused he will suspect his friends and trouble will arise.

Impaired Lives—

Height and Weight. Persons more than twenty per cent. below normal weight for height run more risks than the unduly heavy ones, and especially from tuberculous or nervous affections. On the other hand, light weights stand acute illnesses better than heavy weights, and most of those people who live to be octogenarians are of light build. The size of the bones is an important point to note, for many perfectly healthy people are of slight build.

Many who are light below twenty-five get heavier after this age; family history is an important factor in these cases.

Decreasing weight without the presence of some temporary or removable cause suggests phthisis or malignant disease.

Obesity—that is, weight more than twenty per cent. above normal, especially if progressive, —is against an applicant; the girth of the abdomen should not be greater than that of the chest. Inherited obesity showing in early life is bad. An overweight man of large frame, sound constitution and no family history of obesity, who is living a healthy life, may be accepted on a limited payment policy terminable about sixty. The risks from obesity are the bad way the subjects of it bear accidents or acute illness, the liability to diabetes, cardiac failure, gout and arterio-sclerosis. Many stout people are big eaters and immoderate drinkers without being able to take much exercise. Country dwellers are less risky than townspeople. Women carry stoutness better than men because it is more natural to them and they are more careful in habits and less subject to risks from violent exertion or accident.

At ages over sixty obesity is practically a bar to insurance, and if œdema of the legs be present or shortness of breath on exertion, refusal would be indicated.

Height and Weight. The ideal height for insurance purposes is 5 ft. 7 in. to 5 ft. 9 in. Very tall men are less long-lived than those of medium stature, but family history is important here, as it is in light and heavy weights.

All insurance offices prefer men of normal weight and height, and most of them will make an allowance of fifteen to twenty per cent. either way and accept otherwise good lives at ordinary rates. Beyond these limits opinions vary. Some take roughly two stones above or below the normal as these limits in otherwise healthy lives.

Hutchinson's English table of the mean weight in relation to height in 3000 males at the middle period of life (15 to 40), including weight in their clothes, is a standard often adopted—

Height.				Gross average weight in lbs.
ft.	in.	ft.	in.	
4	6 to	5	0	92.26
5	0	5	1	115.52
5	1	5	2	124.33
5	2	5	3	127.86
5	3	5	4	138.01
5	4	5	5	139.17
5	5	5	6	144.93
5	6	5	7	144.29
5	7	5	8	152.59
5	8	5	9	157.76
5	9	5	10	166.40
5	10	5	11	170.86
5	11	6	0	177.45
6	0	6	+	218.66

The National Fraternal Conference (America) came to the conclusion that longevity depends largely on build. The greater the variation from the average of 5 ft. 7, 8 or 9 in. the greater the risk. The lighter the weight the greater the liability of death short of the expectancy from tuberculosis and nervous diseases. Overweights suffer from heart disease and apoplexy. Underweights when more than twenty per cent. below the limit, and overweights twenty-five per cent. above are poor risks.

The following table gives the average weights of 133,940 applications of selected American risks.

Height.		Age.						
		18-25.	25-30.	30-35.	35-40.	40-45.	45-50.	50-55.
ft.	in.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
5	0	120	125	128	131	133	134	134
5	1	122	126	129	132	134	136	136
5	2	124	128	131	134	136	138	138
5	3	127	131	134	137	139	141	141
5	4	131	135	137	140	142	144	145
5	5	134	138	141	143	146	147	149
5	6	137	142	145	147	150	151	153
5	7	142	146	150	152	155	156	158
5	8	146	151	154	157	160	161	163
5	9	150	155	159	162	165	166	167
5	10	154	159	164	167	170	171	172
5	11	159	164	169	173	175	177	177
6	0	165	170	175	179	180	183	182
6	1	170	177	181	185	186	196	188
6	2	176	184	188	192	194	198	194
6	3	181	190	195	200	203	204	201

Alimentary Organs—

Stomach. Indigestion must be investigated with proper care to see if there is any question of gastric or duodenal ulcer, a liability to either of which would be against insurance. Any symptoms suggestive of organic disease, such as recurrent vomiting or hæmatemesis, must also be carefully investigated. True biliousness is no bar; it is a safety valve or the paying of cash for dietetic debts.

Intestinal diseases, such as chronic diarrhoea, mucous colitis and dysentery would debar from insurance. Ordinary constipation can be ignored. Some people have naturally two or three evacuations of the bowels daily, but otherwise are in normal health. They are acceptable.

Appendicitis. Recurrent attacks of appendicitis are very risky, and any one subject to them should not be accepted unless he be operated on; and then only a few months after this has been quite successful. With a history of one attack of simple appendicitis, if two, or better three, years have passed without any recurrence, and there be nothing abnormal in the right groin, the proposal may be accepted.

Gastro-enterostomy for acute or chronic ulceration of the stomach or duodenum is likely to trouble insurance referees frequently in present times. If it has been done for acute or chronic (non-malignant) ulcer of the stomach or duodenum, the case is insurable after a time. No case should be taken under two years from the date of operation, as it is during this time that any of the ordinary complications will result. If the applicant has remained quite well since the operation and has improved in health and is otherwise unexceptionable, he may then be taken at ordinary rates.

Biliary Colic. No policy should be issued after an attack of gallstones until three years have elapsed with no recurrence. If two attacks have occurred the interval should be five years. Even if operation has been performed there is no guarantee that recurrences will not occur, and such lives are decidedly risky.

Hæmorrhoids. The cause must be made out, whether the result of sedentary occupation or a symptom of hepatic congestion. Simple piles need not prejudice a policy. If troublesome it is best to wait until after operation.

Hernia is not a prominent cause of death, and if a well-fitting truss be worn and the hernia cause no trouble most offices raise no objections to taking them at ordinary rates. Inguinal hernia is the least risky. If any complication, such as undescended testis or irreducible omentum, be present, the risks are considerable.

If a radical cure has been performed six months should elapse before acceptance of the life, to see if the operation has been successful.

Gout. No age, from school days upwards, is exempt from hereditary gout, but typical joint attacks usually first appear between thirty-five and fifty. When the attack is postponed until later in life it is generally mild. The attacks are not infrequently most severe and numerous in the fourth and fifth decades of life. Men are more liable to be affected with typical paroxysms than women, but irregular gout often occurs in women. More than half the cases of gout in insuring classes are hereditary, and women who escape arthritic gout transmit more certainly than the men; paternal heredity is, however, worse than maternal.

The expectation of life of a gouty person under twenty-five is about six years less than that of a non-gouty person. This difference gradually grows less and less with advancing years until sixty, when there is still a year against the gouty person. After seventy there is no difference in the expectation of life. Authorities differ in their estimate of the value of gouty lives for assurance. Some reject in many cases and add twenty to twenty-five per cent. in those accepted. Others think that if a

gouty person over thirty has escaped all symptoms, and is free from bad habits, he may be taken at ordinary rates. If there be any albuminuria or glycosuria in a gouty person the proposal should be rejected, and the habitual indulgence in sweet wine or malt liquors in a person who has attacks should also call for refusal.

Respiratory Organs—

Epistaxis, if recurrent in a young proposer otherwise quite sound, generally means some local lesion of the nasal mucous membrane, and this should be put right before a policy be issued. In older people it generally means some disease of the blood-vessels or kidneys, evidence of which ought to be carefully sought for. Such a life would be unacceptable.

Post-nasal Adenoids should be removed before a policy be issued.

Hay Fever need not influence the issue of a policy, but if nocturnal asthma accompanies it this latter condition must be the weighty one. (See *Asthma*.)

Pulmonary Lesions. Any chronic lesion, such as bronchitis or emphysema, would probably forbid insurance. Asthma in its spasmodic intermittent form, if the attacks are not frequent or severe, need not necessarily debar, as asthmatics are often long-lived people. Some addition to a policy would, however, be necessary.

A history of pleurisy from chill, or idiopathic pleurisy, or of dry pleurisy, is always important, since about one-third of the persons who have had it develop tuberculosis. Whenever a history of it is given the lungs must be examined with special care to see that there is nothing left of the disease and no thickening of the pleura or limitation of movement of the lungs present.

Hæmoptysis—that is, true bleeding from the lungs—is a serious symptom. If it has arisen from an injury or strain some years previously and has left no trace in the lungs, and the proposer be otherwise unexceptionable, there is no reason why he should not be accepted at ordinary rates. If it arises, as it not uncommonly does, from heart disease, the case would be uninsurable. If it is of tuberculous origin no proposer below forty who gives a history of it should be accepted. If a proposer over forty gives a history of hæmoptysis over fifteen years previously and has a tuberculous family taint, but has been quite well in the interval, is of good weight for height and in good condition, and also has no signs of disease beyond a cicatrix in the apex, if he lives a healthy, abstemious out-of-door life, it may be safe to issue a policy for a limited term of years at ordinary rates.

Phthisis. One of the greatest risks of insurance companies is phthisis, and great care must be exercised in deciding on a proposal with any phthisical taint in the family. Phthisis itself is not hereditary, but the predisposition to providing a favourable soil for the growth of the tubercle bacillus is. Therefore family history on this point must be investigated with the greatest care, and any such vague causes of death as childbed, asthma, bronchitis, congestion of the lungs, general decline (in young people), etc., such as may be used as euphemisms to save the family's feelings, or to cloak ignorance on the part of the doctor, must be received with due suspicion and investigated with careful cross-examination, especially as to the duration of the illness and the symptoms present. If a parent has died of the disease the history of the grandparents and uncles and aunts should be investigated, because odd cases do occur in families not tainted with the disease, and these have not such marked importance as those occurring in phthisical families.

Many companies are guided in their decisions on phthisical risks by the principles known as "Thompson's Risks."

(A) *Least Bad Cases.* Phthisis in one sister (it is worse if in a brother) and one collateral relation.

(B) *Bad Cases.* Implication of a brother and sister; many collaterals, especially on the mother's side; and if there be evidence of sexual limitation; and the father's heredity alone.

(C) *Very Bad Cases.* Implication of grandparents; the father, with one or other of the children; collateral relations, pointing to atavism; the implication of many brothers and sisters; family asthma; hæmoptysis without family implication; and the mother's heredity alone.

(D) *Mostly to be Rejected.* Implication of the father, with many members of the family; the mother, with other members; the grandparents and parents, or many members of the family; double heredity and hæmoptysis with family implications.

The age is very important, and Thompson divides the periods of life into four.

1. Below 25. Accept no case with family history of phthisis.

2. 25-35. Reject the class *D* until after 45, and the *B* and *C* until 28. From 28-35 add five years to premium of *B* and seven to that of *C*.

3. 35-45. Add 3 to 5 years to *B* and 5 to 7 to *C*. Take *A* without any extra.

4. After 45. Almost all *A*, *B* and *C* classes may be assured, though paternal heredity may still demand addition: Of class *D* many members implicated constitute a great risk,

whilst double heredity and family hæmoptysis are perhaps too risky for assurance at all. Any of the other cases must still be taken cautiously.

Female Lives. The risk during child-bearing is so great that it is inadvisable to take any woman before forty-eight with phthisical history. Child-bearing over, policies may be issued at slight additional rates and especially light in event of paternal heredity being present. Maternal heredity is more dangerous, and no case of double heredity is acceptable.

As opposed to influence of heredity is that of longevity, and this may ease any addition to premiums.

Under weight, not light weight, is a serious matter, as it shows inability of the system to absorb sufficient food and therefore to predispose towards the invasion by tubercle bacilli.

After thirty a robust physical condition, with well-developed chest and good respiratory movements, good personal habits and healthy occupation allowing plenty of out-of-door life, will outweigh a good deal of hereditary tendency.

The personal age, history, condition and habits are therefore of primary importance.

Other Forms of Tuberculosis—

Enlarged glands in the neck may be reported in the past medical history. These may have been due to some chronic irritation—the mouth or naso-pharynx—and have passed off without suppuration; they then mean nothing. *Casating glands* are almost certainly tuberculous, but *suppuration* may take place from other causes, such as scarlatina. All cases of undoubted tuberculosis in childhood must be carefully considered. If it is some years since the glands have ceased to give trouble and the applicant is otherwise unexceptionable he may be accepted at ordinary rates. If he has other bad points the case is more or less unacceptable, and each must be decided on its own merits.

Tuberculous bone lesions are more serious. If amputation has been necessary and the health is quite sound the case has an insurable value, probably more than where conservative surgery has saved a limb. Some authorities accept all persons who have suffered from hip disease in childhood if they have reached the age of thirty-five or forty and they are otherwise sound.

Genito-urinary tuberculosis is uninsurable.

Circulatory Organs—

Heart Disease. The condition of the heart muscle is the important point, and not the mere presence of a murmur. Some loud murmurs are quite compatible with long life, as they are due more to roughening of a valve than to defect. This is the case with mitral and aortic systolic murmurs, which may be loud and yet

cause no extra work on the heart. But if there is any cardiac enlargement, even with perfect compensation, the risk would be too great for insurance purposes.

Any risk from cardiac abnormality is much less in those who are in easy circumstances than in people who have to work hard for their living.

Changes in the rhythm or character of the heart sounds, as for instance *bruit de galop* or tic-tac rhythm, would debar. Simple doubling of the second sound may be physiological.

Occasional dropped beats occur most commonly as reflex effects of functional stomach disturbance and need be no bad sign. In some persons a beat is dropped regularly every so many heart beats, and this goes on for years and may be a family peculiarity. In such cases it is advisable to make a second examination, and if much tobacco is being taken, after this has been stopped for a month. In young or middle-aged people these dropped heart beats may mean absolutely nothing wrong; in older people they may indicate a gouty or senile heart and are objectionable, even if no other abnormalities are present.

Cardiac irregularity in which extra systoles occur, and only some of the heart beats pass to the radial pulse, though it may be physiological and be unaccompanied by any other physical sign, is a doubtful risk. In one man whom I examined, out of 120 heart beats only ninety were felt at the wrist, yet he would follow the beagles or walk miles without any trouble, and felt, and thought, that he was perfectly well. His risk was too uncertain for the company to accept.

Nervous Hearts. In a small proportion of proposers the thoughts of a medical examination cause quick action of the heart, 120 or more beats per minute, and this keeps up during the whole examination, though the rate may slow down and quicken up again periodically. A pathologically quick heart beat will not vary. If the pulse-rate does not fall below 100 a second visit should be asked for and then the nervousness may have passed off. Even if it has not and the person is otherwise unexceptionable a nervous quick heart need not prejudice a proposal.

Urinary Organs—

Routine Examination of the Urine. The specific gravity should always be taken, and for this purpose it is necessary to have a very small urinometer and suitable urine glass, for often a man can only pass half an ounce or less of urine, having just emptied his bladder. It is very inadvisable to let a proposer go without getting some urine from him, as he may not come again for some days. A specific gravity below

1008 is not satisfactory and another specimen is necessary. Some proposers may know that they have a trace of albumin and may have been put up to having a good drink before the examination, to dilute the amount of albumin. If the specific gravity be above 1025 a reason for it, as for instance hot weather, should be given.

For albumin the heat and acidulation with acetic acid test is the quickest and most delicate. It is specially useful where a trace of albumin is suspected in gouty people or where there is rather a hard pulse. In younger, apparently quite healthy people a faint haze can be ignored, especially if the nitric acid in the cold urine is negative.

For sugar the Fehling test should be used, and this should be done by adding not more than an equal bulk of urine to the solution and boiling for half a minute. If a distinct reaction occurs sugar is present. If the change is slight the phenyl-hydrazin test should be employed.

Any alkalinity in the urine, especially in elderly people, must suggest cystitis.

Shreds or flakes visible to the naked eye are probably prostatic in origin, and need not prejudice an otherwise good proposal.

Excess of phosphates is frequently met with and means nothing.

High tension should be sought for most carefully in any adult proposers, and if any change be suspected inquiry must be made as to the amount of urine passed. The first sign of polyuria is generally noticed by the increased frequency of micturition at night, any change in the daytime often being overlooked, as many men micturate frequently then as a regular thing. Even in early cases there will be distinct accentuation of the heart sounds.

Any increase of tension with an accompanying trace of albumin would be against insurance.

Albuminuria. Any trace of albumin in the urine must be carefully considered. In young men below twenty-five a faint reaction with boiling and acidulation may mean absolutely nothing wrong, but in old men it is generally an indication of some chronic change in the kidneys. If polyuria and any increase of tension accompany the change the life should be refused.

Where albumin appears in an otherwise quite healthy individual a specimen of urine which is passed on getting out of bed in the morning should be examined, and if this contains albumin there is almost certainly a pathological change in the kidneys and the life should be declined.

When there is no albumin in the first urine of the morning the condition is probably one of functional albuminuria.

A microscopical examination should be made in any doubtful cases, and the presence of any casts except a few of the hyaline variety should settle the question against the proposer.

Pathological albuminuria will be accompanied by other signs of disease, noticed in hardening of the pulse, in accentuation of the cardiac sounds and in changes in the heart itself.

In *albuminuria in the apparently healthy* there is no albumin in the urine passed after a night in bed; in some instances over-exercise, too many eggs in the diet, cold baths and blood of diminished coagulability induce the albuminuria.

Most of these people suffer no debility whatever from the abnormality, and the presence of the albumin is only recognized at the insurance examination.

At one time some insurance companies would not take any of these cases, as experience shows that a certain percentage pass into pathological albuminuria, and it is impossible to tell which of them will do this. On the other hand some companies, and of these more than formerly, will accept them with additions (five or ten years) to a whole-life policy, or for endowment policies terminable about fifty.

Glycosuria.—Any considerable amount of sugar in the urine forbids insurance. A trace of sugar raises difficult questions. If there be a family history of diabetes mellitus, no policy should be issued; if not, more specimens of urine should be examined, both with Fehling's solution and the phenyl-hydrazin test. The effect of a carbohydrate and sugar-free, or excess, diets must be also tried. Some persons pass a little sugar in the urine after consuming much sugar, grapes and sweet wine, or regularly after one meal in the day, and they are too risky lives to be accepted. If sugar appears in only one examination out of several made over two or more months and there is no family history, and the life is otherwise unexceptionable, the proposal may be accepted at ordinary rates. But no slight case should be decided on one examination of the urine only.

Renal Colic. A history of renal colic need not adversely influence insurance if the attack has taken place at least three years previously, with no recurrence and nothing wrong noticed in the urine. If two attacks have occurred, a five years' interval is safer. No case with renal calculus would be insurable.

Bladder. Enlarged prostate, if suspected, would debar. If a proposal be made after successful enucleation in an otherwise good life, a short-term policy might be issued.

Cystitis, if present, would debar from insurance, and so would vesical calculi, or the history of such.

Stricture, if present to any degree, would prohibit insurance.

Syphilis. The effects of syphilis in its tertiary stages on the nervous system are well known,

and need not be dilated on here. But its effects on the circulatory system are greater than is often appreciated. Thus, apoplexy below fifty and especially below forty years of age, with no primary kidney disease, is quite likely to be of primary syphilitic origin, and aneurysm of the thoracic aorta, coronary arteritis and angina pectoris below these ages are also often due to the same primary disease. Other syphilitic lesions occur less commonly, but those above mentioned are most likely to cause trouble in after-lifetime of subjects of syphilis.

A syphilitic proposer is, *ceteris paribus*, not as good a life as a non-syphilitic proposer. No case should be accepted in which there is a doubt as to proper treatment having been carried out, but even proper treatment does not always prevent sequelæ from appearing. Only those proposers who are first-class lives in other respects should be considered, and none should be accepted until at least three years have elapsed since the date of infection, without any secondary or tertiary symptoms having appeared in the interval. An interval of six years is still safer, as fatal tertiary lesions may occur in this period of time. Of course no proposer showing any signs of the disease in any one of its stages should be accepted; and no one acquiring it after forty years of age.

The information afforded by a properly carried out Wassermann reaction might influence the decision on these cases. I have had such information offered by a proposer.

An extra premium should be charged in all cases, and this should be equivalent to the addition of five years, under the most favourable circumstances, on a whole-life proposal from a man under thirty. This number of years should be added to if any unfavourable circumstances of age, family or personal history be present in addition. Policies with premiums limited to a certain number of payments, or terminable at fifty, might in favourable circumstances be issued at ordinary rates.

Nervous System.—Most cases of organic disease of the nervous system should be debarred from insurance. Monoplegias resulting from infantile paralysis in childhood need not of themselves affect a policy.

Neurasthenia or functional disease of the nervous system must be dealt with cautiously. If a man has broken down from over-work and worry of a business, and has been set up again by a few months' holiday and has kept well for a year or more, and is not running risks of breaking down again, he may be accepted at ordinary rates if otherwise a good life. If neurasthenia develops in a man with no occupation the risks are uncertain.

Tic douloureux debars from insurance. The

pain is so severe that it sometimes leads to suicide, or to the necessity of a very severe operation.

Epilepsy would prohibit insurance.

Mental diseases would hardly ever call for consideration in a proposer, unless it be a question of heredity. Many lunatics live the full expectation of life, but some do not. In such a proposal a report from a specialist would be advisable.

Reflexes. Knee-jerk. Lively knee-jerks are frequently met with in nervous people in insurance examinations. Unless there be some other defect they indicate no pathological change. Ankle clonus is never present in these nervous cases. Any pupil reflex change, nystagmus or speech defects present as well would mean some serious disease, and probably ankle clonus, and the extensor-tendon reflex would be found also. Absent knee-jerks generally mean organic nervous disease, but it is stated that they may be absent in perfectly healthy individuals. The previous history would be very important in such cases.

Any marked difference in the reaction on the two sides would suggest general paralysis.

Pupils. Abolition of the pupil reflexes means organic disease of the nervous system. Sluggish reaction or pin-point pupils also suggest this. Inequality and irregularity are very serious signs, although slight degrees of the former may be met with in healthy people, the difference being congenital.

Argyll-Robertson pupil means organic disease of the nervous system.

Ear. Chronic deafness due to nerve or drum lesions, or to dry catarrh in a gouty constitution, with no other ear symptom accompanying it is, apart from the risk of accidents, no bar to insurance.

Bone lesions of the middle and inner ears causing purulent catarrhs are dangerous, as secondary brain disease often develops from them. If a discharge has really ceased the outlook is more favourable, according to the length of time which has elapsed since the discharge ceased. Two years is the least limit that should be taken, but serious bone lesions may remain latent over longer periods of time, and then become active. When an operation has relieved the discharge, if all is well about a year afterwards, the case may safely be accepted at ordinary rates.

Alcohol. Any tendency to alcoholic excess, whether inherited or acquired, should forbid insurance. Those who are really moderate in their habits are as good lives as total abstainers, but moderation is often a difficult thing to estimate, the question being chiefly one of personal idiosyncrasy.

When a proposer smells of drink even after

a meal, especially when his pulse is full and bounding, he almost certainly is not a moderate man. Regular drinking between meals and treating with alcoholic liquors at business generally means immoderation. Publicans are also lives to be suspected. When any doubt exists as to the proposer's habits, the information afforded by the personal references is often of the greatest value. The appearance of a proposer, his voice and a history of morning nausea might afford confirmatory evidence of suspected alcoholic habits.

If a proposer says he is a total abstainer he should be asked how long he has been one, because some heavy drinkers turn total abstainers—for a time.

Malignant Disease. The chief mortality from cancer occurs late in life, ninety-five per cent. of deaths taking place over thirty-five years of age, eighty per cent. over forty-five, seventy-five per cent. between forty-five and seventy-five. The most fatal period is the decade fifty-five to sixty-five. Even above seventy-five a large number of deaths are due to cancer. The chances are five to one that a person will not die of cancer before forty-five, and five to three that he will not die before fifty-five. The age of death from cancer is in great contrast to that from phthisis.

Males. Death from cancer occurs as a rule so late (fifty-five to sixty-five maximum decade) in males that the risk would be almost neutralized in the case of a policy payable at sixty, better still at fifty-five. The death even of both parents from cancer, which is a rare event, need not modify the rule, since it depends on the expected age at death. For a whole-life policy some addition to the premium may be required. One death from cancer in a family may be neglected, two deaths require an addition, rarely rejection.

Females are worse cancer risks, more being affected and at an earlier age (forty-five to fifty-five maximum decade) than men. In a whole-life policy the death of even one relative should be taken into account, the mother's requiring a substantial addition. If one other female relative has died also from cancer the risk is serious, if not prohibitive. There is the special risk arising from the frequency with which cancer of the breast, and perhaps of the pelvic organs, is transmitted by inheritance. Therefore two female deaths in the family (including the mother) from cancer of the breast, and probably of the uterus too, makes the life ineligible for assurance. The age at which any life, male or female, is accepted must, of course, be taken into account in deciding the amount, if any, that is added to the premium.

Thyroid Gland. Simple enlargement, or the so-called "Derbyshire neck," generally has no

effect on the system beyond that of possible pressure. If the gland has been present for some years with no sign of tending to increase, the case may be accepted, but not otherwise. Graves' disease and myxœdema, or a history of either, would debar.

Spinal Curvature. The insurance value of these cases depends on the cause of the disease, whether tuberculous or not, and on the presence or absence of any pressure on the viscera.

Pott's Curvature or *Spinal Tuberculosis* is practically uninsurable, the average age of death in thirty-one cases being 49.5 years.

Curvatures not due to Disease of the Vertebrae. The round back, simple lordosis and slight scoliosis, which frequently arise from habitual adoption of a faulty body position, are acceptable at ordinary rates in otherwise quite healthy people.

Kyphosis and paralytic lordosis are acceptable conditionally, according to the extent of the paralysis and the degree of deformity, and if they are due to infantile paralysis. Spondylitic kyphosis runs a slow chronic course, and is acceptable conditionally with policies terminable at forty-five to fifty years. Inflammatory ankylosis of the vertebral column, grave kyphosis with rheumatic arthritis and chronic rheumatic disease of the spine should be refused. Severe scoliosis and kypho-scoliosis are only acceptable in very favourable cases for policies terminating at the age of forty or forty-five years.

Infantilism or *dwarfism* in any form would be probably undesirable for insurance purposes, the prospects of life being uncertain.

E. M. B.

IV.—CLINICAL PATHOLOGY

THE HISTOLOGICAL EXAMINATION OF THE BLOOD

THE following are the more important facts which may be elicited by a clinical examination—

1. *Hæmoglobin* : the relative amount present.
2. *Red cells* : the absolute number; their shape, size, and staining properties; the presence of nucleated cells.
3. *White cells* : the absolute number; their character and the number of each kind.
4. *The Colour Index*, i. e. the ratio between the percentage of hæmoglobin and the number of red cells.

Obtaining the Blood

Blood for these examinations may be obtained from the lobe of the ear or the end of the finger. The skin in either situation is well rubbed with cotton wool soaked in ether, or merely washed with soap and water. A bold prick is then made with a sharp bayonet-shaped needle, and the blood which oozes from the puncture is collected as described later. Should blood not ooze freely, pressure may be applied at a distance from the prick. The blood may be (a) examined as a fresh specimen under the microscope; (b) spread into films and then stained by Leishmann's solution, or Ehrlich's tri-acid dye; (c) collected into one or more of the special pipettes for certain quantitative or qualitative estimations to be described later.

Microscopical Examination of Fresh Blood

This is not of very extended value in practical medicine. The principal points that can be observed are: (1) The malarial parasite may be seen, and its development watched. (2) Abnormal shapes and sizes of the red cells may be studied in pernicious anæmia. (3) The presence of abnormal numbers of white cells may suggest the existence of leukaemia, or of leucocytosis.

Preparation of Blood Films

Blood films should always be prepared whenever a "blood-count" is undertaken. Films may be made either on large cover-slips or on slides. The glass must be quite clean and free from grease. This is secured by boiling in strong nitric acid or potassium bichromate, rinsing in running water, and keeping under absolute alcohol. If cover-slips are used, a slip is taken in a pair of forceps and allowed to touch the drop of blood at its centre, and is

then dropped carefully, face downwards, upon a second slip. The two are then separated by a sliding movement. A very thin film is aimed at. If slides are used, the short edge of a slide is allowed to touch the drop of blood at its centre, and is then placed in an inclined position upon a second slide lying horizontally. The drop of blood will spread along the edge of the first slide; this is now drawn steadily along the horizontal slide, upon which a thin film of blood is then deposited. The films are allowed to dry in the air, without the aid of heat.

The Hæmoglobin

The colouring matter of the red cells is measured as a percentage, the standard (100 per cent.) being chosen to represent the amount usually found in healthy adult men. The estimation may be made with Haldane's modification of Gower's hæmoglobinometer.

1. *Estimation of Hæmoglobin*. The liquid in tube A serves as the standard colour. The

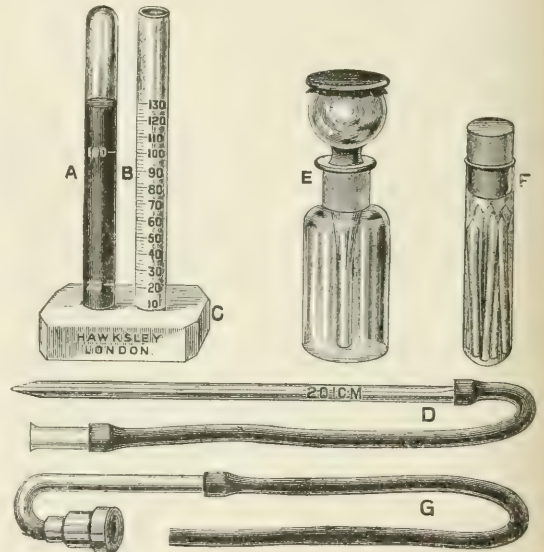


FIG. 1.—Haldane's Hæmoglobinometer.

tube B has the same internal diameter as A, and is graduated in percentages. A little water, up to about the 20 per cent mark, is first put in the tube B. Blood is now sucked up into the pipette D, which must be clean and dry, as far as the mark (20 c.mm.). The point of the pipette is wiped, then inserted just beneath the surface of the water in tube B, and

the blood is gently blown out. The pipette is kept in the same position and is rinsed several times with the water. The tube B is now rolled rapidly between the hands to mix the blood and water, and a stream of coal gas is passed into it for a few seconds by means of the rubber tube and cap G, which is made to fit over a gas burner. As the rubber tube is withdrawn, with the gas still passing, the end of B is closed with the forefinger, and by repeated inversion the liquid is made to pass up and down the tube several times so as to saturate the hæmoglobin with CO. Water is now added drop by drop from the drop bottle E, the tube being inverted after each addition. This procedure is repeated until a point is reached at which the tints of the liquids in the two tubes are equal. The reading is then taken. In judging of the equality of the tints, the tubes should be held against the light from the sky, or, if artificial light be used, against the light from an opal glass shade.

2. *Increase in Hæmoglobin* is occasionally found in moderate degree as a physiological condition in both men and women, but especially in the former. It may merely denote "rude health," or it may carry no significance at all. In pathological conditions an increase is found in congenital heart disease and in splenomegalic polycythæmia. It has also been observed in diabetes insipidus.

3. *Decrease in Hæmoglobin*. A slight decrease may be physiological in some town-dwellers. As a pathological state it is present in every case of anæmia. Taken in conjunction with the number of red cells, the amount of decrease gives important information as to the type of

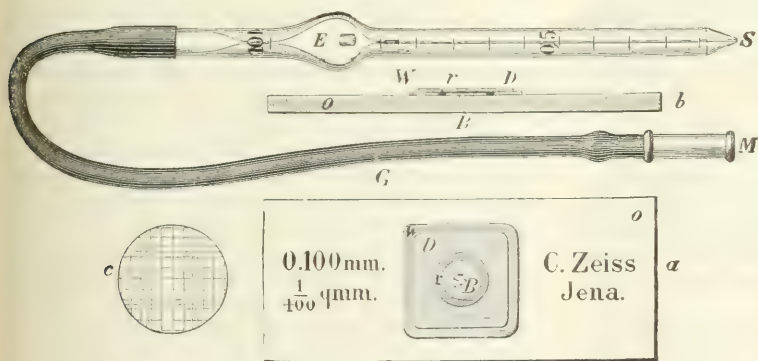


FIG. 2.—Thoma-Zeiss Pipette and Counting Chamber.

anæmia that is present. In itself the figure is a measure of the degree of the anæmia, but gives no clue to its type.

The Number of Red Cells

1. *Enumeration*. This is best done by the use of a Thoma-Zeiss pipette and counting

chamber. A pipette, for diluting the blood 1 in a 100, should be chosen, and one which has the 101 mark well above the bulb is best. Blood is sucked up the capillary tube to the mark 1. Any excess of blood is quickly wiped off the nose of the pipette, and some appropriate diluting fluid drawn up into the bulb to the 101 mark. The pipette is now withdrawn

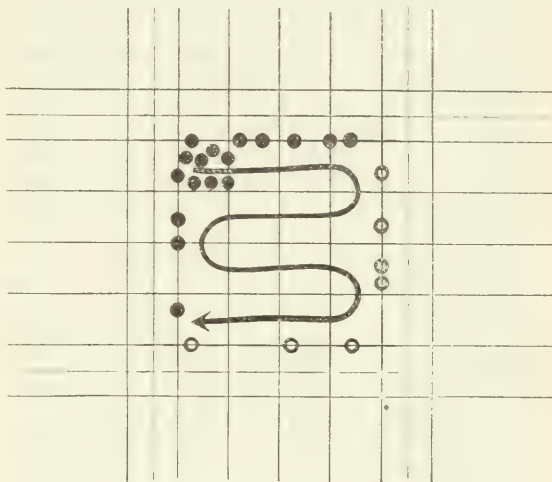


FIG. 3.—Method of Counting Cells.

from the fluid, and rotated rapidly for a minute to ensure thorough mixing of the blood and diluting fluid. The diluting fluid in most general use is Toison's fluid, which may be obtained in "soloid" form. This fluid stains the leucocytes a faint violet colour, but leaves the red corpuscles almost unstained. About one-third of the contents of the bulb are now

blown out, and a small drop of the remainder is placed upon the centre of the cell on the counting slide. The special cover-slip is put over the drop, which should be of such size as just to fill the cell when the cover-slip is gently pressed down. If the drop is too large, the slide and slip must be cleaned and dried and a smaller drop of the mixture must be used. The corpuscles are allowed to settle and are then counted.

Fig. 3 represents a part of the field of the microscope when one-sixth objective and No. 2 eye-piece are used. The corpuscles lying over the greater part of the figure have been omitted for the sake of clearness. The arrow indicates the order of the small squares on the slide which it is recommended to follow in making the count. Cells lying on the top and left-hand lines are to

be counted and those lying on the bottom and right-hand lines of the square are omitted. Thus, in the diagram, cells marked in black are counted, those shown in white are not. In this way all the cells will be counted that lie within the large square, and half of those that lie partly within and partly outside it. Experience has shown that counting five large squares yields a result that is very trustworthy. Then if x be the number of cells in the five large squares, the number of red cells in 1 c.mm. of blood is $x \times 5000$. The number of red cells present in the blood of healthy adult men is about 5,000,000 per cubic millimetre. If there is no other unusual feature about a blood examination, any figure lying between 4,500,000 and 5,500,000 may be taken as being within the range of health.

2. *Increase in the number of Red Cells* (erythrocytosis; polycythæmia). This is found in the same conditions mentioned as causing increase in hæmoglobin—congenital heart disease, chronic cyanosis with splenomegaly, and diabetes insipidus. In congenital heart disease, the count may rise as high as 12,000,000. In splenomegalic polycythæmia the red cells usually vary between 6,000,000 and 10,000,000.

3. *Decrease in the number of Red Cells* (erythropenia; oligocythæmia). A condition which, in more or less degree, accompanies almost every disease, and constitutes a cardinal feature in all forms of anæmia (*vide infra*).

The Colour Index

1. The proportion of hæmoglobin to the number of red cells present is termed the "colour index." Hæmoglobin is estimated as a percentage; red cells are counted in absolute numbers; to obtain the index it is therefore necessary to reduce the number of red cells to a percentage, 5,000,000 being taken as 100 per cent. Thus—

$$C.I. = \frac{\text{per cent of hæmoglobin}}{\text{per cent of red cells}} = \frac{100}{100} = 1 \text{ (in health).}$$

But it is rare to find an index of 1.0 in healthy persons; it is more often a little less than 1.0, because the hæmoglobin tends to be less than 100 per cent. by most of the instruments used in its estimation.

2. *Increase in the Colour Index* is seldom seen except in pernicious anæmia, in which disease it is the rule. It may be as high as 2.0. The colour index is sometimes raised in leukæmia.

3. *Decrease in the Colour Index* is seen in all cases of secondary anæmia and in chlorosis.

Types of Anæmia

In health the erythrocyte is a non-nucleated biconcave disk measuring, with great constancy, about 7μ in diameter. It stains

fairly well with acid dyes (oxyphilic). In severe grades of anæmia the following abnormal features may be observed—

1. *Small cells* (microcytes).

2. *Large cells* (macrocytes). No special significance attaches to these cells.

3. *Nucleated cells* (erythroblasts) are of two kinds, and it is essential to recognize these two varieties because they possess a different significance. (a) The nucleus is relatively small in proportion to the protoplasm, and stains deeply with basic dyes; the nucleus may be lobed. This cell is termed *normoblast*. It occurs in the blood soon after a severe hæmorrhage, is common in the anæmias of childhood, in leukæmia, and in marked degrees of anæmia in adults. Its presence is not of bad prognostic import. (b) The nucleus is relatively large in proportion to the protoplasm, and stains feebly with basic dyes; the protoplasm itself often stains badly. This cell is termed *megaloblast*. It is seen in some cases of leukæmia, and in the most severe grades of anæmia of the pernicious type, when, according to many observers, it indicates that the case is one of primary pernicious anæmia, and not one of secondary anæmia of the pernicious type.

4. *Abnormal shapes* (poikilocytes). A variety of distorted shapes may be observed in anæmic blood, and, in extreme cases, cells with scarcely any contour at all. These marked changes are associated chiefly with pernicious anæmia.

5. *Abnormal staining* (polychromatophilia). This may be a uniformly feeble staining, a stippling, or a variable depth of staining in different cells. Such changes are common in cells of abnormal size and shape.

The Number of White Cells

Enumeration of White Cells. This is undertaken in the same manner as the enumeration of the red cells (*vide supra*). If a count of the white cells only is required, a 0.5 per cent. solution of acetic acid tinged with methyl green may be used as the diluting fluid—this solution renders the red cells invisible, but makes the white cells more conspicuous.

Having filled the counting cell with the diluted blood, the tube of the microscope is so adjusted that the field of the $\frac{1}{6}$ objective just includes eight small squares in its diameter. The field thus includes fifty small squares. The slide is now moved about, and the leucocytes are counted in twenty fields. If x be the number of cells thus counted, there are $x \times 400$ white cells per c.mm. of blood.

The number of white cells present in healthy adult blood varies between 6000 and 8000 per c.mm.

Quantitative changes in the white cells are much more complex than in the case of the red

cells, because there are different kinds of white cells in the blood. The "differential count" of the white cells in healthy adult blood is as follows—

	Percentage.	Number per c.mm.
Polymorphonuclear .. (the leucocyte).	65-75	5000
Small lymphocyte ...	20-25	1500
Large lymphocyte ...	3-5	300
Eosinophile	2-4	150
Basophile	0-0.5	50
		7000

Leucocytosis

An increase in the number of polymorphous cells is termed a leucocytosis. It is always symptomatic of some other disease process. Its presence is usually decided merely upon a count of total cells, without a differential count; but this method involves a possible fallacy, because it cannot be said with certainty, in counting the white cells by the Thoma-Zeiss method, which cells are polymorphous and which are lymphocytes, etc. A leucocytosis is an important clinical fact, and its demonstration frequently assists greatly in questions of diagnosis and prognosis. Instances of leucocytosis may be divided into two classes—

1. *Physiological Leucocytosis*. This is seen in newborn infants, during pregnancy and after parturition, during digestion, and after cold bathing and exercise.

2. *Pathological Leucocytosis*. This occurs in a large number of morbid states which may be grouped as follows—

(i) *Acute General Infections*. The only known exceptions are typhoid fever, Malta fever, influenza, malaria, measles and general tuberculosis. In all other specific fevers a leucocytosis is found. All forms of acute septicæmia show a leucocytosis.

(ii) *Acute Local Infections*. In erysipelas, cellulitis, acute abscess, tonsillitis, otitis media, appendicitis, pyelitis, and many other acute infections, a leucocytosis is almost invariable. When local inflammatory conditions complicate the specific fevers mentioned under (i)—which are otherwise unaccompanied by leucocytosis—there is a rise in the number of white cells—e.g. peritonitis in typhoid fever is productive of leucocytosis. The intensity of the leucocytosis varies directly with the tendency to pus formation at the seat of the local inflammation.

(iii) *Chronic Infective Conditions* are associated with a leucocytosis, though usually less in degree than is seen in acute infections.

(iv) *Malignant Disease* in nearly all cases gives rise to a leucocytosis, especially when the growth is ulcerating or increasing rapidly.

(v) *Hæmorrhage*. The initial decrease in

leucocytosis is followed by an increase during the stage of "reaction."

(vi) *A Terminal Leucocytosis* is an almost constant antecedent of death.

Prognostic Value of Leucocytosis. Generally it may be said that if a cause of leucocytosis be present, the higher the count the better the prognosis. A trivial leucocytosis occurring in a case in which a cause of leucocytosis is present and the infection is marked, indicates that the resistance of the patient is low, or the degree of poisoning is severe. Both conditions may occur in the same case. Thus in pneumonia, if the disease is taking a favourable course, the leucocyte count rises steadily until the crisis, at which time it becomes very high (20,000-40,000). If, however, the patient is debilitated, or is an alcoholic, or if the degree of infection is very severe, this critical leucocytosis may be absent. In septicæmia the leucocytosis rarely exceeds 15,000. In local infections proceeding to suppuration, it is quite common to find 30,000-50,000, even in adults.

Leucopenia

A decrease in the number of polymorphonuclear cells is termed leucopenia. It occurs in the following conditions—

1. *Acute Hæmorrhage*. The reduction involving all varieties of cells is not strictly a leucopenia. It is soon replaced by a leucocytosis.

2. *Pernicious Anæmia*. The white cell count is reduced to 2000-3000.

3. *Splenic Anæmia*.

4. *Lymphadenoma* (occasionally).

5. *Acute Specific Infections*, of which the following is a complete list: malaria, Malta fever, typhoid and paratyphoid fevers, measles, influenza and general tuberculosis. In some acute infections by *B. coli*, such as cholecystitis, a leucopenia also occurs. The diagnostic value of a leucopenia in an acute febrile illness is thus very great.

Lymphocytosis

An increase in the lymphocytes in the blood is usually seen in *pertussis*, *active rickets*, and some forms of tuberculosis. It is sometimes met with in lymphadenoma.

Eosinophilia

An increase in the eosinophil cells occurs in—

(i) *Parasitic Diseases*. *Tænia mediocanellata*, *oxyuris*, *ascaris*, *ankylostomum* and *hydatid* disease all cause eosinophilia.

(ii) *Asthma*, especially during the paroxysm.

(iii) *Certain skin diseases*, such as pemphigus.

BLOOD-CULTURE

Blood-culture, undertaken for the purpose of discovering the presence of micro-organisms,

has become a matter of primary importance in the diagnosis and treatment of disease. The treatment of septicæmia, whether by bactericidal serum, or by specific inoculation, or by a combination of both, must depend for its success upon the isolation from the patient's blood of the micro-organism present, and that at as early a stage of the disease as possible.

By blood-culture, the existence of a septicæmia, and its nature if present, can be determined.

1. *The Existence of Septicæmia.* On clinical grounds alone the diagnosis of septicæmia is impossible. It is a disease in which micro-organisms exist in the blood and multiply there.

(a) In some cases the disturbance of the body functions is so slight that the existence of a general blood infection is not suspected. Thus, patients may suffer from infective endocarditis, with little deterioration in their general health for a long time. Some dyspnoea, loss of flesh, an anginal attack, joint pains, an intercurrent illness—either of these, or some other thing, may bring the patients under close observation, and the presence of fever which does not yield to treatment, leads to a suspicion of the real nature of their illness. The presence of fever in any case of valvular disease is always to be regarded with seriousness, and, if no quite obvious cause of the pyrexia be discovered, a blood-culture should at once be undertaken.

(b) In other cases the general disturbance is very considerable, suggesting a septicæmia; whereas, in reality, the patient is suffering from a local infection with an intense degree of toxic absorption. This problem is not uncommon in the sphere of obstetrics, and after certain surgical operations.

2. *The Nature of a Septicæmia.* Micro-organisms exist in the blood in several diseases which we are not wont to designate septicæmia. Thus typhoid bacilli are present in the blood during the first two weeks of typhoid fever; and pneumococci can often be demonstrated in the blood of pneumonic patients. The great majority of cases of septicæmia are due to one or other of the pyrogenetic micro-organisms, and run no definite course. The causal microbe, be it streptococcus, pneumococcus, staphylococcus, gonococcus or influenza bacillus, can only be determined by blood-culture.

There are three available methods of examining the blood for micro-organisms—

1. *Blood-films* may be made directly and stained by some suitable dye—as Leishmann's.

It is the only method available when the micro-organism is one which defies cultivation outside the body, or reproduction of the disease by animal inoculation. Such are the parasites of malaria and sleeping sickness.

2. *Animal Inoculation.* Not a convenient method, but one which may be reserved for special cases.

3. *Blood-culture.* Various nutrient media are inoculated with the patient's blood. This is the method which is by far the most useful.

Technique

The blood is obtained from a vein in the arm, with a sterilized hollow needle. The puncture is fraught with practically no discomfort to the patient.

1. *Preparation of the Patient.* That arm is chosen in which the largest and most prominent veins are seen beneath the skin of the antecubital fossa. The patient lies on his back, near the edge of the bed. A good light is essential. The skin is cleansed with soap and water, followed by ether or acetone, and is temporarily covered with a piece of gauze or lint soaked in the same fluid. Elaborate efforts at complete sterilization of the skin by chemicals are unnecessary. The arm is now allowed to hang out of the bed and a handkerchief is tied round it well above the elbow, so as to cause the veins to stand out prominently. In some cases a vein may be distinctly felt when it cannot be clearly seen; the puncture is just as likely to be successful in these circumstances.

2. *Preparation of the Syringe and Needle.* Into the water in which a 5 c.c. glass syringe and needle are boiling, a small tabloid of sodium citrate is put, so as to make a solution containing about 0.5 per cent. of the salt. Needle and syringe are now fitted together, and about 0.5 c.c. of the boiled citrate solution is taken up into the syringe. This prevents rapid clotting of the blood.

3. *The Puncture.* The syringe is taken in the operator's right hand. The patient's arm is held fully extended, and at right angles to his body. The gauze is now removed from the arm and a little ether is poured over the skin. The puncture is made as the fluid is evaporating, the vein being supported by the finger and thumb of the left hand. The skin is pierced immediately over the vein, the direction of the needle being made parallel with the surface of the skin, so as to avoid puncturing the posterior as well as the anterior wall of the vein. When the needle enters the vein, a flow of blood takes place into the syringe without the employment of suction, and the piston may be gently removed before the incoming blood until the syringe is full. If no blood flows, the most probable accident is that the posterior wall of the vein is punctured and the needle should be withdrawn a very little; this often leads to an immediate flow of blood. If this does not occur, the needle is not in the vein at all, and it is removed still further, but kept just beneath

the skin; and a second attempt is made to puncture the vein. The syringe being full, the needle is promptly withdrawn, the handkerchief removed, and the arm raised. The skin puncture rarely bleeds and needs no dressing. Occasionally a small subcutaneous hæmatoma results if there has been an initial unsuccessful puncture—in this case a firm bandage is applied for a few hours.

4. *Inoculation of the Culture Media.* The method employed depends upon whether the culture tubes can be incubated forthwith, or must be sent through the post prior to incubation.

(a) *The tubes can be incubated forthwith.* The blood is quickly transferred to a series of broth tubes which are in readiness close by. Other media are rarely, if ever, necessary. Half-a-dozen tubes containing 10 c.c. of broth are used, roughly graduated dilutions of the blood being made by adding a tenth of a c.c. to the first tube, a fifth to the second, a half to the third, and so on. The first tube, therefore, contains blood in the proportion of 1 to a 100 of broth. The objects in view are (i) to dilute any antibodies which may be present, and yet (ii) to have a good bulk of blood in one or two of the tubes.

Immediately after inoculation the tubes are rolled vigorously between the hands, and are then incubated at 37.5° C. In a few hours, in all but the very dilute tubes, a translucent jelly-like clot is found suspended in the broth. In this clot colonies of any micro-organism present usually develop as isolated whitish masses, easily distinguished and counted.

(b) *The tubes must be sent through the post.* In this case gelatin tubes are used instead of broth tubes. The gelatin is melted by placing the tubes in water at a temperature of 30° C. The blood is then well mixed with the medium in the manner described under (a), and the tubes are allowed to cool down to the temperature of the room. When the gelatin has solidified, the tubes are posted to the pathologist. This method cannot be adopted in very warm weather unless the tubes are packed in ice or in a Thermos flask.

The examination of the culture tubes is a matter of bacteriological technique, and therefore does not come within the scope of this article.

Interpretation of Results

If the method of blood-culture described above be adopted, contaminations will be found to occur very rarely. If they do occur, their elimination is easy. The commonest contaminations are *staphylococcus epidermidis albus*, and various *sarcinæ* from the skin or air.

Unless the same micro-organism can be

demonstrated in each of the tubes, considerable distrust must be entertained that it has come from the blood, unless its characters make this conclusion practically certain.

With due regard to the question of contaminations, the pathologist will report the presence or absence of micro-organisms in the cultures, and if present he will state their character and give some idea of their numbers. This report must be taken in conjunction with the clinical features of the case, and with any blood-tests that may have been undertaken. Valuable diagnostic knowledge though it is, the mere demonstration of micro-organisms in the blood, apart from other facts connected with the case, gives little information in regard to prognosis. It is known to-day that micro-organisms exist in the blood, in the course of more disease processes than was formerly thought to be the case. The almost hopeless prognosis to which their discovery once led the physician, no longer holds good. The associated condition is of fundamental importance in any conclusion with regard to prognosis. It must be remembered that the typhoid bacillus can be demonstrated in the blood during the first two weeks of a large number of even mild cases of typhoid fever; also that the pneumococcus can similarly be demonstrated in the blood in many cases of pneumonia. In both these instances, however, the number of micro-organisms is usually quite small. It may be confidently said that the prognosis is bad in proportion to the number of micro-organisms present. If, for example, there be evidence of ulcerating endocarditis in pneumonia, the number of pneumococci in the blood is generally great, and the prognosis is as grave as it can be. In typhoid fever, the later in the course of the disease that bacilli are found in the systemic blood-stream, the worse the prognosis, and the isolation of the bacillus from the blood after the tenth day constitutes a very bad sign.

T. J. H.

LUMBAR PUNCTURE

The conditions in which lumbar puncture becomes advisable are year by year increasing, as our knowledge of the cerebro-spinal fluid and the changes which it undergoes in disease is extended.

1. *Diagnostic Indications.*

(i) *Acute Meningitis.* The diagnosis of this disease from certain toxæmic states associated with headache, delirium and fever, may be quite impossible on purely clinical grounds. Several of the symptoms of meningitis are not infrequently seen in such cases as typhoid fever, pyæmia, pneumonia, epidemic diarrhœa, and middle ear disease. Such are headache, delirium, vomiting, irregular pulse, absent

tendon-jerks, stiffness of the neck, and Kernig's sign. On the other hand optic neuritis and various paralyses are very frequently absent in meningitis, especially in the early stages, when diagnosis is of paramount importance. Not only is the question of the existence of meningitis generally settled, but the cause of the meningitis (when present) is also often revealed by a lumbar puncture. And thus both prognosis and treatment may be very definitely assisted.

(ii) *Chronic Meningitis* (Pachy-meningitis). This is usually a chronic disease of tuberculous, syphilitic or traumatic origin, mostly spinal in its distribution, and often local.

(iii) *Coma* of doubtful origin. The importance of lumbar puncture in all cases can scarcely be overestimated, and contra-indication does not exist. A fractured skull may be suggested by the presence of blood intimately mixed with the fluid. Uræmia may be clearly manifested by the discovery of a high percentage of urea.

(iv) *Parasyphilitic Affections of the Brain and Cord*. *General paralysis of the insane* and *tabes dorsalis* lead to recognizable changes in the cerebro-spinal fluid. In all doubtful cases of these two diseases, lumbar puncture should, therefore, be performed.

(v) *Meningism*. This term is employed to indicate the toxæmic state referred to in the first section when there are no convincing signs of organic disease of the brain or meninges. Some neurologists do not mark off such cases from meningitis proper, and conceive of them as being in reality mild cases of meningitis. But the course of the disease, the prognosis, and above all, the normal condition of the cerebro-spinal fluid, completely justify the position of those who regard such cases as meriting a separate category.

(vi) *Uræmia*. Emery considers that the chemical examination of the cerebro-spinal fluid affords the simplest test of the functional capacity of the kidney. In one case he found 0.4 per cent of urea, or ten times the amount present in health.

2. Therapeutic Indications.

(i) *In the Treatment of Meningitis*. Periodic drainage of the spinal meninges, acting, it is thought, by removal of bacteria and their toxins, has been found of distinct benefit in some cases of acute meningitis; this is especially so in the treatment of meningococcal meningitis, and under certain circumstances a small cannula may be left *in situ* for twelve hours or more. It is clear that the persistence of acute meningitis indicates removal of the effusion by lumbar puncture, and this mode of treatment calls for no special pathological training on the part of the practitioner. In tuberculous meningitis, temporary benefit is derived from the puncture

and in some cases actual recovery has been reported. But it is difficult to believe that a true meningitis was present in these cases.

(ii) *The Relief of Intracerebral Pressure*. Lumbar puncture may be performed to relieve tension. Coma is not infrequently replaced by temporary consciousness after the puncture, and it is likely that the progress of an optic neuritis may be delayed by this means. The puncture may, therefore, well be performed periodically in cases of rapidly developing optic neuritis in association with cerebral tumour due to syphilis, pending the action of anti-syphilitic drugs. Trephining, which has been performed with the same object in view, may be reserved as a more permanent measure if necessity arise.

(iii) *The Relief of Headache*. Temporary, but sometimes very marked, relief from headache, may follow the puncture. This has been seen to occur in cerebro-spinal meningitis, in cerebral tumour, in sinus thrombosis, and in uræmia. Emery refers to a similar beneficial effect in chlorosis.

(iv) *The Introduction of Remedial Substances into the Spinal Theca*. In the treatment of meningitis, especially that due to the meningococcus, lumbar puncture may be performed with a view to the introduction of specific sera into the spinal canal. In tetanus, anti-tetanus serum may be given by this route, and good results have been reported after the injection of magnesium sulphate. Drugs may be used for the induction of spinal analgesia. (See *Anæsthetics*.)

Technique

1. *Position of the Patient*. In the majority of cases the patient is actually ill, and the recumbent position is obligatory. He lies on his side near the edge of the bed, with knees drawn well up, head bent forwards, and trunk arched with convexity backwards. The lower shoulder must not rest upon a pillow or the line of the spine will not be straight.

2. *Surface-marking for the Puncture*. The fourth lumbar spine is that lying nearest to the transverse line which joins the highest point of the iliac crests. The puncture is made between the third and fourth lumbar vertebræ. In an adult a point is chosen about a third of an inch on one side of the mesial line, at an equal distance from each spine. In children the puncture is made in the middle line.

3. *Preparation of the Skin and Apparatus*. The skin is prepared by rubbing with swabs, using soap and water, followed by ether—as for other punctures. While the patient is being prepared, a 10 c.c. syringe, with a stout needle, at least three inches in length, is being boiled. A “Barker’s” needle is very serviceable, and

may be used without a syringe, the fluid being directed into a sterile test tube.

4. *Question of Anæsthesia.* A general anæsthetic is only required when the patient is delirious. In all other cases the skin at the site of the puncture may be frozen with an ethyl chloride spray, or, better still, rendered analgesic by the injection of a little novocaine.

5. *Making the Puncture.* The needle is inserted at the spot already indicated, and is directed forwards, with a slight inclination upwards and inwards. In the case of an infant the direction is wholly forwards. If obstruction be encountered, before the needle enters the spinal canal, the instrument is withdrawn a little way and the direction is slightly altered until the canal is entered, when fluid will be seen to enter the syringe. If this does not take place, very gentle suction is exercised by the piston. The commonest cause of a "dry puncture" is the fact that the needle has not entered the canal; less common causes are the striking of a nerve-root, and the presence of an inflammatory exudate too inspissated to flow through the needle. A little practice in the performance of this small operation is naturally of much assistance: this may be secured in the post-mortem room.

Examination of the Fluid

If a complete examination of the fluid is required, the fluid is transferred to a sterile vessel and forwarded to the pathologist. At the bedside the following facts may be investigated.

1. *The Pressure* under which the fluid is contained. To those unaccustomed to perform lumbar puncture, the fluid, even in health, appears to flow at first with more force than is expected. In meningitis this normal pressure is sometimes exceeded; occasionally it is very high.

2. *Naked-eye Appearance of the Fluid.* Normal cerebro-spinal fluid is clear, limpid and colourless, forming no deposit on standing. In meningitis it may vary from this condition, through different degrees of opalinity, up to one of such turbidity as to suggest thin pus. Flakes of unorganized protein matter are common in cases of meningitis. Blood may be present either because (a) a vessel has been wounded during the puncture, or (b) the effusion is blood-stained, or (c) blood has entered the cerebro-spinal system at some point as the result of trauma (e.g. fractured skull). In (a) the added blood usually colours the first portions only. Such fluid contaminated with blood, though useful for culture purposes, is useless for cytological examination. In (b) the fluid is bloody throughout. The colour may vary from bright red, due to recent hæmorrhage, to a pale straw colour resulting from a small

or old extravasation. In (c) the amount of blood is apt to be considerable, and is present throughout the whole of the fluid.

3. *Chemistry.* Normal cerebro-spinal fluid contains a minute trace of albumin, and reduces Fehling's solution. If albumin be present in sufficient amount to give a definite cloud on boiling, or a ring with cold nitric acid, a certain indication of disease is given. The reducing action of the fluid is, as a rule, diminished in meningitis. Urea may be detected in uræmia.

4. *Cytology.* In health the actual number of cells present is not more than ten per cubic millimetre of the fluid; the estimation may be made on the Thoma-Zeiss counting chamber. In disease the number of lymphocytes may be much increased, or polymorphonuclear cells may be also, and mainly, present. A film prepared from the deposit which forms at the bottom of the tube and stained by Leishmann's fluid will reveal the characters of such cells.

5. *Bacteriology.* In the same film search is made under a twelfth objective for micro-organisms. The completion of this part of the examination needs a laboratory, though such an organism as the meningococcus, from its morphology and intracellular distribution, may be identified with almost certainty in film preparations.

T. J. H.

A. E. G.

THE SPUTUM

In this section attention will be given to material which is expectorated, that is, which comes from the larynx or some part lower than this in the respiratory tract. The points to be made out are most conveniently dealt with under the particular situations whence the material is derived.

1. *The Larynx.*—Either of the three chief forms of chronic laryngeal disease—*tuberculosis*, *syphilis* and *new growth*—when ulceration has taken place may lead to several ounces of sputum in the day. The sputum is not frothy unless there be much associated bronchitis. It is highly purulent, and in the case of *malignant disease*, especially, is apt to contain a varying amount of bright blood scarcely mixed with the muco-pus. Groups of cells may be found suggestive of new growth.

In *tuberculous ulceration*, isolation of the tubercle bacillus, even if there be no certain physical signs of disease in the lung, must not be taken to mean that the tuberculosis is confined to the larynx.

In the pre-ulcerous stage of these three diseases, and in simple *laryngitis*, the amount of sputum is quite small and consists of small plugs of tough mucus, usually translucent.

In *laryngeal* or *tracheal diphtheria* pieces of membrane may be coughed up.

2. **The Trachea.**—The sputum of tracheitis is similar in appearance to that of laryngitis. During the first few days of an acute attack *M. catarrhalis*, *B. influenzae* or the pneumococcus may be found, but as the disease progresses the flora becomes more varied. An *aneurysm* leaking into the trachea or left bronchus may lead to blood-stained sputum perhaps for weeks before the final rupture occurs. An *oesophageal fistula* may be suspected if with appropriate symptoms the sputum is intimately mixed with food particles.

3. **The Bronchi.**—Frothy sputum indicates *bronchitis*. In the early stage of an acute attack the quantity of sputum is slight and the mucous element predominates. Later, and in chronic bronchitis, the mucus is mixed with pus. In some cases of acute bronchitis the sputum, as in asthma, contains large numbers of eosinophil leucocytes. In acute bronchitis the commonest micro-organisms found in the secretion are those demonstrable in acute tracheitis; in the chronic disease the varieties of microbes present are exceedingly numerous.

In the unusual form of bronchitis called *pituitous catarrh*, the amount of sputum is large and rapidly formed. It consists chiefly of thin fluid like gum-water, on which there is usually a layer of frothy mucus—not unlike the so-called “albuminous expectoration” which occasionally follows *paracentesis thoracis*, but it contains very little albumin. The condition of *pituitous catarrh* may occur with *oedema* of the lung or with *tuberculosis* and also with the congestion consequent upon a dilated heart or contracting cancer. Somewhat similar is the sputum in cases of *acute suffocative catarrh*—an acute bronchitis—but here it is very viscid, mucopurulent, greenish in colour and may contain blood; the pneumococcus is, apparently, the causal microbe.

Foetid sputum raises a suspicion of gangrene or other form of lung destruction, though no such condition may in reality be present. *Anærobic bacilli* can usually be demonstrated in such sputum.

In *plastic* or *fibrinous bronchitis* the sputum contains casts of the smaller bronchi. Care must be taken to distinguish these from *diphtheritic membrane*, which may be similarly branched when coming from some part of the bronchial tree. Cultures should always be taken from such casts, because the operation of a specific micro-organism, whether that of *diphtheria* or not, is always an important consideration.

In *bronchiectasis* both the manner of production of the sputum by the patient, and its characters, are important points in diagnosis.

Not all patients who cough up a large quantity of purulent material in the early morning are the subjects of *bronchiectasis*. A similar state of things may obtain in *phthisis*, and in chronic *bronchitis* with *emphysema*. The sputum is sometimes, though by no means always, foetid. On standing it generally forms into three layers. The lowest and most considerable consists of pus, bacteria, albuminous debris with the occasional addition of blood and crystals. The intermediate layer is a serous fluid. The upper layer consists of muco-pus. *Hæmoptysis* is a not infrequent complication of *bronchiectasis*. The flora is in most cases exceedingly varied and the quantitative microbic content of the material is very high. In the bacteriological investigation of the sputum the pus must be reduced to known dilutions, and a series of cultures made from these. Some knowledge of the dominant micro-organism present can then be gained, so that in the event of vaccine treatment being employed, some confidence can be placed in the method of examination adopted.

4. **The Bronchioles.**—The seat of production of the sputum, which often characterizes an *asthmatic paroxysm*, is the bronchioles. Omitting the secretion which is sometimes due to an attendant bronchitis, the sputum in *asthma* is of two kinds :—(a) copious, quickly and easily expectorated and consisting of gelatinous-looking material, with little or no admixed air; or (b) it may be scanty, expectorated with much difficulty, and consist of long, slender, semi-opaque strings or spirals of tough mucin, or of similar threads curled up tightly into the so-called “perles,” which are casts of the bronchioles. The sputum is easily distinguished from that of bronchitis and pneumonia by the large number of eosinophil cells which it contains. There are also present, in many samples, *Charcot-Leyden crystals*—colourless pointed octahedrals.

The bacterial content of *asthmatic sputum* is very low when compared with that of, say, acute bronchitis. The dominant micro-organism may be a *streptococcus* or *micrococcus catarrhalis*.

5. **The Lung.**—Sputum from the lung varies in its character according as the tissue is or is not ulcerated or destroyed by the disease-process.

(a) *Non-destructive Processes.* *Pneumonic sputum* is usually termed “rusty,” owing to the presence of altered blood. A pneumonia may be ushered in by a definite hæmoptysis, especially if the patient be the subject of such a condition as *mitral disease*. The sputum is exceedingly tenacious, though the secretion characteristic of inflammation of the alveoli may consist of a few lumps only. Cells present

are leucocytes, red blood cells and epithelial cells from the alveoli with ingested erythrocytes and micro-organisms. In most cases the pneumococcus is the dominant microbe, in others the influenza bacillus, and in a few the tubercle bacillus, Friedlander's pneumo-bacillus or a streptococcus. Mixed infections are common in broncho-pneumonia.

Young children swallow the material they expectorate and do not spit it up. Valuable information may be obtained, not infrequently, in cases of pulmonary disease, by swabbing the child's throat, and, after the resulting fit of coughing, securing the expectoration, before it is swallowed, upon a second swab.

In *œdema of the lung* if sputum be present it is usually similar to that in pituitous catarrh. "Albuminous expectoration" which sometimes follows paracentesis thoracis is probably due to an acute œdema of the rapidly expanding lung.

The sputum in chronic *congestion* of the lung is usually blood-stained and contains swollen alveolar cells with granules of pigment. After *hæmorrhagic infarction* the infarct may be expectorated, giving rise to rusty sputum or actual hæmoptysis.

(b) *Destructive Processes.—Phthisis.* In the early stages of chronic phthisis, whilst the lesion is a purely infiltrating one, there is no sputum. When softening and ulceration take place the sputum shows the features of chronic bronchitis with the addition of caseous particles. Secondary pyogenic infection of the ulcerated areas now occurs and pus is added to the sputum. If, in a suspected case, sputum is not readily forthcoming it is well to provide the patient with a pocket flask into which to expectorate after the coughing or "hawking" which so frequently occurs whilst dressing in the morning. (In some cases of phthisis there may be no sputum throughout the whole course of the disease, and in the acute miliary form of pulmonary tuberculosis and in the so-called acute pneumonic phthisis, absence of sputum is the rule rather than the exception.) "Nummular" sputum, composed of isolated lumps of airless, greenish material floating in the sputum pot, though suggestive of a tuberculosis cavity is by no means diagnostic of it. In other cases the sputum is similar to that of bronchiectasis, and more rarely it is foetid.

Blood occurs in the sputum of phthisis very frequently. (i) The hæmoptysis which not infrequently ushers in the disease in a young adult probably indicates the relief of congestion around the infiltrating focus in the lung. (ii) During the ulcerating stage separate lumps of frothy mucus may be brightly tinged with it, or the muco-pus may contain threads of bright or dark-red blood, or the whole sputum may

be of a pale red colour. It is likely that all these forms of bleeding result from slow or rapid oozing from the vascular wall of the phthisical cavity. (iii) When the disease is well established large hæmorrhages may occur from ulceration of a good-sized vessel in the wall of the cavity, or from the rupture of an aneurysm of a branch of the pulmonary artery crossing the cavity. The passage of calcified matter, in "arrested" phthisis, through the lung may be accompanied by hæmoptysis.

The examination of the sputum for tubercle bacilli must on no account be omitted because the clinical symptoms and signs seem to be conclusive in favour of phthisis. A repeatedly negative result may at length induce the physician to ponder a diagnosis hitherto thought to be secure. The occurrence of elastic fibres in the sputum is a sure sign of destruction of lung tissue, and there is one cytological evidence afforded by sputum in favour of phthisis, and that is the presence of numbers of round mononuclear cells resembling lymphocytes.

The secondary pyogenic infections of phthisical cavities and of inflamed bronchi are responsible for many of the symptoms in the later stages of the disease; but if any good is to be expected from vaccine or other specific therapy in this connection, it is of paramount importance to undertake quantitative estimations of the bacterial content, as is the case with bronchiectasis.

In *gangrene of the lung* the sputum has a characteristic odour and contains pieces of lung tissue or isolated elastic fibres. It sometimes separates into three layers.

Abscess of the lung is usually associated with foetid sputum and breath. It contains isolated elastic fibres but not pieces of intact lung tissue.

Actinomycosis of the Lung. Granules of the fungus, about the size of a small pin's head, colourless, yellow or occasionally black, may be seen with the naked eye or with a hand lens. Any such particles should be examined microscopically. The sputum is free and purulent.

Hydatid Disease. Hooklets and scolices may occasionally be found during microscopical examination.

The sputum in *malignant disease* of the lung is said to resemble prune juice from the admixture of altered blood. Quite as often, however, it consists of copious muco-pus which may be foetid; or it may be similar to that of pituitous catarrh.

6. **The Pleura.**—Muco-purulent sputum is often present in pleurisy. If an effusion collects rapidly, blood may be present also. The material is derived from the subjacent lung and bronchi. In a few cases of pleurisy with effusion the fluid which has collected in

the sac ulcerates through the membrane into the lung and is expectorated.

(a) An *empyema* is not infrequently coughed up. In the majority of such cases the patient has been ill immediately prior to the event though physical signs of the empyema may not have been discovered. It occasionally happens, however, that the sudden pyorrhœa is the first evidence of anything amiss.

(b) Very rarely a *serous pleural effusion* makes its way into the lung and is coughed up.

7. **Parts adjacent to the Lung.**—A *liver abscess* may extend through the diaphragm and pleura and its contents may be expectorated. The material at first has an appearance likened to anchovy sauce. The microscope may reveal amœbæ. Bile pigments and bile salts may be shown to be present; and fragments of tissue having the histological features of liver cells may also be demonstrated.

Both actinomycosis and hydatid disease of the lung may be secondary to a primary focus in the liver.

T. J. H.

A. E. G.

PLEURAL PUNCTURE

Puncture of the pleural sac is indicated in every case where there is a suspicion of a pleural effusion, however small, when the primary disease is located in the pleura or lung; in some cases of chronic valvular or renal disease with anasarca no special knowledge is likely to be gained by the puncture.

Mode of Making the Puncture. The patient, suspected of a pleural effusion, is already in bed. The position of the patient is semi-prone, the affected side being uppermost, with a pillow placed beneath the unaffected side. The uppermost arm is brought well to the front. If the exploration is to be made in the front of the chest, as when an empyema is suspected at the apex of the lung, the patient lies on his back with a pillow beneath the shoulders and the head turned to the unaffected side.

While the syringe and a clean sharp needle are being boiled, the skin over the seat of the puncture is treated with soap and water and then with ether. If an empyema be suspected the needle must not be too fine lest it meet with pus too thick to flow along it, and for an adult it should be at least three inches long. The puncture is made where the signs of effusion are most marked. In some unusual situations care must be taken to avoid wounding the heart or big vessels. The needle, being held at right angles to the skin, is made to pierce the chest wall quickly in a costal interspace immediately above the lower rib. When by gentle suction the needle has been filled, or the puncture has been proved to be "dry," the needle is quickly

withdrawn, the skin being prevented from following the needle by pressure of the finger close to the point of insertion. The puncture is sealed with a piece of gauze or wool soaked in collodion.

Naked-eye Examination of the Fluid. The puncture at once determines the nature of the effusion, whether serous, sero-purulent, hæmorrhagic, milky or chalky.

1. A *serous effusion* is most often due to tuberculosis of the pleura. It sometimes complicates rheumatic fever, is less often due to the pneumococcus and is rarely associated with a streptococcal infection. If the fluid quickly coagulates into a firm jelly this indicates an inflammatory origin of the exudate. If clotting is partial, or almost absent, it is likely that the fluid is more a passive transudate than an active exudate. A small serous effusion may co-exist with a definite septic focus such as abscess or gangrene of the lung.

2. *Sero-purulent effusion* is rather common as a result of pneumococcal infection and may accompany lobar consolidation of the lung. Although it is to be classed among the purulent rather than the serous effusions, it does not usually call for immediate aspiration, for it is frequently absorbed after the diagnostic puncture has been made. Chronic pleural effusions are frequently turbid, as the result of much débris of leucocytes and other molecular matter.

3. *Purulent effusions (empyema)* indicates pyogenetic infection—by pneumococcus, streptococcus or staphylococcus. Its discovery indicates free drainage by means of resection of one or more ribs. Empyema is often regarded as a possible result of tuberculosis—this is a rare event, if indeed it occurs at all. If the patient be tuberculous the infection is a mixed one and pyogenetic micro-organisms are present as well as the tubercle bacillus.

4. *Hæmorrhagic effusion* is most often due to tuberculosis. New growth of the pleura is a less common cause. The effusion complicating heart disease, especially when associated with infarction of the lung, is prone to be bloody. So also is the effusion sometimes accompanying an aortic aneurysm. If pleural effusion occur in scarlet fever it may be hæmorrhagic. Lastly, any of the so-called hæmorrhagic diseases—purpura, hæmophilia, scurvy, leukæmia—may be complicated by blood-stained pleural effusion.

5. *Milky effusion*—a generic name for three different forms of opaline effusion:—

(a) *Chylous.* The effusion may consist of chyle, due to the escape of this fluid from the thoracic duct or one of its tributaries into the pleural sac. In this effusion the fat rises to the surface as a cream.

(b) *Chyliform effusion* is not to be distinguished

from (a) by the naked eye, but it has much less tendency to "cream."

(c) *Milky non-fatty* effusion does not cream at all.

Little is known of the origin of the two latter effusions.

6. *Chalky effusion* is white and opaque, due to the presence of calcium phosphate. This condition has not been proved to be due to the escape of material from a softened calcified gland into the pleura, although calcified bronchial glands have been found in such a case post-mortem.

The Cytology of Pleural Effusion.—1. *Serous Effusion.* A different cell-content is present according to whether the cause of the effusion is inflammatory or transudatory; and, again, in the inflammatory effusions, according to whether the cause is tuberculosis or pyogenetic infection. When the dominant cells present in a pleural effusion are small lymphocytes, the probable cause of the inflammation is the tubercle bacillus; when the dominant cells are polymorphonuclear leucocytes, the probable cause is some pyogenetic micro-organism. During the early stages of a tuberculous pleurisy the predominance of the lymphocyte is less marked than as the effusion progresses. In the secondary pyogenetic infection which not uncommonly complicates tuberculous pleurisy when phthisis is present, a gradually increasing number of polymorphous cells appear in the exudate, thus disturbing the proportions seen in primary tuberculous pleurisy.

In *pleural transudates*, such as accompany heart and kidney disease, endothelial cells, often arranged in mosaic, are a striking feature.

In pleural effusion complicating malignant disease of the pleura or lung the fluid should be carefully searched for histological evidences of new growth; the difficulty of distinguishing between groups of endothelial cells and cells derived from a tumour is, however, very great.

2. *Empyema.* The presence of pus is but an extended degree of dominance of the polymorphous cells in the exudate, with the significance already observed.

The Bacteriology of Pleural Effusion.—The search for micro-organisms must be conducted by film preparations, by culture, and (if necessary) by animal inoculation.

1. *Serous Effusion.* (i) In most cases of serous effusion no micro-organisms are demonstrable by either of the first two of these methods. If the search for the bacillus be undertaken by inoculation of a guinea-pig, which must be regarded as by far the most critical method, the proof of tuberculosis is probably as high as ninety per cent. Other methods for finding the bacillus, which meet with a variable degree

of success, are: (a) the simple sedimentation and staining of films; (b) "inoscopy" or digesting the clot with artificial gastric juice, or dissolving it in antiformin, centrifugalizing the deposit and preparing films; (c) hardening the shrunken clot, cutting sections of the embedded material by the paraffin method, and staining these with carbol-fuchsin.

(ii) A serous effusion is sometimes *pneumococcal* in origin. This may be so whether there is concurrent hepatization or not. The pneumococcus is found without difficulty, often in the films, as well as by culture.

(iii) Occasionally a serous effusion is due to a *streptococcus*. In the post-mortem room it is not rare to find streptococci in the pleural exudate accompanying rheumatic fever.

(iv) The *typhoid bacillus* has occasionally been isolated from the pleuritic fluid. In one instance the effusion was hæmorrhagic. Pleurisy during convalescence from typhoid fever is very prone to be the work of the tubercle bacillus, and even if the typhoid bacillus be isolated from a case of pleurisy, tuberculosis must none the less be suspected.

(v) The *influenza bacillus* and *gonococcus* have been isolated from pleuritic effusion in a few cases.

2. *Empyema.* In the great majority of cases of purulent pleural effusion micro-organisms are isolated without much difficulty.

(i) The *pneumococcus* is considerably more common than any other microbe, especially in the empyema of childhood. Cases due to this cause are generally comparatively benign.

(ii) Next in frequency is the *streptococcus*, relatively more common in the empyema of adults than of children. The type of streptococcus is most often *S. pyogenes*. It may be concluded that the pneumococcus accounts for nearly three-quarters and the streptococcus for nearly one-quarter of all empyemata.

(iii) Of the remaining cases of empyema (less than one-quarter) the *staphylococcus* accounts for a few. If empyema complicates osteomyelitis, this is the organism generally present. Mixed infection, either with the tubercle bacillus or streptococcus, is not uncommon if the staphylococcus be present, and if the case is not one of staphylococcal pyæmia.

If empyema complicates malignant disease of the œsophagus a variety of micro-organisms is usually found in the pus.

(iv) The tubercle bacillus, according to most English pathologists, is rarely, if ever, the sole cause of empyema.

(v) *B. typhosus*, *B. coli*, *Pfeiffer's bacillus*, *actinomyces*. These micro-organisms have all been found in empyema, the last-named especially, when secondary to subphrenic suppuration,

and perhaps as often in mixed infection as in pure culture.

The presence of diphtheroid micro-organisms is often reported. These are common contaminations of the skin and of certain sinuses. On this account their presence in pus has little pathological significance.

Toxicity of Pleural Exudates.—Quite apart from the action of any bacteria contained in the fluid, there is evidence that pleural effusions possess toxic properties. The rapid absorption of the fluid in a patient is sometimes associated with fever, and on this account a higher range of the temperature occurring at any stage of the disease need not be regarded as of bad import, provided the physical signs indicate diminution of the effusion. It has been found that the hypodermic injection of one c.c. of his own pleuritic exudate into a patient who had been proved to be tuberculous produced a general reaction similar to that seen in a positive tuberculin reaction. This procedure may possibly differentiate the tuberculous from the non-tuberculous cases.

T. J. H.

A. E. G.

LUNG PUNCTURE

Prior to the advent of the histologist and the bacteriologist, a "dry" puncture of the chest was wholly negative in its information. The needle either entered a pleural effusion or it entered the lung. If the latter, a small amount of blood-stained fluid was brought away and immediately discarded. These drops of lung juice may yield very important information as to the presence and nature of disease within the lung itself. A diagnostic puncture of the lung may be made under two conditions: (i) a pleural effusion is suspected and exploration negatives this; or (ii) the lung is deliberately punctured for the purpose of discovering the nature of a disease process within the lung.

Indications. Puncture of the lung is indicated—

1. In any case of consolidation of the lung in which examination of the sputum fails to reveal the nature of the disease, and in which satisfactory progress is not being made.

2. In abscess, to obtain pus from the actual seat of suppuration; more accurate knowledge of the causal microbe is thereby gained than is possible when dealing with the sputum.

3. In bronchiectasis the same comment holds; the flora of the sputum is notoriously varied and difficult of interpretation.

Technique. The mode of performing the puncture follows exactly that of exploration of the pleura. It is advisable to use a good-sized needle, and provided this be clean and sharp the patient suffers very little discomfort.

It should be noted that no risk is run which is not present with every negative pleural puncture, and this latter proceeding is notoriously free from danger when carefully undertaken. The puncture is made at a point on the surface of the chest immediately over the area of lung yielding the most marked abnormal physical signs. The needle is inserted into the lung, the piston is withdrawn about an inch so as to keep up gentle suction, and the needle is then slowly removed whilst the skin is supported by the finger and thumb of the left hand. Just before the needle is completely withdrawn the piston is released, so as to abolish the vacuum in the syringe.

Sometimes the amount of fluid obtained is so small that it is advisable to utilize the whole for purposes of cultivation of micro-organisms. If, however, the quantity admits of this, films are also prepared and stained as in the case of pus. This is, of course, the only method by which the tubercle bacillus can be demonstrated. If a bacteriological examination only be decided upon, the needle is inserted into a little sterile broth from a culture tube, and the mixture of lung juice and broth is squirted on to the surface of an agar slope, or into broth, and incubated at 37.5° C.

If films are prepared, better results are obtained by spreading a drop of undiluted lung juice in the same way as in the preparation of blood-films. Films may give valuable cytological information bearing upon the nature of the disease process.

T. J. H.

A. E. G.

INFECTIVE CONDITIONS OF THE NOSE, MOUTH AND THROAT

I.—The Nose

It is often advisable to make a bacteriological examination of a nasal discharge. A little of the discharge should be smeared on a couple of slides, and culture tubes inoculated, as in the examination of pus. If it is desired to send the discharge, as such, to the pathologist, the patient is instructed to blow his nose into the inside of a clean handkerchief; this is then folded up carefully, but loosely, and forwarded to the pathologist in an air-tight box.

1. In **Acute Coryza** cultures of the nasal discharge rarely yield a single micro-organism. Occasionally, however, the result is an almost pure culture of *M. catarrhalis*, of *pneumococcus*, or of *B. septus*. More often there is a mixture of one or more of these with streptococci, staphylococci, *B. influenzae*, Friedlander's bacillus or various diphtheroids.

2. **Nasal Diphtheria** is such a common event, and is so often overlooked, that a bacteriological examination of all purulent nasal discharges

should be made. The presence of the pseudo-diphtheria bacillus (Hoffmann) in the nose is of no practical significance.

3. **Chronic Rhinitis** is associated with the organisms enumerated under (1). Much can sometimes be done to check or to cure the trouble by appropriate vaccine treatment.

4. The discharge may be a result of *antrum* or *sinus* disease—a state of things that must be determined by clinical examination.

II.—The Mouth

1. Bacteriological examination of the *saliva* is of little or no value in disease, because this fluid contains so many and various microbes during health—never less than 10,000,000 per c.c.

2. **Ulcers and Aphthous Patches** should be cleaned by sterile cotton-wool, then scraped firmly with a stout platinum wire, transferring the material thus obtained to slides and culture tubes.

In **Ulcerative Stomatitis** this investigation may be of much service.

3. **Pyorrhœa Alveolaris**.—A severe grade of this affection may exist without any constitutional disturbance. But, on the other hand, this condition of the gums may be responsible for far-reaching effects upon the general health, some of which may present great difficulty in their elucidation. Absorption of toxic substances may lead to direct effects upon the digestive organs, or may lead indirectly to anæmia, arthritis and various nervous phenomena.

To obtain a specimen of pus for investigation from a case of pyorrhœa alveolaris, it is necessary to dry thoroughly the surface of the gum around the pocket which is being examined with sterile absorbent wool. The gum is then massaged and the exuding pus is wiped away carefully. The platinum wire is now passed to the bottom of the pocket or massage is again employed, squeezing the pus well from the bottom of the pocket. This material is now taken up with a platinum loop and tubes of sloped agar are directly inoculated with it. When the pus is obtained from a place as near to the peri-odontal membrane as possible, it is found that in the great majority of cases the micro-organism obtained is *streptococcus salivarius*. It is often possible to make up a series of doses of vaccine at once from the original culture.

III.—The Throat

In bacteriological examinations of the fauces and tonsils it is imperative that the operator should see exactly what he is doing. If a definite patch of exudation is to be seen, a platinum loop directed on to the surface of such

patch will bring away material which is more valuable than may be obtained by a swab. If there is any membrane present on the fauces, a bit of this should be removed with a pair of sterile fine-nosed forceps and forwarded for examination in a small glass tube fitted accurately with a cork. Swabs used for throat cultures should be sent away in air-tight tubes, so as to avoid desiccation. A film from such material may be at once examined by the practitioner. "Neisser staining" of such a film may be carried out in the case of suspected *diphtheria*.

With regard to the bacteriological diagnosis of **Diphtheria**, it must be borne in mind that whereas a positive report concerning a throat swab makes the diagnosis certain, a negative report carries only presumptive evidence against diphtheria being the cause of the infection. The bacteriological investigation of cases of sore throat is of the utmost value, for (1) it often proves cases to be diphtheria which are from a clinical standpoint quite equivocal. (2) It often enables the practitioner to decide whether the initial dose of antitoxin, given as a safeguard in a doubtful case, should be repeated. (3) It sometimes assists in tracing the source of infection, both in a single case and in epidemics, to a "carrier." (4) It is the most certain means of deciding when a patient ceases to be infectious.

In **Tonsillitis, Quinsy** and other forms of sore throat the procedure is the same as in suspected diphtheria.

In **Syphilis**, during the "secondary" stage, spirochætes may not seldom be demonstrated in the secretion on the tonsils by the direct method of dark illumination.

IV.—Post-Nasal Space

Material may be obtained for bacteriological examination by a device introduced by Mr. C. E. West. A metal speculum, curved almost to a right angle at an inch from one end, has the edges of the opening of the short limb slightly everted. This tube carries a twisted copper wire, armed with a small plug of sterile cotton-wool, which can be withdrawn into the tube or projected beyond the end at will. By this instrument any mucus that has previously been seen in the post-nasal space may be removed without contamination by micro-organisms from the mouth, and may be submitted to cultivation.

T. J. H.
A. E. G.

INFECTIVE CONDITIONS OF THE URINARY TRACT

The materials requiring investigation in connection with the diagnosis of these infections are two—*pus* and *urine*.

1. *Pus*. All material discharged from the urethra should be dealt with in two ways: films should be prepared and tubes of suitable media inoculated at once. If tubes be not available, the pus should be drawn up into a sterilized wide capillary tube, the ends sealed in the flame, and sent to the pathologist.

Films are of great value in the diagnosis of gonorrhoea, as the intracellular disposition of the *gonococcus* is one of its most distinctive features. Gonorrhoeal pus often shows an unusually large number of eosinophil cells.

In a large number of cases of gonorrhoea the *gonococcus* is present in such small numbers, and grows with such difficulty, that it is necessary to inoculate a blood-agar plate with the material if a culture is desired. A culture not only enables a diagnosis of gonorrhoea to be confirmed, but also shows the presence or absence of secondary infection (by *staphylococci* etc.). A culture may be used for preparing a vaccine. The pus from a urethra occasionally yields no growth of bacteria—as when it results from the application of caustics to the mucous membrane at some portion of the tract.

2. *The Urine*. In the case of females all specimens of urine for bacteriological examination should be obtained by the use of a sterile catheter. The first few drops are neglected, the rest is collected in a sterile bottle. In males it suffices to clean the glans with soap and water, dry it with sterile wool, and allow the patient to micturate directly into the sterilized bottle, again neglecting the first few drops.

Cultures are made from the specimen as a whole, using known quantities of the material (e. g. one drop, .5 and 1 c.c.), and also from the deposit obtained on standing or after centrifugalization. From the sediment films will also be made. If the search be made for the *gonococcus* and little or no sediment be obtained, it may be desirable to massage the prostate before the patient passes his urine, after which the urine may contain muco-pus or "threads"—of great value for examination.

The commonest micro-organism present in *cystitis* and *pyelitis* is the *colon bacillus*. It is easily seen in films and grown on media. In the absence of pus from the urine, the mere presence of a few *B. coli* does not necessarily denote disease. *B. typhosus* occurs frequently in the urine of typhoid patients, especially during the third week of the disease.

B. proteus, *streptococci* and *staphylococci* occur as infecting agents in the bladder, and mixed infections are fairly common.

The *tubercle bacillus* may occur alone or as a mixed infection with *staphylococcus albus*; indeed, the isolation of *staphylococcus albus* in pure culture from a purulent urine always suggests the possibility of a tuberculous in-

fection. Tuberculosis of some part of the urinary apparatus is such a common condition that the urine should always be searched for this microbe in any case of doubtful nature in which symptoms are referable to these organs. The tubercle bacillus may be found in urine which is free from pus, for cases of tuberculosis of the kidney occur without pyuria. It is rarely easy to demonstrate the bacillus in the urine; but in a few cases, and especially where the sediment from a large quantity of urine is examined, the bacillus may be found without much difficulty in films stained by the carbol-fuchsin and acid method. If the pathologist fails to demonstrate the bacillus in any case which is regarded by the clinician as possibly one of tuberculosis of the kidney or urinary tract, he should proceed to the inoculation of a guinea-pig. T. J. H.
A. E. G.

JOINT PUNCTURE

It is sometimes advisable to puncture a diseased joint in order to ascertain the nature of the fluid in it.

The *technique* is very simple. The joint is placed in such a position as will remove the bones from apposition as far as possible. That part of the joint is selected for the puncture where the fluid is seen to be most apparent. If, in the knee-joint, there is a uniform swelling, the puncture is best made beneath and to the inner side of the patella. A clean and sharp needle with a fairly large bore is chosen. The skin is, if necessary, shaved, thoroughly washed with soap and water, and afterwards treated with ether. An ethyl chloride spray may be used, but is not of much service.

The fluid removed may be transferred to a sterile glass-stoppered bottle, or in part used to inoculate tubes of culture media at once, in the manner described in the section on blood-culture.

The micro-organisms obtained by joint-puncture are chiefly the *gonococcus*, *streptococcus*, *pneumococcus*, *staphylococcus* and the *tubercle bacillus*.

Some observers describe a specific diplococcus as being present in the joints in *rheumatic fever*. The majority, however, meet with constantly negative results in this disease.

The character of the fluid varies from the clear viscid synovia of normal joints, through slightly or very turbid fluid up to thick pus.

T. J. H.
A. E. G.

EXAMINATION OF THE STOMACH CONTENTS

In the investigation of certain cases of chronic indigestion chiefly referable to the stomach, valuable information may often be obtained

from the examination of the gastric contents, or by a determination of the capacity of the stomach.

Such information falls under one or more of the following headings:—

1. The time taken by the process of digestion in the stomach.
2. The relative and total acidity of the gastric contents.
3. The presence or absence of the products of fermentation.
4. The ferment activity of the gastric juice.
5. Microscopical examination.
6. The capacity of the stomach.

In order to obtain material for an examination on these lines, a *test meal* should be given, and withdrawn after it has been allowed to remain in the stomach for a certain length of time. The test meal consists of two ounces (slices) of toast and a pint of weak tea made without sugar and milk; sugar is omitted because, if present, the fluid becomes sticky during the subsequent evaporation; milk is not added, since its presence interferes with the chloride determination.

The "meal" should be given at 9 a.m., the patient having fasted since midnight. In rare cases, where the test is being undertaken for a second time on account of an equivocal result, it is advisable to wash the stomach out with warm water just previous to giving the meal.



Senoran's Stomach Aspirator.

Usually, however, this is not necessary. One hour later the meal should be withdrawn. This may be conveniently done by means of Senoran's stomach aspirator (Allen and Hanbury) attached to a Vanvalsa's velvet-pointed stomach tube. This tube is well lubricated with glycerine, olive oil or warm water and is passed as follows:—The

patient sits upright in bed or upon a chair. The tube is taken in the operator's right hand and the point directed into the throat with the index finger of the left hand. The patient is then instructed to swallow vigorously several times, and while he is doing so, the tube is pushed onwards. It enters the cardiac orifice of the stomach when the sixteen-inch mark on the tube reaches the teeth. The tube should be passed on beyond this mark for another two inches or so. The aspirator is now attached to the tube. The rubber ring being rolled up to expose the hole in the neck of the bottle, the bulb is compressed and the ring replaced over the aperture. The bulb is then released, causing a slight negative pressure in the bottle. If food does not at once appear, the patient is told to take a few deep breaths. No water is to be added to the stomach contents.

The volume of fluid recovered can be read off directly in the aspirator; it affords evidence as to the motive power of the stomach. Very occasionally nothing at all can be withdrawn from the stomach one hour after such a test meal; in this case the stomach should be washed out with water to make sure that there is nothing left in it.

The quantitative examination of the gastric contents can only be performed in a well-equipped laboratory. The practitioner should, therefore, send the recovered test meal in a stoppered vessel to the pathologist. He should first notice the quantity, appearance and smell.

On standing the fluid separates normally into three layers—below, a finely divided layer of undigested starch separated by a deeper layer of turbid liquid from a clear layer above. The *smell* is normally not at all objectionable; if fermentation is taking place in the stomach, the contents may smell of butyric acid, sulphuretted hydrogen, or the odour may even be putrid or fæculent.

Interpretation of Results

1. Motive Power.

Food Delay. Under normal circumstances the stomach is empty one and a half hours after the administration of such a test meal. At the end of one hour 120–150 c.c. should be recovered; if none is obtained, even after washing out the stomach, there can be no delay in the passage of food through that organ.

Food Hurry. In hyperchlorhydria and in some neuroses the food may pass through the stomach more quickly than in health. In pyloric obstruction the period during which the food remains in the stomach is much prolonged.

2. Chemical Examination.

Total Acidity. (In results chlorine is calculated as HCl per 100 c.c.) This estimation has

probably no significance. The active hydrochloric acid, *i. e.* free HCl together with protein HCl, is of much greater importance. *Mineral chlorides* in gastric and duodenal ulcer, in hyperchlorhydria and in chronic gastritis are usually low—that is below 0.1. In about eighty-five per cent. of cases of carcinoma of the stomach the mineral chlorides are relatively and absolutely increased and greater than the active hydrochloric acid; they are increased, but not greater than the active acid, in thirteen per cent. of the remaining cases. Thus cases of carcinoma are rare without this increase in the mineral chlorides; and when in the examination of a doubtful case of carcinoma a small increase above the normal (0.07) is found, the test meal should be repeated after taking the precaution of previously washing out the stomach. Increase in the mineral chlorides also occurs when gastroenterostomy has been performed independently of carcinoma, and when regurgitation of the contents of the small intestine takes place into the stomach from any cause.

Absence of Free Hydrochloric Acid. Eighty-five to ninety per cent. of cases of gastric carcinoma show complete absence of free HCl by Gunzberg's test. But the certain diagnosis of carcinoma merely on the absence of free HCl is not possible, since in thirty per cent. of all other cases of gastric and duodenal ulcer and gastric pain free hydrochloric acid is not present. The amount is diminished in cases of carcinoma elsewhere in the alimentary tract.

Hyperchlorhydria is present when the active hydrochloric acid is greater than 0.2. It is met with in cases which present no organic lesion, as well as in gastric and duodenal ulcers. The diagnosis between the two latter conditions cannot be made on the result of the examination of a test meal alone.

Hypochlorhydria, active hydrochloric acid being below 0.15, accompanies chronic gastritis, anæmia, alcoholism and malignant disease. The protein HCl is relatively increased in all cases of chronic gastritis.

Lactic, butyric and other fatty acids in the gastric contents point to fermentative changes taking place, but their presence is devoid of diagnostic significance.

The glycol-tryptophane reaction (of Neubauer and Fischer), when positive, is apparently of great value in the diagnosis of gastric carcinoma. The reaction depends upon the presence of polypeptide splitting ferments in the gastric juice, liberated from the cells of the malignant growth. It is of no avail if bile, blood, trypsin or tryptophane be present in the gastric contents.

Ferment Activity. Sufficient data are not yet available for judging as to the value in the diagnosis of disease of variations in the amount of pepsin, rennin and lipase in the gastric juice.

3. Microscopical Examination.

Starch granules in various stages of digestion are always found in the sediment of the test meal. *Sarcinæ* and *yeasts* are met with especially in cases of dilated stomach. *Pus* and *blood cells*, when present, as a rule indicate the existence of ulceration; both may, however, be derived from the mouth or pharynx.

Fragments of growth, presenting the histological characters of carcinoma, may in rare instances be recovered in cases of this disease.

The presence of the *Oppler-Boas bacillus*, though met with more frequently in cases of carcinoma of the stomach than in other conditions, is without any diagnostic significance.

Streptococci derived from the saliva, and often dead, are almost invariably present. In some cases of gastritis they occur in the living state in very large numbers, and may be the direct cause of such a condition.

T. J. H.
A. E. G.

EXAMINATION OF THE STOMACH

I.—Motor Functions

1. *Size, Shape and Position.*—*Inspection* of the abdomen may reveal the outline of the stomach in thin patients, especially if pyloric obstruction has led to excessive activity of peristalsis. *Palpation* under similar circumstances enables us to feel the lower border of the stomach; it may also reveal the presence of a tumour, the size, shape, position and mobility of which should be estimated. When the gastric contents can be splashed with unusual ease on palpation or on shaking the patient, the approximate size and position of the stomach can be determined from the area in which the splash is best heard with a stethoscope. *Percussion* may give some idea as to the quantity of gas in the stomach, but it cannot help in the determination of its size, shape or position; *auscultatory percussion and friction* have been shown by means of the X-rays to be quite valueless for examining the stomach. *Inflation of the stomach with gas* is an exceedingly valuable method. The stomach being empty, the patient drinks in rapid succession two quantities of water, in which are dissolved respectively $1\frac{1}{2}$ dr. of sodium bicarbonate and $1\frac{1}{2}$ dr. of tartaric acid. The carbon dioxide evolved distends the stomach, so that it can often be easily seen and felt; its size and position can always be determined by percussion. Normally the distance between the lesser and greater curvature should not be more than four inches, and the greater curvature should not reach below the umbilicus. Dilation and an abnormally low situation of the stomach can thus be recognized. This method

can only be used in the horizontal position, as the gas is immediately eructated on sitting up; it is therefore frequently impossible to recognize the presence of ptosis, as in the majority of cases this is only present when a vertical position is assumed. The method is contra-indicated when an ulcer is present, owing to the danger of perforation.

X-Rays. The size, shape and position of the stomach can be readily and accurately determined, both in the vertical and horizontal position, by means of the X-rays after a meal of porridge containing two ounces of bismuth oxychloride. There is no possibility of error in determining the shape of the stomach, although mistakes may be made in the interpretation of unusual appearances. By palpation during the screen examination its mobility can be investigated and the presence of adhesions recognized.

2. *Tone.*—*Splashing* and *succussion* give information concerning the tone of the stomach under certain definite conditions alone, as they may occur in the normal stomach after an ordinary meal. When, however, they can be produced after two ounces of water have been sipped, the stomach being empty, atony is probably present.

Inflation. One and a half drachms of sodium bicarbonate yield with $1\frac{1}{2}$ dr. of tartaric acid 1700 c.c. of carbon dioxide at the body temperature and atmospheric pressure. The normal stomach, when rapidly filled, has a volume varying between 600 and 1200 c.c.; 1700 c.c. of gas are therefore subjected to a considerable degree of tension when set free in the normal stomach. When the tone of the stomach is deficient, its capacity, even when empty, is greater than 1700 c.c.; consequently it will not be tightly distended. The tumour it forms is therefore softer and its outline is less easy to determine by palpation and percussion than normal; no discomfort is produced, and the gas is expelled on sitting up with less force.

X-Rays. Owing to the adaptation of the stomach to the volume of its contents, there is little difference in the upper level of the semi-fluid contents, chyme, as seen with the X-rays in the erect position, whether its volume be five ounces or two pints, and the greater curvature is very little depressed as the stomach is gradually filled. When the stomach is atonic this adaptation to the volume of its contents does not occur; the food is seen to drop to the most dependent part, its upper level slowly rising and the greater curvature becoming more dependent as the volume of its contents increases.

3. *Peristalsis.*—*Inspection and Palpation.* In unusually thin women normal peristalsis is occasionally visible, but in the majority of cases the presence of visible peristalsis indicates

organic pyloric obstruction. The patient should be examined after a meal; in doubtful cases peristalsis can be rendered more obvious by massage. At a stage preceding that in which peristalsis is visible it may often be felt as a periodic hardening if the hand is kept for some minutes gently pressing upon the right side of the abdomen a little above the umbilicus.

X-Rays. Deficient peristalsis cannot be recognized with certainty by any method except the X-rays. In pyloric obstruction the peristaltic waves can be seen to commence in the fundus instead of in the centre of the body, and to lead to unusually great depressions in the outline of the organ at a period considerably earlier than that in which it becomes visible through the abdominal wall.

4. *Rate of Evacuation.*—*Splashing and Succussion.* The stomach should be completely empty in less than six hours after dinner. If, therefore, splashing and succussion can be elicited six hours after such a meal, it may be concluded that stasis is present. This may be due either to atony if the erect position has been maintained, feeble peristalsis, or pyloric obstruction. If, however, these signs are present twelve hours after dinner—at 9 a.m., for example, if dinner was taken at 9 p.m.—organic pyloric obstruction is almost certainly present. An important exception is ulceration in the neighbourhood of the pylorus, which may cause a continuous secretion of gastric juice, so that the stomach is never empty, although there is no delay in the passage of the food into the duodenum.

Stomach-Tube. When the symptoms or physical signs suggest the possibility of pyloric obstruction, it is essential to investigate the case by means of a stomach-tube. A dinner, containing meat and green vegetables, sweets and some raisins or dried plums, is given at 9 p.m., and the tube is passed at 9 a.m., nothing having been taken in the interval. If the patient does not involuntarily strain he is told to do so, as the stomach can generally be completely emptied in this way without siphonage or pumping. If nothing is brought up, half a pint of water is poured through the tube; on straining this is returned, together with any traces of gastric contents which were insufficient to be expelled alone. In atonic dilatation the stomach is always empty twelve hours after a meal. In chronic gastritis, especially when due to alcohol, a small quantity of thick alkaline fluid, consisting mainly of swallowed saliva and pharyngeal and œsophageal secretion, may be present. In the continuous secretion which results from an ulcer near the pylorus, even in the absence of obstruction, a small quantity of very acid fluid without any food residue is found. When an ulcer has led to organic

obstruction, starch granules and vegetable débris, but no meat fibres, are present, in addition to some acid fluid; the quantity of the latter is much increased if the ulcer is still active, as hypersecretion then occurs in addition to stasis. In malignant obstruction the gastric contents are thicker and contain débris of both vegetable and animal food; free hydrochloric acid is absent, "active" hydrochloric acid is greatly reduced and lactic acid is present.

X-Rays. If the shadow of the stomach is still visible six hours after a bismuth meal, nothing having been taken in the interval, stasis is present; after nine hours it is probably, and after twelve hours it is certainly due to organic pyloric obstruction.

II.—Chemical Functions

The chemical functions of the stomach can only be satisfactorily investigated by means of a *test breakfast*. The first thing in the morning, the stomach being empty, a pint of weak tea with a little milk and sugar and a round of thin buttered toast is given. An hour later a tube is passed and the gastric contents expressed; they occasionally require to be aspirated, but no water should be added. The quantity removed, the proportion of food to fluid and the smell of the contents should be noted, and the presence of pathological constituents, such as blood, pus and mucus, should be looked for. Congo red turns blue in the presence of free acid, whether lactic or hydrochloric; the acidity is due to hydrochloric acid if a scarlet colour is produced on slowly warming a porcelain dish containing a few drops of the gastric filtrate with an equal volume of Gunzberg's reagent (two parts phloroglucin, one part vanillin, thirty parts absolute alcohol).

The only important quantitative estimation is that for active hydrochloric acid, *i.e.* the quantity of free plus organically combined hydrochloric acid. Two equal portions of filtered gastric contents, to the first of which excess of sodium carbonate solution is added, are evaporated to dryness and ignited at a low red heat until charring is complete. The chlorides are estimated in each portion by Volhard's method, the first giving the total chlorides and the second the mineral chlorides, the difference being the active hydrochloric acid, the normal quantity of which varies between 0.1 to 0.2 per cent.

Lactic acid may be recognized by Uffelmann's reagent (30 c.c. one per cent. carbolic acid with a few drops of ferric chloride solution), which it changes from blue to canary yellow. An ethereal extract of the gastric contents must be used, 5 c.c. of gastric contents having been shaken with 30 c.c. of ether.

Microscopical examination of the gastric contents may reveal the presence of red cor-

puscles, leucocytes, very rarely fragments of mucous membrane or growth, sarcinæ in non-malignant pyloric obstruction, and the Boas-Oppler bacilli in malignant cases. It is sometimes necessary to examine for traces of blood by the guaiacum reaction, but there are fewer sources of error if this is done with the stools.

Vomited material should be examined by the same method, but the quantitative estimation of hydrochloric acid is only of value after a test meal.

An examination of the fæces is frequently of importance in gastric disorder. Apart from the obvious presence of blood (*melæna*), "occult blood" may be recognized by chemical means. The patient is put on to a farinaceous diet, the third stool passed after this being examined. A small quantity is rubbed with glacial acetic acid; ozonic ether is added and the ethereal extract poured off. A few drops of tinct. guaiaci added to the extract give a blue colour if any trace of blood is present. If there are symptoms suggesting gastric disease and no other obvious source of hæmorrhage is present, the blood may be presumed to come from the stomach. If excess of *fibrous tissue* can be recognized in the stools of a patient who has been given underdone meat, the gastric juice contains a deficiency of hydrochloric acid.

A. F. H.

THE EXAMINATION OF THE FÆCES

Examination of the fæces yields very important diagnostic evidence in various diseases. Direct microscopic examination reveals the histological elements present, both animal and vegetable, and the state to which these have arrived by the processes of digestion.

The presence of *pus* in the stools can often be made out by naked-eye examination, supplemented by the microscope. If due to ulceration its demonstration is not so easy, because pus cells are not readily recognized.

Fragments of *new growth*, *hydatid hooklets*, portions of *actinomycotic* tissue and *amaebæ* can be made out from time to time.

Chemical

Chemical examination demonstrates the amount of saponified and unsaponified fat present, and the occurrence of "occult" blood—observations of great value in the diagnosis of pancreatic disease and ulceration of the stomach or bowel respectively. Chemical examination also decides the amount of bile pigment and its derivatives, and, together with similar investigations carried out upon the urine, assists in the diagnosis of diseases of the liver and gall bladder.

Bacteriological

The normal intestine possesses a very rich flora of micro-organisms. The bacteria present

in greatest numbers are streptococci and coliform bacilli. In health both groups appear to act as saprophytes, but either may take on a pathogenic action, giving rise to acute or chronic infective processes. These infective processes may (1) involve the mucous surface of the bowel only, as in colitis; or (2) they may involve the peritoneum immediately adjacent to the bowel or organs which communicate more or less freely with the gut, as in cholecystitis; or (3) may lead to a systemic blood infection, as in infective endocarditis.

Much help can be derived in diagnosis and treatment from the qualitative investigation of the flora of the faeces. For the purposes of the examination a little of a fresh stool is collected in a tin or wide-mouthed bottle with a well-fitting top. This is forwarded at once to the pathologist. If the stool contains mucus, or sloughs, or blood-clot, or pus, these are specially chosen for the examination.

It is essential that the pathologist shall receive, with the specimen, some details concerning the case, and some guide as to what the clinician wants in the way of investigation. The bacteriologist will begin by making films directly from the faeces, and stain these by Gram's method, to get some idea of the relative quantity of Gram-positive and Gram-negative organisms. Plates will be made from the diluted material, using special media (*e.g.* Drigalski and Corradi) for the purpose of differentiating colon bacilli from such pathogenic organisms as *B. typhosus*, Gaertner's bacillus, etc.

In **Typhoid Fever** the isolation of the bacillus from the stools, for purposes of diagnosis, has been superseded, during the first week of the disease, by blood-culture. In the later stages the application of Widal's test and the estimation of the leucocyte count make the isolation of the bacillus unnecessary for diagnostic purposes.

In **Paratyphoid Fever** the isolation of the causal microbe from the stools is more important, because the clinical features of the disease are apt to be ambiguous and the blood gives no agglutination reaction with *B. typhosus*.

In **Food Poisoning** an investigation of the faeces may yield colonies of Gaertner's bacillus.

In **Dysentery** either the bacillus of Shiga or of Flexner may be isolated.

B. pyocyaneus not seldom appears to be the causal agent in cases of colitis, both in adults and in children.

The *Tubercle bacillus* must be searched for in faeces by the same methods adopted for sputum, urine, etc. The antiformin method is especially applicable.

Parasitological

Search for the ova of parasitic worms in fresh unstained preparations should never be omitted

in any case of obscure anæmia, fever (especially in children), or intestinal dyspepsia. Attention is not seldom called to this examination of the stools for ova, by finding eosinophilia on blood examination.

T. J. H.

A. E. G.

THE DIAGNOSIS OF TUBERCULOSIS AND ITS SPECIFIC TREATMENT

There is probably no difficulty with which the physician is more often faced than the diagnosis of a doubtful case of tuberculosis. The question of physical signs will not be dealt with here, but however conclusive physical signs may appear to be, they should never lead to more than a strong presumption in favour of tuberculosis. Be the pathological process situate in the lung, or lymph glands, or urinary tract, or elsewhere, an effort must always be made to put the diagnosis upon a more exact basis than that of physical signs.

Demonstration of the Tubercle Bacillus. The symptoms, or physical signs being such as to suggest tuberculosis, the first consideration is whether or not any material can be obtained from which the tubercle bacillus can be isolated. In a case of suspected phthisis a specimen of sputum must be secured, and should the patient protest that there is none he should be provided with a sputum cup or pocket flask, which often favours the appearance of a hitherto absent expectoration. In disease of the urinary tract the urine should be collected (for twenty-four hours) and the sediment searched. If the bowel or peritoneum is the seat of the disease the faeces must be examined. If any puncture-fluid be obtained—as from the pleura, peritoneum, spinal theca or a joint—this is of course invaluable for investigation. No pains must be spared by the pathologist and clinician in the endeavour to demonstrate the bacillus, for nothing approaches in significance the isolation of the tubercle bacillus as a means of diagnosis of tuberculosis. Certain observers have claimed that they can demonstrate tubercle bacilli in the blood in the majority of cases of phthisis examined. The identification of isolated bacilli in films admits of much difficulty, and most workers have failed to confirm these results. If no materials are available for examination or if their examination has led to negative results we turn to the indirect methods of diagnosis.

The Tuberculin Reactions. If a minute quantity of "old" tuberculin be injected subcutaneously into a tuberculous person, a reaction occurs which is of a very highly specific character. This "old" tuberculin is the glycerine extract of tubercle bacilli which

Koch originally introduced in a tentative manner for the treatment of tuberculosis. Its administration for this purpose has been almost completely abandoned, the great use to which it is now put being in diagnosis. The tuberculin test may be employed in one or more of three ways: subcutaneously, cutaneously and conjunctivally.

1. *The Subcutaneous Test* (Koch). This mode of performing the test is contra-indicated in patients who are febrile and in those who are acutely ill. When it can be used it is of greater value than either of the two methods to be described later.

The best method of performing the test is to administer an initial dose which is quite small. If no reaction follows this in forty-eight hours a second dose of double the size is given. If a slight reaction follows the first dose the same interval is allowed to elapse and a dose of the same size is administered a second time. If the response to a second dose of the same size is more marked than was the response to the first dose, this constitutes a positive reaction of great delicacy. If no reaction follows either the first or the second dose, a third and still larger dose is given. If there is still no reaction the test may be considered to be negative.

Opinions differ as to the actual size of the dose which it is advisable to employ. Some discretion must be exercised in respect of the extent of the lesion and whether it is deep-seated or capable of being kept under view during the stage of possible reaction. In the majority of cases it is advisable to begin with 0.001 c.c. of the tuberculin (= 1 mg.) and to proceed to 0.002 c.c., 0.005, and possibly 0.01 c.c. for the subsequent doses, observing the qualification as to the value of an increase in the reaction as the result of using a second dose of the same size. In infants and small children doses which are one-tenth of these sizes should be used. The practitioner may order a series of doses of the above amounts, each of which will be diluted to 1 c.c. and sent by the dispenser in ampoules for immediate use, or he may order a small quantity of undiluted tuberculin and make up the necessary dilutions as required.

Though not absolutely necessary, the patient is, for preference, in bed during the application of the test. The temperature has been recorded on a four-hourly chart for at least two days prior to the test, and is found not to be above 99° F. The injection is made in the early morning so that two-hourly temperatures may be taken, which should always include the sixth to the twelfth hour after the injection. The site of inoculation should be as near to the suspected focus as practicable.

The "reaction" may be of two kinds, general or local.

(a) *The general reaction* includes a rise of temperature and pulse-rate, headache and general malaise. The former is the most valuable sign of a positive reaction, and generally occurs some time between the sixth and twelfth hour after injection. A rise of more than half a degree must be regarded as evidence of a positive reaction if the initial dose be not larger than 0.001 c.c. in an adult and as an indication for making the second dose of the same size as the first.

(b) *The local reaction* is not always to be observed; but when present constitutes a point of even greater importance than the rise of temperature. The local reaction varies according to the site of the disease process. In phthisis it may show itself as increase of cough and pain in the chest. Tuberculous glands may become slightly more swollen and tender.

2. *The Cutaneous Test* (von Pirquet). This method is analogous to the performance of Jennerian vaccination for smallpox. The superficial layers of skin are lightly scarified and a drop of twenty-five per cent. solution of old tuberculin is rubbed into the spot. Two control marks are made close by; one of these is treated with the 0.5 per cent. of carbolic acid in glycerine used to dilute the tuberculin and the other is left without any application. A positive reaction is indicated when the area becomes rose-red in colour, slightly raised above the surface, and when the reaction is marked one or more vesicles may appear upon it, while the surrounding zone becomes hyperæmic. These changes are usually at their height in about forty-eight hours, but the results are not infrequently somewhat equivocal in character, leaving the observer in doubt as to whether the reaction is positive or negative. The test is of little value in patients over twelve years of age. A modification of von Pirquet's method has been introduced by von Morro, who uses the tuberculin in the form of an ointment to be rubbed into the skin.

3. *The Conjunctival Test* (Calmette). A drop of one per cent. solution of old tuberculin is inserted into the conjunctival sac of one eye. If a positive reaction ensues changes begin in from six to twenty-four hours. The mildest degree consists of reddening of the caruncle and of the palpebral conjunctiva. The next degree shows these changes more markedly with hyperæmia of the scleral conjunctiva. The third degree of reaction constitutes a genuine acute conjunctivitis, with exudation into the sac. In a few cases the reaction has been very intense, causing chemosis or even corneal ulceration. The test cannot, therefore, be said to be devoid of some risk.

Comparison of the Three Tests. The chief trouble with the cutaneous and conjunctival tests is in dealing with the not inconsiderable proportion of equivocal results, and the indecision that arises as to whether they are positive or negative. This difficulty is rarely met with in the subcutaneous method, which, being more constant in its results, has a much greater diagnostic value. An actual comparison of their relative value can be made by employing any two or all three tests at the same time in the same patient.

The Tuberculo-Opsonic Index. The "tuberculo-opsonic index" of the blood is by some authorities held to be so constant in non-tuberculous subjects that any marked deviation from the normal is by them considered to be good evidence of tuberculous infection. Such a conclusion must not be based upon a single examination, but a series of indices should be taken. This method is not within the scope of the practitioner, and must be undertaken by a pathologist well versed in opsonic work.

The Specific Treatment of Tuberculosis. The only form of specific treatment at all widely adopted is by means of Koch's new tuberculin (T.R.). It is inadvisable to give tuberculin to patients who are markedly febrile, or who show much oscillation in temperature and in general condition. The best cases to select are those in whom there has been produced, as the result of non-specific measures, some definite retrogressive change in the tuberculous lesions. As regards the size of dose and the frequency of its administration there is no rule to follow. It is probably of no service in the treatment to aim at a reaction to the dose of tuberculin employed. In the majority of cases a dose of $\frac{1}{10000}$ mg. may be given to begin with, repeated with an interval of a week or ten days until four doses are given. A second series of four doses of $\frac{1}{10000}$ mg. may follow, observing the same intervals. And so on advancing by $\frac{1}{10000}$ mg. at every fifth dose. Should any reaction, local or general, follow, the dose should be no further increased for a while. Treatment is of long duration and any secondary infection which may be present must be dealt with by an appropriate vaccine. T. J. H.

A. E. G.

CERTAIN SPECIFIC SERUM TESTS AND THEIR VALUE IN DIAGNOSIS

The diagnosis of disease has during recent years received great assistance from the discovery of certain interactions that are demonstrable between the blood serum and other body fluids on the one hand, and the infective agent causing disease on the other. The various principles that are formed in the body

fluids as the result of their invasion by bacteria are termed *Antibodies*. The variety of antibodies produced during the operation of a micro-organism depends apparently on the nature of the infecting agent and upon the kind of response made by the patient to infection by it; and the art of pathological diagnosis by means of specific tests turns upon devising means whereby the presence of certain antibodies can be demonstrated in the tissue fluids of the patient. In this section only those serum tests will be dealt with which have the weight of experience and authority to recommend them.

The Agglutination Test (Widal Test)

1. It is in relation to **Typhoid Fever** that most of the observations in connection with this test have been made. The test is also applicable to the diagnosis of paratyphoid fever, to Malta fever, to cholera, to bacillary dysentery and to disease produced by Gaertner's bacillus.

Few practitioners are able to keep a culture of *B. typhosus* as part of their laboratory equipment; the procedure from their point of view is therefore extremely simple. It consists of pricking the patient's ear, drawing up not less than 20 c.m. of blood into a pipette, sealing the ends of the pipette in a flame, and forwarding the specimen to the pathologist. The pathologist draws off the serum, and dilutes it by the addition of known quantities of normal salt solution. The diluted serum is then mixed with a recent culture of typhoid bacilli, and a hanging-drop preparation of the mixture is put up for microscopic examination. Controls of typhoid culture mixed with normal serum and also with normal salt solution are put up side by side with the test specimen. If the test be positive, the organisms lose their motility and are then seen to become grouped into large clumps, leaving no scattered bacilli anywhere in the field. In both of the controls the bacilli remain actively motile and are uniformly distributed over the field. This is the microscopic method of performing the test, and it is the method most in vogue. The macroscopic method consists in making the necessary dilutions in larger bulk, incubating the mixture of serum and bacillary emulsion, and noting the presence or absence of sedimentation at the end of a given time. Controls are, of course, again used.

Since it has been found that the bacilli need not be living in order that agglutination shall take place, it is open to the practitioner to perform the test himself, using an emulsion of dead typhoid bacilli. It is, however, difficult to obtain an emulsion of dead bacilli which is free from small clumps to begin with, and as the loss of motility of the living organisms is one of

the characteristic parts of the reaction, the test with dead micro-organisms is not so delicate as with the living culture.

The agglutination test is a *relative* pathological test. In order that the reaction shall be regarded as definitely positive it is essential that—

(i) The dilution of the serum should not be less than one in twenty.

(ii) The time of the test should not exceed one hour in the warm incubator.

(iii) The interaction should be "complete," *i.e.* all bacilli should be motionless and should be clumped.

(iv) Neither of the controls should show any clumping.

In the interpretation of results the following facts must be taken into account—

(i) The test is rarely positive during the first week of the disease. At this stage the diagnosis of typhoid fever, so far as laboratory methods are concerned, turns upon the isolation of the bacillus from the blood (see p. 418) or from the stools. The importance of a leucopenia is also to be remembered (see p. 417).

(ii) A positive test may mean that the patient has had typhoid fever upon some former occasion, not that his present disease is of this nature. The reaction may persist up to five years after an attack of typhoid fever. *Demonstrable increase in the degree of agglutination from day to day or from week to week proves that this attack is typhoid fever.*

(iii) In a few cases of typhoid fever agglutination is not developed until late, or even not at all.

(iv) The test is occasionally positive in diseases which are not typhoid fever. Thus the serum of patients suffering with catarrhal jaundice not infrequently clumps typhoid bacilli readily. Patients infected with some other micro-organism of the bacillus coli group may agglutinate the typhoid bacillus. ("Group reaction.")

(v) It sometimes happens that the test is positive with one strain of typhoid bacillus and negative with another. If, therefore, the clinical evidence is strongly in favour of the diagnosis of typhoid fever, the test must, if necessary, be performed with more than one strain of typhoid bacillus.

2. Paratyphoid Fever.—Other members of the coliform group of organisms besides *B. typhosus* have been shown to be at times intensely pathogenic, and have been isolated from individual and epidemic cases of acute enteritis. Sometimes the illness resembles typhoid fever very closely, but the causal microbe differs from *B. typhosus* in certain of its characters, and the patient's serum fails to agglutinate the typhoid bacillus. Such cases are termed "paratyphoid fever," and are most

often due to one of two varieties of "paratyphoid" bacilli. The two strains are often kept in pathological laboratories for the purpose of applying Widal's test in the event of the serum of a suspected case of typhoid fever not clumping *B. typhosus*.

3. Gaertner Bacillus Disease.—In another set of cases of acute enteritis, not seldom occurring in small epidemics, the disease runs a much shorter course than in typhoid fever—even as short as forty-eight hours—has a very brief incubation period, and the causal bacillus is again one of the coliform group. One such organism was originally isolated by Gaertner. Outbreaks of "food poisoning" are not infrequently traceable to this source. Agglutination of Gaertner's bacillus by the serum of affected patients—a valuable help in diagnosis—does not persist nearly as long as agglutination of Eberth's bacillus by the serum of typhoid patients. In one outbreak of this disease the writers found that, even in the most severe cases, Widal's test, from being definitely positive, rather suddenly became negative two weeks after the illness.

4. B. Coli Infections.—Sporadic cases of acute infection, intestinal or otherwise, by *B. coli*, are not uncommon, and the only means of identifying the causal microbe may be by carrying out Widal's test with the patient's serum and several colonies in turn of the bacilli isolated from the stools. A "group reaction" may be shown in these cases, partial clumping being obtained with the typhoid bacillus. This fact emphasizes the necessity of observing the "minimum requirements" in performing Widal's test.

5. Malta Fever.—Widal's test is of great value in the diagnosis of Malta fever, and especially in chronic or latent cases in which blood-cultures may prove sterile. Complete agglutination of the *M. Melitensis* by serum of dilution one in thirty in half-an-hour may be taken as a positive test in any case giving clinical evidence of the disease.

6. Cholera.—The order of Widal's test may be reversed, and a micro-organism of doubtful nature may be identified by use of a serum known to be immunized against certain bacteria. This is illustrated in the diagnosis of cholera. It may even be carried out with the mucus from a suspected stool, in which the vibrios are very numerous, without their isolation by culture. For this purpose a commercial immune serum is employed, and a hanging-drop specimen is made direct from the faeces. If the cholera vibrio is present clumping will occur, sometimes with a dilution as high as 1 in 10,000. In a similar manner a coliform bacillus obtained from a patient's blood or elsewhere may be proved to be, or not to be, the typhoid bacillus.

Diluted serum from a known case of typhoid fever or from an animal immunized against *B. typhosus* is mixed with the bacillus under investigation, and agglutination is tested for.

The Immune Body Test (Wassermann Reaction, or "Fixation of Complement")

The technique of this test is at present beyond the powers of the clinician, and necessitates exact laboratory methods. The test has its widest application in the diagnosis of **syphilitic disease**, and in any case in which the diagnosis of syphilis or of parasyphilitic affections is indicated the practitioner collects blood from the patient, and forwards it to the pathologist. The blood may well be obtained with a hypodermic syringe from a vein in the arm, as a liberal amount should be sent—not less than one cubic centimetre.

The results obtained. It is probable that at least the following hold good.

The question of the duration of treatment receives considerable help from the test, for a negative reaction, following a positive one, indicates that the tissues are free from the virus. The prevalence of syphilis as a causal factor in diseases of the aorta and aortic valves is borne out by finding that a considerable percentage of patients suffering from these affections give a positive Wassermann test.

T. J. H.

A. E. G.

TREATMENT BY SPECIFIC INOCULATION

The Use of Bacterial Vaccines in Disease

As the result of the labours of Sir Almroth Wright, bacterial vaccines have now become very generally recognized as valuable therapeutic agents in certain infective disease processes. A *vaccine* is a suspension of killed micro-organisms in some neutral liquid medium such as normal salt solution, for the purpose of subcutaneous injection. It is, to all intents and purposes, a preparation of the intracellular toxins of the micro-organism.

The first step in the preparation of a vaccine is the isolation of the causal micro-organism of the disease in pure culture. If a local lesion is to be dealt with, a portion of the exudate or secretion is obtained, as free as possible from contaminations, and is forwarded in a sealed sterile vessel to the pathologist. If the practitioner has culture tubes he may make his own cultivations and send the inoculated tubes to the pathologist. In a few instances this is almost imperative; thus in pyorrhœa alveolaris it is necessary to clean the surface of the gum and to inoculate an agar slope either with a little of the pus squeezed out from the pocket lying between the gum and the tooth, or better still, to make cultivations from the root of a tooth

immediately after its extraction. In the case of a patient suffering from septicæmia without a local lesion, or one which is out of reach, a blood culture must first be made (see section 2). In most cases the infection is by a single micro-organism; sometimes, however, the infection is mixed, in which case a vaccine may be prepared from the various micro-organisms present.

Modes of Administration of Vaccines

1. The common mode is the subcutaneous one, and it is to this route that all subsequent remarks apply. The method is extremely simple, and is the same as is employed for the hypodermic injection of various drugs. The upper arm is a convenient site for the inoculation. There is, however, some reason for believing that the introduction of a vaccine near to the seat of a local lesion is occasionally of advantage. Before breaking the neck off the ampoule containing the vaccine, the phial should be well rolled between the hands to ensure uniform suspension of the bacteria, which may have formed a sediment, due to standing. As the bulk of fluid constituting the dose of vaccine is scarcely greater than many hypodermic injections in common use (vaccines are generally made up to 1 c.c. = 17 minims), its introduction leads to no material discomfort to the patient. No dressing of any kind is required to cover the puncture.

2. The *intravenous* route has as yet been employed but little, and chiefly in an experimental fashion.

3. Upon the use of vaccines *by mouth*, again, very few observations have been made. Some authorities administer tuberculin in this way and recommend it.

The Immediate Effects of Vaccine Inoculation

1. *Local Effects.* There is no uniformity of opinion as to how little or how much local "reaction" should be aimed at when a vaccine is used therapeutically. When given for prophylaxis (e.g. against typhoid fever) a local reaction is anticipated. The principle of practice with most workers appears to be that in cases of chronic and of local infection a mild but definite reaction is aimed at, but in cases of acute and of general infection no reaction is sought. By a "mild but definite" reaction is meant as follows:—From four to eight hours after inoculation a tender spot appears at the site, surrounded by a small area over which the skin presents a faint blush. Slight swelling is also present. This is tender, and there is slight stiffness of the limb on movement. After eighteen to twenty-four hours the inflammation begins to subside, leaving only slight thickening of the subcutaneous tissues, which may persist

for forty-eight hours. A dose which is unnecessarily large for its purpose, or which is highly toxic, produces a more marked reaction and may lead to redness and swelling of a large part of the arm and much discomfort. It happens quite often that such a moderate reaction as that just described follows the first of a series of doses of vaccines, but is not seen after subsequent doses, even when these are increased in size.

2. *General Effects.* After a *prophylactic* dose of vaccine, when, as a rule, a large dose is chosen, there is usually a fairly marked general disturbance: headache, lassitude, nausea, pains in the limbs, and a rise of temperature to 100°–103° F. These symptoms come on a few hours after the injection, and subside during the second twelve hours. After the initial *therapeutic* dose in chronic infective processes nothing so severe as this occurs; but there is often a feeling of slight malaise during the day following the inoculation. After subsequent doses it is unusual to see any such general effects, but often a state of general invigoration, in some cases quite marked.

Prophylactic Use of Vaccines

In preventive medicine the principle of inoculation has been applied on a large scale to *plague*, to *typhoid fever* and to *cholera*. Protective inoculation may also be undertaken in patients who are to be submitted to operations involving risk of pyogenetic infections afterwards, as in removal of the tongue, etc. The inoculation should be made in such cases during the week but one preceding the operation. It is possible that children might with benefit be inoculated with a prophylactic dose of the meningococcus in the presence of *cerebro-spinal meningitis*.

1. The chief use in England of prophylactic inoculation is in connection with *typhoid fever*. Persons going to districts abroad where typhoid fever is endemic are well advised to be thus inoculated. The vaccine may be given in two doses at a week's interval—the first of 1000 million killed typhoid bacilli, followed on the seventh or tenth day by a dose of 2000 million. Two or three different strains of recently isolated typhoid bacilli are used in the manufacture of the vaccine. The reaction after the first dose may be severe (*vide supra*). It is desirable to allow a clear fortnight to elapse between the second inoculation and the time of arrival at the district where typhoid fever is rife.

2. Reference has been made to the prophylactic use of *colon bacillus* vaccine prior to surgical operations upon regions infected with this micro-organism. A similar vaccine may be used in cases of *chronic* bacilluria, and chronic cystitis and prostatitis in which it is impossible to get

rid of the micro-organisms from the urine by therapeutic inoculation. It is probable that a series of doses of appropriate vaccine is of service in preventing those exacerbations of the morbid state which constitute a “flare-up,” and by the same means a spread of the infection to other parts of the urinary tract may in great measure be prevented.

3. The use of *tuberculin* is indicated as a prophylactic measure in patients whose pulmonary or other lesions have become arrested by other modes of treatment.

4. After the treatment of *furunculosis* and *pustular acne* it is advisable to continue inoculations in a prophylactic manner some time after the disease has been cured.

5. Attempts have been made recently at immunization against such acute microbial infections as *influenza*, *acute rhinitis* and *sore throat*. It is as yet too early to draw any conclusions regarding the result of such prophylactic treatment.

Cases Suitable for Treatment by Vaccines

The infective processes amenable to treatment by specific inoculation may be considered as—

- | | |
|-----------------------|----------------|
| A.—Local Infections. | · { 1. Chronic |
| | · { 2. Acute |
| B.—General Infections | · { 1. Chronic |
| | · { 2. Acute |

A.—(1) *Chronic Local Infections*

This group of diseases has yielded the best results to vaccine therapy.

(a) *Staphylococci.* Chronic local infections which are most often due to this organism are *boils*, *carbuncle*, *syphilis*, *pustular acne*, some forms of *eczema*, *suppurating Meibomian cyst* and *sinuses* left after opening of abscesses. Of these boils react best to treatment, and a cure, for a more or less long period of time, may confidently be promised to almost every patient. A guarded prognosis must always be given in the other forms of staphylococcal infection. It is as an adjunct to other forms of treatment that vaccine therapy is so valuable, and efficient surgical measures must always be undertaken in conjunction with it.

(b) *Streptococci and Pneumococci.* *Pyorrhoea alveolaris* is always due to streptococcus salivarius, and some cases of the disease respond well to vaccine treatment. Suppuration in *nasal sinuses* and the *middle ear* sometimes react favourably, though here again obvious measures for effective drainage must be attended to.

(c) *Gonococci.* Chronic urethritis often responds well to vaccine treatment. Secondary invasion of the urethra by staphylococci is common in chronic gonorrhoea, requiring the use of staphylococcal vaccines. That form of

gonorrhœa which shows recurrences of the discharge after quiescent periods seems to react favourably to inoculation.

(d) *Bacillus Coli*. Infections of the urinary tract in which symptoms are present, such as frequent micturition, local discomfort, pyrexia, etc., may be considerably improved by this treatment. The amount of pus in the urine often becomes less or entirely disappears. A state of colon bacilluria is usually unaffected by vaccine-therapy. Chronic otitis media infected by this organism sometimes responds well. *Post-operative suppuration*, not infrequently seen in cases of appendix abscess, is a condition pre-eminently amenable to vaccine-therapy.

(e) *B. Typhosus*. Suppurating foci which are sequels to typhoid fever are favourable for vaccine treatment.

(f) *Tuberculosis* has been considered elsewhere.

A.—(2) *Acute Local Infections*

(a) *Streptococci*. In erysipelas recovery seems to be frequently hastened by one or two small doses of *streptococcus pyogenes* vaccine. If it is possible to cultivate the organism from a vesicle of the actual case, so much the better. In cellulitis and acute abscess due to a streptococcus inoculation may hasten healing after proper surgical measures have been undertaken. So also in empyema of the various sinuses (often pneumococcal) and other forms of post-operative suppuration.

(b) *Staphylococci*. Acute boils and carbuncles tend to abort when treated early with a dose of vaccine, and no ill effects appear to follow such treatment.

B.—(1) *Chronic General Infections*

In chronic gonorrhœal arthritis good results quite commonly follow the use of vaccines. In chronic staphylococcal pyæmia inoculation should be tried, but results are not very pronounced, especially when the lesions are in connection with the bones. In chronic infective endocarditis vaccines apparently never save the patient ultimately, though their use is attended occasionally with encouraging results for a time.

B.—(2) *Acute General Infections*

In this class results have been less promising than in cases of localised infection. It appears that the more acute and generalized the infection, the less marked are the benefits of specific inoculation.

In *pneumonia*, where the natural course of the disease gives a good criterion by which to judge of the effect of any form of specific treatment, the crisis does not appear to be hastened by the employment of pneumococcus vaccine.

Puerperal fever, osteomyelitis, acute infective

endocarditis and other forms of acute general infection end fatally with such frequency that the tentative use of appropriate vaccines is quite justifiable, provided all the other known aids to recovery are employed. The combination of vaccine and anti-serum is eminently rational and not infrequently proves beneficial. Immediately the diagnosis of acute streptococcal infection is made, a full dose of anti-serum should be given, preferably intravenously in normal saline; this should be repeated after twelve hours.

In *typhoid fever*, especially in protracted cases, small doses appear to produce marked improvement in the symptoms. Some authorities report good results after the employment of large doses *i. e.* 500 million dead bacilli in the routine treatment of the disease.

Malta fever may respond very favourably to vaccine treatment.

The Choice and the Frequency of the Administration of the Dose of Vaccines

A determination of the opsonic index has been found to be unnecessary as a guide for the purposes of actual practice, and for the choice of dose and for the frequency of its administration reliance should be placed upon a careful study of the clinical condition of the patient and upon experience of similar cases already treated. There is good evidence from animal experiments that the effective dosage of vaccines is fairly wide, and that within this range no ill effects are likely to ensue to the patient.

The doses of vaccine suggested below are set out tentatively, for they are by no means arbitrary, being modified in individual cases as seems necessary.

One of the greatest difficulties attending the question of dosage is the *variation in virulence* of different strains of the same micro-organism, and of the same strain after sub-culture. This applies particularly to the streptococcus group, to the pneumococcus and to the gonococcus. Another difficulty arises from the individual differences seen in the response made by various patients to the same dose of the same strain of a micro-organism. This is often seen in the case of prophylactic inoculation against typhoid fever.

1. *Prophylactic dosage*. For typhoid fever see p. 438. In *plague* prophylaxis the vaccine is prepared from a four weeks' old broth culture of the bacillus. The culture is sterilized by heat and 3 c.c. of it is inoculated subcutaneously as a single dose (Haffkine). In *cholera* prophylaxis the same worker employs for the first dose 1 c.c. of vaccine prepared from an attenuated culture, and for the second, after a few days' interval, 1 c.c. of vaccine prepared from a more virulent culture.

In prophylaxis against pyogenetic infections during or after surgical operations, a large dose of vaccine, appropriate to the particular infection feared, is used. Thus a dose of 1000 million killed staphylococci or killed bacillus coli is injected ten days before the operation.

In the case of *cerebro-spinal fever* 200 million killed meningococci may be regarded as a safe prophylactic dose for an adult.

2. *Curative dosage.* The more virulent the micro-organisms, and the more acute and the more generalized the disease process, the smaller should be the dose of vaccine employed.

A.—(1) Chronic Local Infections

(a) *Staphylococci. Furunculosis.* One hundred millions is the best dose with which to begin the treatment of an ordinary case. This is followed by doses of 250–500 millions, with intervals of seven to ten days, if improvement follows the first dose. Chronic carbuncle is treated in the same way. In the treatment of acne much the same line is adopted, and excellent results follow the use of a mixed vaccine of staphylococcus and the “acne bacillus.” In *sycosis* increasing doses, beginning with 250 millions, give good results if the treatment is carried out early. In long-standing cases doses of 2000–5000 million cocci may be required, but in dealing with sycosis and acne it is essential that other forms of treatment, such as epilation and mercurial ointments, should not be neglected. *Ciliary blepharitis* usually yields to the doses recommended for furunculosis.

(b) *Streptococci and Pneumococci.* The vaccine treatment of pyorrhœa alveolaris should be begun with doses of 10 million cocci, increasing this gradually at intervals of 7–10 days, if necessary, to 100–200 millions.

In chronic pneumococcal infections, such as an empyema sinus, a series of weekly doses may be given, commencing with 10 millions and increasing gradually to 50–75 millions.

(c) *Gonococci.* In chronic urethritis and in gleet it is well to begin with a dose of 10 millions to test the patient's degree of response, and to increase the dose gradually until results are obtained. Whilst the dose is still small it may be given at intervals of three to four days; if doses of 100–200 millions be reached, the interval should be ten to fourteen days. Small doses probably suffice for the treatment of gonococcal iritis.

(d) *B. Coli.* In cases of chronic colon bacillus cystitis and pyelocystitis the initial dose may be 20 million bacilli, followed, at weekly intervals, by doses gradually increasing to 50, 100 and 200 millions, the treatment being spread out over a period of two or three months. Other forms of chronic infection by this micro-organism may be treated after the same manner.

(e) *B. Tuberculosis.* (*Vide* section.)

(f) *Actinomycosis.* In a case successfully treated the dose used was $\frac{1}{1000}$ mg. of the growth obtained on solid medium, administered weekly for a period of six weeks.

A.—(2) Acute Local Infections

It is even less practicable to frame rules for dosage of vaccines in acute cases of infection than in chronic cases. Close attention to the individual case, the extent and intensity of the local reaction, the degree of the general resistance as indicated by the amount of strength, condition of pulse, etc., the temperature curve and leucocyte count from day to day—these alone serve to guide the practitioner in his choice of the size and frequency of the dose. If, after careful consideration of the whole condition, it is decided to administer vaccines, these should be given in very small doses, and the effects should be carefully watched.

(a) *Streptococci.* In erysipelas and cellulitis an initial dose of $2\frac{1}{2}$ or 5 million cocci may be given. If improvement appears to follow, the dose may be repeated on the third day, and again after a similar interval, or if the improvement be certain a larger dose may be given on the second occasion.

(b) *Staphylococci.* Acute boils and carbuncles, poisoned fingers, etc., are treated by doses of 20–50 million killed cocci, and the response is usually satisfactory. After acute abscesses have been dealt with surgically, healing is hastened by the use of similar doses, repeated and, if necessary, gradually increased every third or fourth day.

(c) *Gonococci.* In the majority of cases of gonorrhœa inoculations are not indicated.

(d) *B. Coli.* Acute infections often respond well to one or two doses of 10–20 million killed bacilli.

B.—(1) Chronic General Infections

(a) In chronic *staphylococcal pyæmia* 50–100 million killed cocci may be injected every four to seven days, omitting the inoculation just prior to, and just after, any surgical treatment.

(b) In chronic *streptococcal pyæmia* 10–20 million cocci may be given in similar fashion. In chronic infective endocarditis the initial dose should be 10 millions (streptococci, pneumococci, *B. Influenzæ*, etc.), repeated every four to seven days. If no good effect follows, as is usually the case, the dose should be increased to 20, 30 or even 50 million cocci, the temperature chart, leucocyte curve, etc., being carefully studied meanwhile.

(c) The treatment of chronic general gonorrhœal infection should be begun tentatively with doses of 10–20 millions, to test the virulence

of the strain of coccus used. The dose will probably need to be increased to 50, 100 or 200 millions before good effects follow. Some American "immunizers" have given as much as 1000 million cocci for a single dose.

B.—(2) *Acute General Infections*

The question of the advisability of using vaccines in cases of *acute septicæmia* has been dealt with on p. 439. Even when it is decided to use them the dosage must be of a tentative kind, the treatment being tried warily in each individual case. All those clinical observations referred to under acute local infections must be made daily, and must be taken as guides to the employment of the vaccine. Very small doses—*e. g.* 5 million streptococci or 10 million staphylococci—of the micro-organism isolated from the patient may be given and repeated every third or fourth day. It may even be preferable to give smaller doses at intervals of twenty-four hours, or an increasing dose—*e. g.* 5, 10 and 15 million streptococci—on three successive days, followed by an interval of seven to ten days.

Use of Stock Vaccines

Whenever it is possible the particular vaccine used should be specially prepared for each patient. There are instances, however, in which the use of a stock vaccine is compulsory. Thus, for example, in the treatment of gonorrhœal arthritis and erysipelas it may not be possible to isolate the specific organism from the patient; in such cases appropriate doses of a vaccine recently prepared from a number of strains of the causal micro-organism are given. But such procedures should always be regarded as second best, and are to be strictly reserved for cases of the kind mentioned.

A second group in which it is customary to employ stock vaccines contains those diseases caused by organisms whose cultivation is difficult and growth is slow. Examples are all cases of tuberculosis, and some of actinomycosis and other streptothrix infections.

Lastly, a stock vaccine of a more virulent strain of micro-organism than the one isolated, or of a mixture of several different strains, may be used if it is found that little or no good follows the use of the micro-organism actually present in the lesion treated.

Vaccine therapy constitutes an instrument of very great utility in stimulating the natural defensive mechanism of the body against many forms of infection, but much has still to be learnt in regard to the most effective methods of using that instrument. It is not to be regarded as a panacea for all diseases which are of microbic origin—still less as a panacea for all diseases. It

is but a valuable adjunct in the medical and surgical treatment of bacterial infections.

T. J. H.
A. E. G.

FEVER WITHOUT OTHER PHYSICAL SIGNS

In a large number of cases of disease in which clinical pathology gives assistance in diagnosis, *fever* plays a conspicuous part. When "physical signs" are absent the investigation of a case of fever becomes in large measure an exercise in pathological methods.

Cases of fever fall rather naturally into two groups. In the first, certain physical signs more or less adequate to the diagnosis are elicited by examination of the patient; in the second, no such signs are obtained. In this latter group are found many cases which tax the resources of the diagnostician to the utmost and include some of the most difficult yet fascinating problems of clinical medicine. The cases may be divided into two classes, according as the physical signs are latent or difficult to find, or are altogether absent.

I.—Physical Signs Overlooked or Latent

1. **Cholecystitis.**—Patients are usually the subjects of gallstones, and often they are stout, making abdominal examination difficult. Local tenderness is more common than pain; colic is not usually a feature. Flatulent distension of the bowels is almost constant. The attacks are prone to recur, sometimes after brief intervals. Palpation, especially in the genu-pectoral position, may discover a rounded elastic tumour in the right hypochondrium—perhaps only for a brief period in the course of the disease. Jaundice may be completely absent throughout the whole course, but the urine should be tested for traces of bile. Even with an intermitting fever and with rigors the inflammation is not necessarily suppurative, and there may be no leucocytosis.

2. **Pyelocystitis.**—In some cases of infection of the urinary tract the amount of pus in the urine may be quite small; the sole sign of the disease may thus be easily overlooked. Sudden rises of temperature, often accompanied by rigors, in old men, or in patients suffering from diseases of the nervous system leading to sphincter troubles, frequently have their explanation in infections of the urinary tract. By far the commonest infecting micro-organism is the *B. coli*, admitting of ready isolation from the urine.

3. **Pyorrhœa Alveolaris.**—A close inspection of the teeth and gums should never be omitted in cases of fever of obscure origin, which may certainly own no other cause than oral sepsis.

4. **Perigastritis and Subphrenic Abscess.**—In

these serious complications of gastric ulcer physical signs may be delayed, perhaps for a fortnight or more. When signs do appear, pleural friction is apt to be the first. The same conditions may follow gastro-enterostomy or the suture of a perforated ulcer. A rising leucocyte count may suggest the actual sequence of events.

5. **Rheumatism** may give rise to bouts of fever with nothing manifest in the way of physical signs. The administration of sodium salicylate may have no effect on the fever. It is highly probable that in these cases some serous membrane is in a state of smouldering inflammation. These cases of rheumatic pyrexia, not seldom considerably prolonged, are always a source of anxiety to the physician, which is increased in the presence of valvular disease; for the transition from simple rheumatic to infective endocarditis may be very gradual. However, a careful search for the cardinal signs of infective endocarditis, which includes a blood-culture (see p. 417), will generally lead to a prognosis which future events will justify.

6. **Localised Tuberculosis** of lung, pleura, peritoneum, lymph glands, kidney and suprarenal glands, Fallopian tubes or spine may give rise to fever with physical signs that are difficult to elicit. Critical examination of these organs and their functions should be made, and one or other of the tuberculin tests should be undertaken.

7. **Fever following Surgical Operations.**—It must never be forgotten that the wound constitutes a physical sign which must be closely scrutinized. If fever occur after an operation, provided the rise of temperature be not trivial or transitory, the sooner the wound is looked at the better, though the lungs, heart and other organs should also be thoroughly examined. Cultures should be made from any fluid present in the wound, be it blood-stained fluid, serum or obvious pus. If a growth of any pathogenic micro-organism is obtained, an appropriate vaccine should be prepared, so as to be available if a careful consideration of all the facts of the case suggest its administration.

II.—Physical Signs Entirely Absent

1. **Influenza** is probably the commonest cause of a pyrexia without other physical signs. Indeed, most cases of influenza run their course without other signs than that recorded by the thermometer. The fever in uncomplicated cases is usually over by the fifth or sixth day; if it lasts longer than this it is probable that some complication is present, or that the disease is not influenza. If a complication exists a focus of infection is probably present (bronchial, pulmonary, intestinal, biliary, endocardial,

meningeal, etc.) and physical signs are usually forthcoming. In uncomplicated cases a leucopenia is of great service in diagnosis, especially in the absence of the typhoid agglutination reaction. In uncomplicated influenza the microbe is rarely, if ever, demonstrable in the blood-stream, but may be isolated in cases of influenzal endocarditis or thrombosis.

2. **Typhoid Fever** is the most frequent cause of fever of longer duration than five days in Great Britain, physical signs being absent. As a possible cause of any case of obscure pyrexia it must be perpetually borne in mind. The association of leucopenia with even a partially complete Widal reaction is a valuable indication of typhoid fever in its early stages. A complete Widal's reaction with a leucopenia may be taken as diagnostic. During the first week of the disease the diagnosis may often be established by blood-culture. Allied to typhoid, and often indistinguishable from it clinically, are the cases termed paratyphoid fever. The diagnosis can only be made with certainty by isolation of the micro-organism from the blood-stream, from the urine, or from the faeces.

3. **Septicæmia**, especially puerperal septicæmia, may lead to marked fever without other signs. The diagnosis may turn almost entirely upon the results of blood-culture.

The presence of a bone injury in a child suffering from sudden fever must always receive the most critical examination. Some cases of osteomyelitis, due to *staphylococcus aureus*, become pyæmic so rapidly that even the early detection of the focus and its prompt treatment rarely serve to save the patient. In all instances where incisions are made into doubtful areas of inflammation, cultures of the exuding fluid should be made, however innocent it appears to the naked eye. Now and again a drop of serum will yield a growth of staphylococci in the warm incubator within eight hours; this should at once lead to further surgical procedure if no fall has taken place in the temperature or leucocyte count, and if no alleviation has occurred in the general condition as the result of the first incision.

4. **Malta Fever** may be the cause of fever of very obscure origin. Residence in a Malta-fever district may have been of short duration. The patient may complain of general weakness, of neuralgic joint pains, or of the fever some months or even years afterwards, and give no history suggesting the nature of his infection. The diagnosis is made from a positive blood-culture (rarely possible in such a case), or from a combination of leucopenia with agglutination of a strain of micrococcus melitensis by the diluted serum of the patient.

5. **Malaria.**—The diagnosis rests upon the discovery of the parasite in the blood; a leuco-

penia ("relative lymphocytosis") is almost invariable.

6. **Cerebro-spinal Fever.**—Occasionally there may be an absence of the diagnostic clinical signs for some days or even weeks. A persistent headache, with pains in the back and limbs, and progressive loss of flesh accompanied by a leucocytosis, should lead to a lumbar puncture and search for the meningococcus.

7. **General Tuberculosis** is a rare cause of fever in patients who show no other physical signs of disease.

8. **Intestinal Intoxication.**—(i) In young children errors in diet are very commonly associated with fever. One variety of such troubles is termed "carbohydrate fever," being due to an excess of starchy stuff in the food. The stools in such cases are unduly pale, fermenting and offensive. In other cases the prompt effect of small doses of mercury with chalk suggest that excessive or unusual microbic action is the dominant feature.

(ii) The action of intestinal parasites contributes some of these cases. Worms may cause colitis, with the production of much mucus, which acts as a good nidus, not only for the parasite itself, but for bacteria, such as streptococci and colon bacilli. A careful examination of the stools should be made in all cases of obscure fever, especially when occurring in children, not only for parasites, but also for ova.

(iii) **Acute and Subacute Colitis.**—Physical signs may be confined entirely to the stools, which may contain mucus, casts of the bowel and occasionally blood.

(iv) In severe **constipation** it is not uncommon to see bouts of fever, and occasionally these are so marked as to suggest the presence of some focal inflammatory mischief or of typhoid fever. There is always a leucocytosis present, which helps to exclude the last-named disease, but if the count is quite high local inflammation should always be suspected.

9. **Rat-bite Fever.**—A febrile disease, taking the form of a relapsing fever associated with few physical signs, may result from a rat-bite. After an incubation period of three or four weeks fever appears, accompanied by an erythema and much constitutional disturbance. A high leucocytosis is present. A quiescent period follows, during which the patient regains his normal state. The febrile bout recurs, and this alternation goes on for a variable time up to several months. Ultimate recovery takes place.

10. **Nervous Fever.**—Given that a thorough examination has been undertaken in a case of fever, and nothing has been discovered of the nature of physical signs, the question of nervous influence must be considered. Cases of nervous fever fall into two groups.

(i) Some persons "run a temperature" more easily than others. After an acute febrile illness the temperature of such persons is apt to remain irregularly raised, sometimes for several weeks, though the patient may in other respects proceed satisfactorily with his convalescence. These patients are generally very nervous people, and there may be more than mere neurosis in the family history.

(ii) The second group is of the nature of neuromimesis. The patient is usually a young woman of particular temperament, very difficult to describe. Her morbid nervous state shows itself not only by pyrexia without organic cause, but also by the simulation of other pathological processes: anorexia, vomiting, skin-eruptions and contractures. Cured, or rather cheated, of one of these, another takes its place. A careful study of the temperature curve may reveal suggestive features: the morning rise may be greater than the evening rise, and with the pyrexia there may be no associated increase in the frequency of the pulse or respiration.

T. J. H.

A. E. G.

V.—MEDICO-LEGAL POINTS IN PRACTICE

CAUTIONS

EVERY medical man is potentially liable at any moment to have the duties of a medical jurist thrust upon him, and it is unlikely that he will pursue an active medical career without coming into contact with legal questions from some point or another. The duties he may be called upon to perform are of a highly responsible nature; it may be incumbent on him to testify under conditions seriously jeopardizing his own reputation, whilst he is frequently placed in positions making the greatest demands upon his sagacity and tact. A practitioner in any branch of medicine is by the nature of his work frequently exposed to misunderstanding and ill-will on the part of patients and their friends, whose statements or accusations may prove difficult to disprove and damaging to his interests. Hence every medical man should most certainly subscribe to a Medical Defence Society the very day he becomes a registered practitioner.

To avoid any risk of being brought into conflict with others over legal points, and to ensure acquitting themselves with credit should such circumstances arise, medical men should observe in their practices all the attention to detail which is requisite in the conduct of business—it is the common complaint that medical men are unbusinesslike. Accurate daily notes, made as near the events as possible, with dates and figures clearly put forth, will save the practitioner many anxious moments under possible cross-examination;—accounts should be professionally audited.

The medical man should not go beyond his own sphere, he should invariably refuse to act as executor or trustee to his patients; it is wiser for him not to be an ardent party politician, and in general he should, popular prejudice notwithstanding, adhere rigidly to customary professional etiquette, both in dealing with his patients and his colleagues.

In his relations with his patients the practitioner must remember that, whilst the public expects omniscience from him, his knowledge must actually be limited, hence it is to his own interest as well as his patients' to seek help in doubt too often rather than too seldom, too soon rather than too late. In dealing with women the utmost care is necessary to avoid giving any handle to suspicion; hysterical subjects are especially dangerous. The practitioner's relations with his colleagues require him to walk

warily; it is to be remembered that consultation with anyone not on the Register is not permissible, that copies of the Register are supplied to every practitioner on registration, and that full information as to any practitioner being registered or not can at once be obtained from the offices of the General Medical Council.

Any individual patient may well be the potential subject of medico-legal inquiry. It is the duty of the medical man to cultivate accuracy in clinical methods of investigation and examination, especially in cases where the likelihood of legal proceedings is apparent, as in accidents, where suspicion of poisoning, drug-habits, alcoholism, or abortion arises, or where compensation actions might follow. Not to know is excusable, not to have seen is culpable. Hearsay evidence is not to be relied on, what "Dr. X. said" is usually distorted; facts, dates and measurements count for more than impressions; data which observation can furnish need not be the subject of inquiry.

It is impossible that a medical man should always be right, but so long as his main facts are indisputable, an erroneous deduction from them will not prejudice him so strongly in the eyes of judge and jury as will obvious omissions attributable to professional ignorance.

Although possibly a counsel of perfection and thus out of reach, it is nevertheless commendable that every patient be viewed as a possible medico-legal problem, and thus questions which appear trifling and unimportant may receive greater attention, and the confession "I never thought" not be reluctantly extorted.

E. P.

MEDICAL EVIDENCE

A medical man may be called either as a common witness to prove *facts*, *e.g.* the fact of having attended a person suffering from extensive burns; or as an expert to give an opinion on facts observed by himself or proved by the evidence of others, *e.g.* to prove the mental condition of a person. Very often a witness is called both to prove facts and to give an opinion upon the facts. The summons to court usually takes the form of a subpoena, which must be obeyed if served a reasonable time before trial and if accompanied by reasonable travelling expenses. An expert witness, however (if called only for an opinion and not to prove facts, and thus not a *necessary* witness), is not legally bound to obey a subpoena.

Fees may be demanded before being sworn in civil cases, but in criminal cases, when once a subpoena has been accepted, the witness is bound to give evidence, irrespective of the amount of the fee or the certainty of payment. A written undertaking to pay the fees should, therefore, be obtained whenever possible. In criminal cases the fees are regulated by an official scale obtainable on application to the Home Office; the court will, however, allow special fees for expert evidence.

Notes may be referred to in the witness-box for the purpose of refreshing the memory. They may not be read out as evidence, though the witness is at liberty to read them to himself in the box. Any notes so used must have been made at the time of the occurrence to which they relate, or as soon after as possible. An expert may refresh his memory in the witness-box by referring to professional works, but he may not read out quotations from such works as evidence.

A witness is first examined ("examination in chief"); he may then be cross-examined, and, finally, re-examined on points brought out in cross-examination. Questions should be answered as directly as possible and facts should not be confused with opinions; *e.g.* a surgeon stated in evidence that a body had been found "under circumstances of great suspicion" and was corrected by the judge for expressing an opinion on the facts.

"Hearsay" may not be given as evidence, with the important exception that a "dying declaration" may be so admitted, though only in accordance with the following rules:—(1) The case must be one of trial for the murder or manslaughter of the declarant. No dying declaration can therefore be given as evidence in any other kind of criminal case, or in any civil case whatever. (2) The declarant must believe himself to be dying. (3) The evidence can only be given after the death of the declarant has occurred, and it must relate only to the circumstances of such death. (4) A dying declaration, if made orally, must be written down without delay, and if possible should be read over to and signed by the declarant. These rules are rigidly adhered to, for the law is rightly most reluctant to allow evidence not admitting of cross-examination. It may be added that when a dying declaration is to be made the officers of the law should, if time allow, be informed, so that they may attend and receive the declaration in legal form. In a case of urgency the surgeon should record the declaration, avoiding leading questions, and if possible securing the presence of a witness. He should also be prepared with evidence as to the mental state of the dying person, and particularly as to the declarant's settled conviction of

approaching death, this conviction being essential to the admissibility of the declaration.
E. S.

MEDICAL WITNESSES

A medical man shares the common liability to be summoned as an ordinary witness to testify to facts, though naturally he is more often required in a professional capacity. He should be well up in the subject to which his evidence relates, and should have formed definite views as to the particular case involved, for he may have to meet a close inquiry as to the grounds of his opinions from an opposing counsel who has carefully worked up the subject with a view to cross-examination.

Evidence should be given as impartially as possible. The privilege of "taking sides" enjoyed by counsel is not extended to the medical witness; any appearance of partisanship, therefore, detracts from the value of the opinions given, and tends moreover to discredit medical evidence in general.

Technical terms should be avoided as far as possible. Many medical men fully aware of the importance of this point overlook it when giving evidence. This is doubtless due to the existence of many expressions which through familiarity make no suggestion of technicality to the professional witness, but yet may be obscure to the average jurymen, if not to judge or counsel. The terms "integument," "lesion," "cuticle," "alimentary canal," and "hypertrophy," are a few which may be quoted in illustration. It is also useful to remember that an alternative phraseology is sometimes advisable; for example, congenital syphilis may be referred to by preference as "inherited constitutional disease."

No "privilege" can be claimed in respect of professional secrecy by a medical witness; he must answer all questions relating to his patient if relevant to the case, and may therefore be compelled to disclose confidential communications. In this respect doctor and patient are at a disadvantage as compared with solicitor and client, for a solicitor is under no obligation to disclose in the witness-box information professionally acquired from his client. It should, however, be clearly understood that the medical witness is absolutely protected in the sense that no action for defamation can be taken in respect of any evidence given in any court, though liability to a charge of perjury would of course remain for false evidence given. Moreover no witness (medical or otherwise) can be compelled to answer any question if the answer would incriminate himself, *i.e.* if the answer would render him liable to a criminal charge. The mere fact that civil proceed-

ings might result would not relieve a witness from the obligation to reply. Any witness objecting to answer a question should appeal to the judge as to the necessity for a reply. Where a confidential communication is involved such an appeal will at all events indicate an attempt to preserve professional secrecy; moreover the judge will sometimes allow an answer to be written down for the perusal of himself and the jury, publicity being thus avoided.

Counsel will sometimes endeavour to distort the evidence by demanding "yes" or "no" as an answer to a question. Such reply may be incomplete or ambiguous, and in any such case the judge should always be appealed to for leave to answer the question fully.

When the case is one in which evidence has already been given at a lower court the medical witness should read up notes of his evidence given there before appearing at a higher court, for any discrepancies will be seized upon by counsel as material for cross-examination, and may also excite unfavourable comments from the judge. In this connection the witness should remember that copies of all the evidence given at the lower court are placed in the hands of judge and counsel at the higher court, and that a witness giving evidence at, say, some country inquest amid homely surroundings is virtually in the witness-box at the high court. A copy of the evidence given at a lower court can sometimes be obtained; failing this, notes should be made for future reference; this is clearly important when it is remembered that an interval of many weeks or even months may separate the initial and the final stages of a case, whether civil or criminal. (See also *Medical Evidence*.)

E. S.

CERTIFICATES AND REPORTS

Certificates.—In the granting of certificates the medical man should be imbued with a sense of his responsibility and of the weight which in many cases attaches to the facts or opinions to which he testifies, nor should certificates be lightly given merely to suit the convenience of a patient, nor statements be subscribed the accuracy of which the certifier is not prepared to substantiate.

The certifier should guard against all over- or under-statement of facts at the solicitation of the patient.

No statement should be included which is not based upon personal observation; if there is any doubt, however remote, in the mind of the certifier concerning the illness of a patient, the phrase "In my opinion . . ." should precede the statement. A colleague's examination should never take the place of a personal one.

No printed form should be signed with the contents of which the certifier has not made himself fully acquainted; the certificate should be carefully read over before signing. The certificate must be correctly dated, and there should not be any appreciable interval of time between examination and granting the certificate.

It should be borne in mind that a certificate is confidential; no statement of facts concerning a patient's health should be set down except at the request and with the permission of the examinee, or in the case of a minor at the request of parent or guardian. In the case of employer and employee care must be taken that no statement be included possibly prejudicial to the latter's interests.

Reports.—The habit of accurate note-taking is of the utmost value to the medical man, although busy practitioners have, unfortunately, only too little time, and frequently less inclination, for this. Certain cases, such as unexplained deaths and accidents, demand notes upon which reports will have to be founded. One or two considerations must be remembered. Notes should be of personal observations, not of second-hand statements; to be of value they should be made at the time, not written down afterwards from memory, or if delay be unavoidable, it should be the least possible. In making reports all dates should be categorically stated, vague terms such as "last Tuesday," being avoided; sex, age, occupation and name recorded; writing should be clear, preferably typed; technical terms should be avoided; English be preferred to Latin or Greek names; opinions, inferences or comments, together with superfluous adjectives, eschewed; medical facts only, not probabilities, put forward and words used with an understanding of their exact connotations and a lively anticipation of possible legal cross-examination. Any expression of opinion which might be construed as forecasting the finding of a jury will undoubtedly be challenged. When "information received" has to be included in a report it must be clearly differentiated from "facts" observed.

E. P.

NEGLIGENCE

By negligence is meant failure to do something which a practitioner exercising reasonable skill and care would have done. This amounts to wrongful treatment by omission and is best considered under *Malpraxis*.

MALPRAXIS

The law has nowhere defined either negligence or malpraxis, but numerous decisions of the courts have made it clear that what a patient

is entitled to receive from his medical attendant is the exercise of a reasonable degree of skill and care. The patient's legal remedy for wrongful treatment is a civil action for damages. Any case in which neglect or ignorance of a gross character is alleged may also form the subject of a criminal charge; *e. g.* a practitioner whilst intoxicated attended a midwifery case which ended fatally, and as a result he was tried for manslaughter. Juries usually take a common-sense view, and will decide in favour of the defendant unless neglect or wrongful treatment be clearly proved. It is important to note that the law does not require from a given practitioner the exhibition of a higher degree of skill than he might reasonably be expected to possess. Thus a general practitioner operating in an emergency on a case of intestinal obstruction might act unskilfully as a result of inexperience; but in the absence of proved neglect no proceedings against him would succeed, for it is not reasonable to expect all general practitioners to be capable of performing major operations in a skilful manner.

Actions for malpraxis are by no means infrequent, and it should not be forgotten that even the most skilful and careful may be attacked; for unfounded charges may be made, occasionally in good faith, though more often with the object of avoiding payment for medical services. The aim of every practitioner should be not only to secure a verdict when attacked, but so to carry on his practice as to minimize the probability of any charge being brought against him. He is recommended, therefore, in his own interests—

1. To join one or other of the societies for medical defence. The Medical Defence Union and the London and Counties Medical Protection Society deal every year with an aggregate of about one hundred cases in which allegations of want of skill or care have been made. A large number of these cases do not reach the courts, proceedings being dropped when it is known that one or other of the bodies named will undertake the defence.

2. To obtain the patient's consent to do what may become necessary in the course of an operation. Otherwise in the absence of such consent a surgeon may well hesitate over, say, the amputation of a limb or the removal of a second ovary, the necessity for such a step only becoming apparent after anæsthetization of the patient.

3. To be guarded in describing the nature of any obscure case, whether of disease or injury. Thus neglect has been alleged on account of failure to diagnose a fracture or dislocation, the swollen state of the part in an early stage having led to the case being regarded as a sprain. In accident cases the

practitioner frequently loses sight of the patient after the first examination; if, therefore, there is to be no second opportunity for examination, a guarded opinion should be given if doubt exist as to the nature of the injury, and when a fracture is possibly present the precaution of applying splints must not be overlooked.

4. To remember the value of an early conference with a consultant or with a neighbouring practitioner in cases which seem likely to develop a medico-legal aspect. Judges and juries are always impressed by corroborative evidence.

5. To examine thoroughly all patients, so far as is practicable, at an early stage of any attendance. Neglect of examination counts far more than want of skill for mistakes in practice. Moreover, the absence of an examination is readily proved in any case coming before the courts, and will impress judge and jury unfavourably. Instances that readily occur as possibly giving rise to trouble are: enteric fever well established before discovery; acute pneumonia overlooked in its early stages; diabetes or renal disease becoming apparent by the unexpected onset of coma, the urine not having been examined.

6. To bear in mind all the recognized aids to diagnosis, *e. g.* X-rays, Widal's test, Von Pirquet's reaction, and so forth. Even when it is thought unnecessary to employ such tests in any particular case it is often advisable to mention them to the patient, who will then see that no point has been overlooked (for example, the use of X-rays in a case of injury or Von Pirquet's test in suspected tuberculosis). Otherwise the patient is not unlikely to make suggestions as to diagnosis or treatment, the result of reading or of conversations with friends.

7. To be cautious in employing new or unusual lines of treatment. Especially is this to be remembered in any case likely to be the subject of a criminal charge such as murder or manslaughter, for in such criminal case the defence may allege wrongful medical treatment and thus succeed in preventing a conviction.

Hospital surgeons are liable for their own negligence and that of persons acting under their immediate supervision, as for example, the mistake of leaving a sponge in the abdomen owing to faulty counting by an assistant. They are not liable for negligence in details of treatment carried out by subordinates in the surgeon's absence. Thus no responsibility would be incurred by a surgeon for scalds due to a hot bath carelessly given by a nurse acting under the surgeon's orders. In a case of this character, where an action was brought against two hospital surgeons, the judge said, "The defendants cannot be held liable for the negligence

of the nurses unless they were near enough to be aware of it and to prevent it."

Quacks are not exempt from actions for wrongful treatment. Owing to the low standard of skill expected of them such actions seldom succeed, so that a quack may gain a verdict where a legitimate practitioner would fail, as in the *Indian Oculists' case*, 1893; but when evidence of the possession of skill is produced a plaintiff may succeed in securing damages for the failure to employ such skill (*e.g.* *Thomas v. Barker*, 1911). E. S.

CASES OF DIFFICULTY

There are many occasions when medical men may be called upon for action or opinion under circumstances of the greatest doubt and uncertainty, where serious issues may be involved. Some are perennially recurrent problems, well recognized as such, but never easy of solution even to the forewarned practitioner.

Drunkenness and States of Insensibility.—Merely to be drunk is no offence against the law; to be apprehended the drunkard must be dangerous or annoying to himself or others. That the recognition of alcoholic intoxication is difficult may be known by the frequency with which mistakes occur and are reported in the press. The police-surgeon must remember that possibly there may be different answers to the two questions: (1) Is the patient drunk now? (2) Was he drunk when arrested? The quantity of alcohol consumed is no criterion. The classical signs to be looked for are: (1) pupils react sluggishly, (2) lips are dry and sticky, (3) expression vacant, (4) breath smells of alcohol, (5) conception of passage of time is vague, (6) ideas arise rapidly with more or less coherent attempts at expression, (7) gait is unsteady, (8) body-temperature is subnormal, (9) deep reflexes lessened. It is hardly necessary to point out that any or several of these signs may be due to other causes.

Alcoholic Coma may not occur immediately after taking an excessive amount of alcohol, but may then be of sudden onset; a preliminary stage of excitement is more likely to occur if dilute alcohol has been taken than after neat spirits. Prof. Glaister points out that the smell of alcohol suggests a serious cause of unconsciousness leading to administration of stimulant rather than coma, owing to the evanescent nature of the odour. If the patient is allowed to lie undisturbed the pupils are contracted; if he is stimulated they dilate. The temperature is usually subnormal, but this condition may also be found in apoplexy or opium poisoning, and so proves an unreliable test.

Insensibility.—Apart from alcoholic coma the

commonest causes of insensibility are cerebral hæmorrhage, epilepsy, uræmia, opium and carbolic acid poisoning, concussion and fracture of the skull. The history may assist diagnosis if available. Opium, uræmia and pontine hæmorrhage give contracted and immobile pupils; in epilepsy and cerebral hæmorrhage they are dilated. Unequal pupils (ocular disease being excluded) indicate fracture. The cases most likely to be taken for drink are those of excited stupidity due to organic disease and later to be followed by coma.

Criminal Abortion usually comes to light only in the small minority of cases where serious or fatal results occur. The interest to the practitioner arises when he is called in to attend the patient suffering from the results of attempted or successful interruption of pregnancy. It is generally conceded that practitioners are in no way accessories if they attend women under such conditions, nor are they bound to break silence concerning their patients. If, on the other hand, the name of the operator comes to their knowledge it should be reported to the police. Another point to be borne in mind in these cases is the possibility of self-inflicted injuries proving fatal, the women dying without making any statement. A post-mortem examination might disclose conditions which would throw suspicion on the practitioner. The latter should be on his guard, in cases of suspected poisoning in women, that abortifacient drugs are not the cause. Many medicinal means are employed, diachylon, ergot, savin, pennyroyal, cathartics, aloes, cantharides, nutmeg, etc. Mostly these fail of their purpose.

Abortion for Therapeutic Purposes.—The indications for this procedure are well known and laid down in obstetrical textbooks. The operator should be very clear as to the advisability of the operation and be prepared to withstand cross-examination on his motives. No practitioner should ever undertake such a procedure without a second and independent opinion, preferably in writing. Consent in writing from husband, parent or friends is advisable. The practitioner should be on his guard against performing any therapeutic or instrumental manipulation, such as the passage of a sound, the dilatation of or application of local remedies to the cervix at the solicitation of the patient, possibly pregnant and trying to take him unawares.

Duration of Pregnancy.—Medical men may be called upon to testify in paternity or legitimacy cases. It may be assumed that it is not in our power to fix an absolute limit to pregnancy. Prolongation up to 310 and 325 days has been reported, although doubt may be cast upon the authenticity of such cases. Recently Bossi has advanced evidence to prove that

spermatozoa can remain alive in the fornix as long as seventeen days and even throughout a menstrual period.

Pregnancy and Age.—Precocious pregnancy is hardly likely to be a cause of difficulty; pregnancy late in life is of greater importance from a medico-legal aspect. The law fixes no limit beyond which the woman is considered incompetent to procreate, and cases must be judged on their merits. Dixon Mann quotes five cases at 49, 50, 55, 59 and 72. If the last of these is unquestionable it is obvious that the latitude of possibility is very great.

Hermaphroditism.—This would most likely occasion difficulty in the case of new-born infants of doubtful sex. The law recognizes no uncertainty, and if such exists the infant should be registered and brought up as a boy.

Recent Delivery.—The practitioner may have to decide whether a woman has recently given birth to a child. Twenty-four to thirty-six hours after abortion there may be no proof obtainable. Even after delivery traces of parturition may, in six or seven days, be too ambiguous to justify a positive statement; after eight to ten days signs will mostly have disappeared.

Remote Delivery of a foetus at less than six months will probably be impossible of recognition.

Administration of Anæsthetics.—Difficulties may arise in connection with deaths under anæsthesia and with anæsthesia in cases of emergency, especially if the two circumstances coincide. Immediate operation may be necessary to save life and consent not be obtainable at the moment, as when the patient is drunk, or unconscious, or a child. The practitioner can only act for the best and take the risk, if he is satisfied of the absolute necessity. No anæsthetic, however, should be given without a third person being present, nor should the practitioner, except at direst need, be operator and anæsthetist combined.

Suspected Poisoning.—The practitioner may be in a difficult position, with the risk of wrongfully aspersing relatives or friends balanced against allowing the successful perpetration of crime. He should be on his guard against lightly accepting the statement of a patient possibly suffering from hysteria or delusions. He should note the time of occurrence of symptoms, their relation to food, drink or medicine, whether they occur at intervals or constantly. He should obtain specimens of vomit, if any, of excreta, of food, drink or drugs, unostentatiously. If conviction deepens, accidental poisoning should be mentioned as a possibility, consultation suggested, the patient be removed to hospital or put under day and night nurses.

The practitioner's suspicions may be mentioned, not written, to relatives, friends, the patient or his solicitor, as circumstances direct; application to magistrate or police being made only as a last resort. In case of death a certificate is refused.

E. P.

THE CORONER'S COURT

The coroner's court is an ancient institution and is known to have existed as far back as A.D. 900. In early times the coroner's duties included watching over the profits of the Crown, and as these profits were partly made up of the forfeited goods of executed felons, we can see the origin of the coroner's inquiry (inquest) into violent and other unnatural deaths. In Scotland there are no inquests, the functions of the coroner being carried out by an official called the procurator-fiscal.

The duties of a coroner are prescribed by the Coroner's Act, 1887, which, however, is not applicable to Scotland or Ireland. This act provides for an inquest when there is a reasonable suspicion that death has resulted from violence or from other unnatural cause, also when the death of a criminal occurs in prison. A medical practitioner should refrain from giving a death certificate in such cases or when the cause of death is unknown, but should communicate with the coroner, who will decide as to the necessity for an inquest. The absence of medical attendance during life does not in itself necessitate an inquest, for the coroner may consider this superfluous if he is satisfied that death was due to natural causes. On the other hand a death certificate does not preclude an inquest. The coroner can act on information derived from any source, *e. g.* through his officer, the police, a medical practitioner, a registrar of deaths, or some member of the public. Registrars are instructed by the registrar-general to report to the coroner all deaths occasioned directly or indirectly by violence; all deaths occurring under suspicious circumstances; all deaths said to have been "sudden" and regarding which no medical certificate is produced; and all deaths of infants in houses registered under the Infant Life Protection Act of 1872.

There can be no inquest unless the body under consideration (or some part of it sufficient for the purpose of identification) is forthcoming, for the law requires coroner and jury to view the body at the first sitting. No coroner's inquiry can therefore be held upon, say, a suicide by drowning perhaps witnessed by several persons but not followed by the recovery of the body.

Although medical evidence is usually called, there is no obligation on a coroner in this matter. As a rule the practitioner who attended the deceased during his last illness is summoned;

when there has been no such attendance any medical man practising in the locality may be called. The coroner may also at his discretion employ a skilled pathologist for the purpose of making a post-mortem examination. The Coroner's Act provides that when it is stated on oath before the coroner that the death was caused partly or wholly by the negligent treatment of a medical practitioner such practitioner shall not be allowed to perform or assist at the post-mortem examination. A majority of the jury can also require the coroner to summon another practitioner named by them, and can further direct a post-mortem examination (even though this be a second one) to be made.

The jury consists of not less than twelve or not more than twenty-three members. The unanimity of twelve is sufficient for a verdict, so that there is an advantage in swearing more than twelve on the jury; coroner's juries, however, seldom disagree as to a verdict. The functions of the jury are to view the body, to determine the cause of death and to decide who, if any one, is criminally responsible for the death. To the verdict there is often added a rider making some recommendation or censuring some person; such rider is merely an expression of opinion and has no legal force. A verdict of murder or manslaughter is followed by the arrest of the accused on the coroner's warrant. Police court proceedings usually follow, and, finally, if the prisoner is committed from the police court, a High Court trial. The verdict of the coroner's jury does not, however, bind the criminal authorities; it can neither compel nor prevent proceedings being taken against a person. It is very important to know that copies of the evidence taken at the inquest are supplied to judge and counsel at the High Court; the medical witness must therefore remember to be as careful in giving evidence before the coroner as if he were in the witness-box at the High Court. Evidence carelessly given has before now resulted in an innocent person being charged with murder or manslaughter; thus, post-mortem stains have been mistaken for bruises inflicted during life, with an unjust conviction as the sequel.

It should be remembered that a coroner's inquest is not a trial but an inquiry; consequently the ordinary rules of evidence need not be strictly followed, and the coroner may receive statements not on oath. It is advisable, however, that all witnesses should be sworn; at all events the coroner should direct the jury that they must consider only the sworn evidence in arriving at a verdict. Again, any one representing a party to the inquest, *e. g.* a solicitor representing a relative of the deceased, may put questions to a witness by the courtesy of the coroner, but he has no *locus standi* and may not

address the court. In other respects the inquiry resembles a trial. Thus a witness is bound to reply unless his answer would incriminate himself. If he wrongfully refuses to answer, the coroner can punish him by fine or imprisonment for contempt of court. Further, a medical witness failing without sufficient cause to obey a coroner's summons is liable, on the prosecution of the coroner or any two of the jury, to a fine not exceeding £5.

The fees payable in connection with an inquest are one guinea for attending to give evidence and two guineas for making a post-mortem examination and giving evidence. The rules have made no provision for payment for adjournments or for mileage travelled. No fees are payable to medical officers of hospitals, asylums and similar institutions, except in cases where death has occurred before reaching such institution. It has been decided that even unpaid medical officers to cottage hospitals come under this rule. (See also *Medical Evidence*, and *Medical Witnesses*.) E. S.

POISONS

Though we may describe as poisonous any substance which even in small quantities is dangerous to life, the law has nowhere defined a poison, nor is a definition necessary in a medical sense, the most poisonous substances being harmless if taken in sufficiently small or dilute doses. Poisons have been variously classified, *e. g.* into corrosives, irritants, narcotics, and convulsants. Any such arrangement is of little practical importance, for a corrosive, such as a mineral acid, may by dilution become merely an irritant; while other poisons, *e. g.* oxalic acid, may act in any or all of several ways.

The Emergency Bag.—Just as every hospital should have its poison cupboard, so every practitioner should keep at hand an emergency bag, containing:—(1) stomach tube and funnel; (2) gag; (3) hypodermic syringe; (4) tubes of the following hypodermic tablets—morphine hydrochloride, gr. $\frac{1}{3}$; apomorphine hydrochloride, gr. $\frac{1}{10}$; strychnine hydrochloride, gr. $\frac{1}{80}$; pilocarpine nitrate, gr. $\frac{1}{2}$; atropine sulphate, gr. $\frac{1}{100}$; digitalin, gr. $\frac{1}{10}$; (5) emetics—zinc sulphate in thirty-grain powders; common salt; mustard; ipecacuanha in thirty-grain powders; (6) antidotes—magnesia in half-ounce powders; sodium or potassium bicarbonate in two-drachm powders; dilute acetic acid, four ounces; syrup of chloral, four ounces; nitrite of amyl in five-minim capsules; chloroform, four ounces; potassium permanganate in ten-grain powders; tincture of perchloride of iron, four ounces; tannic acid in twenty-grain powders; (7) litmus books, blue and red; (8) graduated glass

measure; (9) flexible catheter, number seven or eight; (10) two empty stoppered bottles, for preservation of samples of stomach contents and urine; (11) a small reference book, such as Murrell's *What to do in Cases of Poisoning*.

General Principles of Treatment. (1) Empty the stomach by lavage or emesis, except in corrosive poisoning. In using a tube some water should first be introduced into the stomach in order to dilute the contents and facilitate their removal. A sample of the stomach contents should be preserved for examination. It is worth while to remember that venesection provides a means of removing a considerable portion of the poison circulating in the system and is useful in poisoning by alkaloids; from ten to twenty ounces of blood may be removed. (2) Give the appropriate antidote. (3) Treat symptoms—for pain, morphia hypodermically; for collapse, hot bottles and blankets, strong coffee by mouth or rectum; for heart failure, hypodermics of strychnine or ether.

General Remarks. (For details as to individual poisons reference must be made to works on toxicology.) There are no special symptoms indicating acute poisoning in general, but suggestive signs are: sudden onset of symptoms, but not instantaneous onset except in prussic acid and corrosive poisoning; appearance of symptoms in a person previously in good health; occurrence of symptoms soon after taking food or medicine; simultaneous illness of several persons in a household.

A decision as to the kind of poison taken should be made as rapidly as possible. The odour of the patient's breath sometimes gives valuable information at once, *e. g.* in poisoning by carbolic acid, laudanum, alcohol, acetic acid, phosphorus, chloral, and with less certainty in the case of volatile poisons such as ammonia or prussic acid. With corrosives there are often stains on hands or clothing; these are usually due to an acid, but they may be rapidly tested by litmus, for poisoning by corrosive alkalies is not uncommon. The state of the pupils is characteristic in belladonna and in opium poisoning, but in grave cases of the latter the contraction may disappear towards the end and be replaced by dilatation. If the patient be convulsed, strychnine is at once suggested; convulsions may, however, occur with many other poisons, *e. g.* arsenic, antimony, and in any case where very violent pain is present. The convulsions of strychnine poisoning (as distinguished from those of tetanus) have the following characteristics:—they arise suddenly after previous good health, they do not begin in or specially affect the lower jaw, and there is complete relaxation between the spasms.

The rule that in corrosive poisoning a tube should not be passed has an exception in the

case of carbolic acid. This poison has a hardening rather than a corrosive effect, and the tube may be cautiously introduced. With oxalic acid, also, no signs of corrosion may be seen about mouth or throat, owing to the poison having been taken more or less diluted, and in such cases the tube may be safely used. The value of apomorphine (gr. $\frac{1}{10}$ hypodermically) should not be forgotten when there is difficulty in giving an emetic by the mouth or in passing the stomach-tube. A word of caution may be given as to the treatment of poisoning by corrosive mineral acids; the alkali selected should be magnesia, chalk (*e. g.* liquor calcis saccharatus), whitening, or plaster from wall or ceiling, rather than solutions of sodium or potassium carbonate or bicarbonate, for with the latter the rapid evolution of CO_2 is not only very painful but involves risk of a rupture of the weakened stomach wall. The same preference should be observed in oxalic acid poisoning, but for a different reason, viz. that the oxalates of sodium and potassium are not only soluble but very poisonous.

In a case where slow homicidal poisoning is suspected the first step is to prevent any further administration of poison. This may be effected by the employment of reliable nurses, or the patient may be removed to a hospital or nursing home. A consultation with a fellow practitioner is advisable; the question of communicating with the police may also arise. This step should only be taken when very good proof of criminality is forthcoming. In preserving a sample of the vomit, the bottle used should be sealed and labelled, and parted with only to the police or to the person who is to make the analysis. It is usually advisable to keep also a sample of the urine, using the same precautions. Should the case result in a criminal trial, counsel for the defence will certainly inquire as to the bottles or vessels employed; the medical witness must be prepared to swear these were absolutely clean, otherwise a defence of accidental contamination may be set up, with a miscarriage of justice as a possible result.

Many proprietary articles contain poison; the poisonous ingredients of some of these are appended: paregoric, opium; Winslow's Soothing Syrup, morphia; Mother's Friend, morphia; Tucker's Asthma Cure, atropine, cocaine; St. Jacob's Oil, aconite; teething powders, calomel and opium; oil of bitter almonds, hydrocyanic acid; headache remedies, antikamnia, anti-febrin; Godfrey's Cordial, morphia; hair washes and face paints, mercury, lead, bismuth; rat paste, phosphorus; Battle's Vermin Killer, strychnine, arsenic and phosphorus; fly papers, arsenic; weed killer, arsenic; Burnett's Fluid, zinc chloride.

E. S.

EXAMINATION OF THE DEAD BODY

Careful records should be made at the time of examination, and all details of the examination minutely noted and written down. The original notes should be kept for reference. Prior to making the examination, preliminary data as to the circumstances under which death took place, the name, age, sex, the names of those present at the death, and a clinical history should be obtained when possible.

The examination should be made in daylight. The position, general appearance of the body, and any peculiarities of surroundings should be noted in reference to a struggle, and for objects which may have dropped from the body, such as clothing, etc., when the body is seen where it was first discovered.

The examination consists of external and internal inspection.

External Inspection. Under this heading the following should be noted: Condition of dress if clothed, the height, sex, approximate age, body heat, colour and state of skin, nutrition, stature, presence of putrefaction, degree of rigor mortis, post-mortem lividity or staining, the position and contents, if any, of the hands, the presence of cadaveric spasm.

The skin should be examined for wounds, *nævi*, tattoo marks, cicatrices, bruises. All the body apertures should be carefully examined. Wounds should be described as to length, breadth, depth, direction and type, and localised by anatomical landmarks. Gunshot wounds should be noted and the blackening from powder, if present, described.

The exterior of the body should be systematically examined from head to feet. The head for peculiarities of shape, character of hair; the scalp for injury; the eyes; the nose, mouth and ears for foreign bodies and blood; the mouth and lips for corrosion. The teeth should be carefully noted, and loss recorded, and any artificial plate retained. The neck should be examined for marks of violence, *e.g.* strangulation, throttling, hanging, and for glandular enlargements. The thorax should be examined for abnormalities of shape or development; the mammary glands; the abdomen for distension, herniæ, pigmentation, *liniæ albicantes*, pubic hair, cicatrices, *e.g.* appendix region or midline after operation. The anus, and the vagina in women, should be searched for injury, inflammation, discharge or foreign bodies; the penis in man for venereal sores or scars, and the urethra for purulent discharge or blood. The limbs are to be examined for deformities, defects, œdema, local swellings, gouty or rheumatic conditions, wounds and scars. The condition of fingers and toes should be accurately described. Bruises and local swellings should

be incised. The hair should be shaved in order to examine the head. Marks of ligatures may be present on the wrists or ankles.

Internal Inspection. As a general rule the abdomen should be opened in the middle line and the general appearances noted without disturbing the viscera, but the position of the diaphragm should be ascertained. The calvarium should be removed next without the use of chisel and mallet, and the appearances of the surface of the dura described. Proceed then to the thorax and after removal of the sternum and costal cartilages describe the general appearance and relations of heart and lungs, and the presence of fluid in the pericardium or pleural cavities.

The *cranial cavity* should now be fully examined, the dura first opened and any abnormalities described. The brain must be carefully removed after properly incising the dura, and section of the cranial nerves and spinal cord below the medulla. The interior of the skull should be minutely examined for fracture, vascular rupture or other pathological conditions. The consistence of the brain, the meninges for inflammation or adhesion, and the condition of the vessels should be noted. Hæmorrhages, tumours and wounds, require careful record. The brain cerebellum, pons and medulla, should be incised, and the ventricles examined. The method of sectioning these may be varied according to the conditions present.

The spinal cord may be exposed now by a median incision from occiput to coccyx, reflection of tissues, section and removal of the laminae. The surface should be searched, and the cord removed by section of spinal nerves after incision of the theca, care being taken not to bruise the cord in the process. The cord should be cut into sections between each two pairs of nerve roots.

During the removal of the cord the spine can be examined for fractures and dislocations. The orbits may be opened through the roof and the posterior half or if necessary the whole eyeball removed.

The roof of the tympanum should be removed, and if desirable the petrous bone, by sawing from above down before and behind it through the base of the skull and the bone turned outwards. The nasal cavities and sinuses are examined after section through them, either transversely or sagittally.

In some instances it may be desirable to harden the brain in an approved fixative solution before proceeding to its dissection.

The Thorax. The thorax having been opened and the general appearances noted, the hand should be passed into the cavity and the surfaces of the lungs examined for adhesions. Where these exist care must be taken in their

separation. The condition of the thymus gland must be noted, and the mediastinum also. The lungs may then be removed by section at the root (after tying, if necessary, the large vessels). Each lung should be incised in various directions and its condition noted; it is to be examined in detail. The bronchi should be opened up and carefully examined. The lungs should be weighed separately.

The pericardium is opened with an incision from below upwards, the heart's surface, size, form and position noted, and the condition of of the sac and its contents examined.

The auricles and ventricles may be opened before removal of the heart to observe their contents. The organ may be removed first by tying the aorta and vessels in suitable places and removing them entire so that the blood content is left intact.

Both ventricles should be opened and the contents and condition noted.

The auricles follow suit, and then the vessels may be severed at their origin, and holding the heart up by the auricles the competence of the semilunar valves tested with water. The mitral and tricuspid valves tested also, and their openings measured, after which the valves should be examined for pathological changes. A complete examination of the aorta and the coronary arteries is necessary. The heart should be weighed, the thickness of muscle measured and its condition recorded.

If it be desirable to remove the heart without the aorta, the large vessels may be tied at their origin and cut through.

Following this the aorta, œsophagus, trachea, larynx and thyroid should be removed. To do this an incision should be extended up to the symphysis menti, if necessary the lower jaw severed, and the tongue brought down and cut from its attachments, the thyroid dissected away, the large vessels cut through at the root of the neck and all separated from the spine from above downwards. The œsophagus should be ligatured in two places above the diaphragm and cut between the ligatures; the vessels also. The structures can now be removed and each tube laid open and examined. The thoracic glands should be incised and examined.

The neck may have to be specially examined, on the surface for marks of violence, and the deeper structures for the results of violence or injury, *e.g.* ecchymoses, rupture of muscles, and laceration of the vessel coats, the pharynx gone carefully over, and the larynx dissected minutely.

Abdominal Cavity. After the general inspection of the abdomen, for peritonitis, fluid, etc., the spleen should be removed by cutting through its ligaments, it should not be torn out; weigh it and examine it by incision.

The liver held up will reveal the region of gall bladder, duodenum and pancreas. The appendix and pelvic cavity should be examined and then proceed to the removal of the stomach and intestines. To do this, ligature the stomach at the pyloric end twice and cut between, remove the stomach with its contents.

Ligature the small intestine at the ilio-cæcal valve and cut it through; remove it entire. The duodenum may be removed separately. The large intestine and rectum may be removed together. The kidneys are removed after section at the hilus, care being taken of the suprarenal capsules.

The liver should be removed with the gall bladder. If the urinary bladder be full, ligature it at the neck and remove it, or withdraw the water through a clean catheter into a clean vessel. In the female the uterus, tubes and ovaries should be removed with the vagina.

The pancreas is removed and the glands in front of the spine examined. The aorta, large vessels and nerves are to be examined, and removed if necessary.

The stomach contents having been emptied into a clean vessel the organ is laid open along the lesser curvature and carefully examined. These should be retained where necessary. The intestines should be laid open entirely and examined. The liver and kidneys, etc., are sectioned and a complete examination of the uterus, tubes, ovaries and vagina is necessary in the female, and the bladder with the ureters attached opened and examined. All organs should be weighed, and the whole or part retained for reference or analysis when necessary. The prostate in the male requires examination.

The testes and epididymis should not be forgotten.

The Extremities. In special cases the various structures may require careful dissection and examination and portions retained when necessary. Joints should be opened. The bone marrow is to be examined after longitudinal section of the bone, and in certain cases centres of ossification and the epiphyses must be described. Diseased or abnormal bones should be retained.

The Spine. This can be examined after the abdomen, thorax and tissues of the neck for injury or disease. It is desirable to remove a vertebra for analysis especially in metallic poisoning.

Special Examination. All wounds should be minutely described and if penetrating their direction and relation to the deep structures gauged and recorded. Where fractures of bones are present the parts should be retained. It is necessary to record the vital appearances of wounds.

In cases of suspected poisoning all the viscera

should be retained; the stomach and contents kept separate from the intestines. A portion of bone should be kept. Care must be taken in removal of the œsophagus, stomach, intestines, and bladder that no contents be lost. A sample of blood (from heart) should be kept. The organs should be placed into chemically clean glass jars and stoppered, sealed, labelled and dated; they must be kept under lock and key. Portions of clothing stained in any way should be kept.

In cases of *drowning* special attention should be paid to the hands and nails, the tongue, nostrils, mouth, contents of the trachea, bronchi, water in the stomach and intestines, the fluidity of the blood, the penis and dartos. In cases of suspected hanging, strangling, throttling or smothering, finger or ligature marks should be noted, and attention given to marks of violence elsewhere, the tissues beneath should be carefully examined; the serous membranes and lungs, and the condition of the heart noted.

Blood should be retained for examination where there is a history of burning or inhalation of gases.

In *suspected criminal abortion* special attention must be given to the size, condition and contents of the uterus, the presence of injury, the condition of the alimentary canal in reference to irritant drugs, the kidneys and bladder in reference to cantharides, and the condition of the surrounding pelvic structures.

Examination of New-born Children. In this examination the skull should be opened with scissors, or sawn horizontally right through, the brain being divided at the same time. In opening the abdomen the umbilicus must not be disturbed two incisions from the ensiform

cartilage to the anterior superior iliac spines should be made and the triangular flap turned down. Points for elicitation are the age and maturity of the child; the period of time since death; whether it died before, during or after parturition; and the cause of death. The condition of the skin and its appendages, the secretions of the skin, the pupillary membrane, the condition and position of the umbilicus, the contents of the stomach and intestines, the size and position of the testes in the male, centres of ossification, especially the lower end of the femur, the character of clothing, if any, on the body should be carefully noted. All the internal organs should be completely examined with special attention to the heart and the aeration of the lungs. All injuries should be described minutely, and apertures examined for foreign bodies, etc.

Exhumations. The medical man ordered to make the post-mortem examination of the body should be present at the exhumation, and the body should be identified by a responsible person. After recent interment the post-mortem examination may be done by the usual routine. Where decomposition has advanced, injured bones, the uterus in the female, or organs which putrefy late may provide valuable evidence. In cases of suspected poisoning all organs and some bone should be kept. A portion of the coffin and some of the surrounding earth should be obtained.

No antiseptics should be used during the examination of the dead body for medico-legal purposes and no fixative or preservative used when organs, etc., are retained for analysis. In certain cases special modifications of the above routine may be desirable according to their nature.

R. J. M. B.

VI.—MENTAL DISORDERS IN PRACTICE

THE ETIOLOGY OF INSANITY

THERE are individuals born of sound stocks that no acquired conditions, extrinsic or intrinsic, can render insane. There are others, in most cases derived from a neuropathic stock, whose mental equilibrium may be disturbed by any one of many such conditions, or without any apparent cause except the physiological processes appertaining to puberty and adolescence, reproduction and the menopause. Between these two extremes are all gradations of mentality.

Every case of insanity should be regarded as a biological problem, and the study resolves itself into the acquirement of a knowledge of what an individual is born with—Nature, and what has happened after birth—Nurture. The former can only be approximately ascertained by study of the ancestry, and analysis of the family history in direct and if possible collateral lines, whereby many important facts relating to the transmission of a neuropathic taint can be obtained. It must always be remembered that the neuropathic tendency may be variously manifested; there may be neuroses, *e. g.* chorea, epilepsy, migraine, hypochondriasis, neurasthenia, neuralgias, hysteria, or the taint may be temperamental and manifested by eccentricity, melancholy or undue optimism, or by an inborn lack of moral sense or feeble will-power. The neuropathic tendency may be revealed by a neurosis, crime, suicide or insanity. Again, we often find genius and the neuropathic taint in the same stock.

Such inherited tendencies may be partly restrained by proper nurture, but given an environment in which suggestion and imitation can play their part, *e. g.* temptation to drink, evil companionship and unemployment, the result will sooner or later be insanity, crime or suicide. A long study of pedigrees of the insane, together with an investigation of the relatives who are at present or who have been in the London county asylums, has convinced me that the hereditary predisposition is the most important factor in the production of insanity, imbecility, idiocy and epilepsy. At the present time there are between 800 and 1000 individuals so closely related as parents and offspring, brothers and sisters, in the London county asylums. These occur in 20,000 people brought together from the 4,522,961 population of London. The figures, to my mind, are strong confirmation of the importance of heredity as a cause of insanity. From these data certain

conclusions may be drawn which may be briefly summarized as follows.

Certain types of insanity may be transmitted with greater frequency than others. This has been termed similar heredity. The types are periodic (also termed recurrent or maniacal depressive) insanity, epilepsy and delusional insanity. The general rule is, however, for a different type to appear.

Mothers transmit insanity and epilepsy with greater frequency than do fathers; women are more liable to become insane or epileptic than men.

An analysis of the ages at the first attack of insanity in 500 parents and 500 offspring has revealed the signal occurrence of anticipation or antedating, whereby the offspring suffers at a much earlier period than the parent; more than one half of the insane offspring of insane parents are congenital idiots and imbeciles, or have their first attack in the period of adolescence. This adolescent insanity is especially frequent, and it is very liable to develop into an incurable form of dementia (*dementia præcox*) in a large number of cases; in others it is usually mania, melancholia or periodic insanity, and epilepsy with or without imbecility. Rarely does the parent become insane at an earlier age than the offspring.

The same tendency to antedating was found in nephews and nieces, though not so marked as in parents and offspring; but a double neuropathic inheritance—*e. g.* collateral taint on one side of the family and direct on the other made more offspring affected—shows the antedating more marked, and a more intensive form of insanity manifested. Consanguinity in neuropathic parents necessarily increases the liability in the offspring.

Since inherited neuropathic tendency is the most important factor in the production of true insanity, why is it that on an average not more than one in five of the offspring of insane parents become insane? It is possible that Nature by intensifying the disease as it were crystallizes out the unsound elements of the stock into one of the offspring who, becoming insane at an early period of life, is unable to survive and propagate his like.

It seems that Nature is always tending to end or mend degenerate stocks. If that be so, it is probable that as fast as Nature tends to eliminate degenerated strains, the neuropathic tendency may be revived in stocks undergoing such purification, or the first stages of degeneracy

may be developed in sound stocks by the cumulative effects of an unfavourable environment. Morel held that irritable nervous weakness—neurasthenia—may serve as the starting-point of degeneracy of a stock; according to him it is the source of origin of the neuropathic taint. If this be admitted, then this unstable nervous condition may be produced by combinations of such factors as alcoholic abuse, sexual excesses, the ungratified sexual instinct, the stress of town life, competitive examinations, religious fervour, emotional stock, the imposition of celibacy on large numbers of women and the unphysiological conditions of sexual life, whereby the maternal instinct is starved. Again, all forms of emotional stress, psychic as well as physical trauma, and the depressing after-effects of infectious diseases may result in neurasthenia and light up a latent and waning neuropathic taint in a previously sound individual. Can we assume that this irritable nervous weakness is originated in a sound stock and that neurasthenia may thus become the reservoir which continually supplies degeneracy in its many forms? According to this view the cumulative effect of these conditions in successive generations forms in a stock the prelude to neurosis, insanity and degeneracy generally.

A large proportion of cases of congenital amentia are due to brain disease; also a large proportion of the cases of dementia, *e. g.* general paralysis, syphilitic brain disease, tumours, cerebral softening, arise in consequence of acquired causes (*vide General Paralysis and Alcohol and Insanity*). We should not consider such as belonging to the true insanities. The recognition of this fact is very important from a Eugenic point of view, for, comparatively speaking, these mental diseases resulting from organic brain disease are non-inheritable, and therefore, although the subjects of organic amentia and dementia may have been certified as lunatics and even die in an asylum, yet their offspring do not therefore inherit a neuropathic tendency with anything like the degree of frequency that the offspring of subjects of neurosis and psychosis do, even though they may not have been certified insane. F. W. M.

GENERAL PARALYSIS OF THE INSANE

Synonyms: general paresis; dementia paralytica; (French) paralysie générale; (German) Allgemeine progressive Paralyse).

Definition. A disease characterized by progressive decay of the brain, progressive paresis and dementia, often associated with grandiose delusions, and terminating in death.

Historical. The credit for the discovery of general paralysis as a distinct disease is due to the efforts of French observers in the early part of the last century.

Clinical recognition of the disease was shortly followed by anatomical investigation of the brain, and much discussion ensued as to whether the changes found were due to an interstitial encephalitis, as Rokitsansky originally stated, or whether they were of parenchymatous origin; but with the advances in knowledge and the development of the neurone doctrine opinion has changed round to the view that the disease is a parenchymatous encephalitis and the vascular and glia changes are secondary to the nerve cell degeneration.

Etiology. Fournier was the first to put forward the doctrine that general paralysis and tabes were the result of syphilis, and that they might be regarded as one disease affecting different parts of the nervous system; and the failure of Krafft-Ebing to inoculate with the virus of a hard chancre a number of general paralytics with no history or sign of syphilis, led him to state that general paralysis was the product of syphilization and civilization.

Although numerous causes have been asserted to be the agencies capable of inducing general paralysis, and while I do not deny that alcoholism, sexual excesses, inherited neuropathic and psychopathic predisposition, worry and excessive mental strain, indeed all those causes which may lead to neurasthenia, are important exciting factors, yet I am convinced from my own experience that syphilis is the essential cause. This is now generally admitted by all our leading authorities.

Age and Sex Incidence. About eighty per cent. of the cases of general paralysis occur in the fourth or fifth decades. This may be accounted for by the fact that the majority of syphilitics are infected as a rule in adolescence or early manhood, and if ten to twenty years are allowed as the latent period it explains why tabes and general paralysis occur at the prime of life or soon after.

In two per cent. of cases the disease begins in early adolescence; such cases are termed juvenile general paralysis. I have seen over sixty cases; they are invariably congenital syphilitics; both sexes are affected in equal numbers. In the cases which I collected of tabes and general paralysis the proportion of males to females was about the same, viz. three or four males to one female. Blaschko found that in a population the number of men affected with syphilis was in the ratio of four males to one female, and this corresponded to the ratio of male paralytics to female paralytics for the same population.

Symptomatology. The clinical history of general paralysis varies considerably. There are many types, but there are a few phenomena which are seldom if ever absent:—(1) Progressive dementia affecting the mind in its

totality, usually accompanied by elation, motor activity and grandiose delusions, sometimes by depression; (2) unequal, generally irregular pupils, responding sluggishly or not at all to light, but reacting to accommodation (Argyll-Robertson pupil); (3) progressive paresis with tremor, especially affecting the tongue and face muscles; (4) hesitant, tremulous, slurred speech with elision of syllables and similar affection of handwriting; (5) altered knee-jerks, generally exaggerated; sometimes absent on one side, or on both sides without Babinski's sign or ankle clonus. Although grandiose delusions are very common, yet some cases are associated with marked mental depression and hypochondriasis, while others are characterized simply by a paretic dementia.

When the above symptoms are present the diagnosis is easy, but in the earliest prodromal stage, sometimes termed "the medico-legal," there may be considerable difficulty in forming an opinion. In all cases of doubt the blood and cerebro-spinal fluid should be examined.

The symptoms of the *prodromal period* may be considered under two headings; psychic and somatic.

Psychic Symptoms. There is usually a modification of conduct and character, with irritability and hypochondriasis, lassitude and apprehension; there is some loss of memory and evidence of slight intellectual failure. There is a gradual deterioration in the auto-critical faculty. Periods of depression may be followed by excessive mental activity, the patient is full of new ideas and projects and may launch into speculation of the wildest kind. At this period abuse of alcohol is very frequent and there is often a hyperæsthesia sexualis. Acts of misdemeanour, indecency and drunkenness may consequently be perpetrated by a person who has hitherto led a blameless life. It is precisely in this early stage that a correct diagnosis is most important. A careful examination will often detect some dementia and somatic signs, and intimate friends and relatives may be able to give information which will enable the diagnosis to be made. The examination of the blood and cerebro-spinal fluid will also be of the greatest possible value.

Somatic Disturbances. Apoplectiform, epileptiform or congestive seizures may be the first signals of the onset of general paralysis. Sometimes the attacks are slight, like fainting attacks or attacks of giddiness. At other times they are more severe and apoplectiform in their suddenness. These may be followed by a hemiplegia which is usually transitory. Right-sided hemiplegia is frequently associated with a transitory aphasia or paraphasia. Occasionally the patient may become aphasic without any loss of consciousness. This also is usually transitory. Epilepti-

form attacks may resemble those of true epilepsy or may be of the Jacksonian type. Migrainous attacks with supraorbital headache and vomiting may be associated with transitory hemianopia, aphasia or paresis of the limbs. Again, transitory ptosis, strabismus and diplopia may occur. Neuralgia, a tight feeling of constriction round the head and insomnia may be complained of. In many respects the patient resembles a neurasthenic and hence the importance of recognizing this neurasthenic form of the prodromal stage of general paralysis.

First Stage of the Pronounced Disease. In some cases the disease may first declare itself by a seizure; more frequently the first stage is heralded by a gradual development of the somatic and psychic symptoms of ataxic paresis and progressive dementia.

Somatic Symptoms. The physiognomy may at the onset lead to a correct diagnosis. Sometimes the face shows an imbecile atonic expression associated with elation or beatitude, or there may be a stupid drowsy expression with tendency to drooping of the eyelids. Sometimes there is a wild, excited and exalted expression. There may be spasmodic tremors and fibrillary contraction of the facial muscles. The pupils are usually unequal in size and present the Argyll-Robertson phenomenon. This is found in about fifty-eight per cent. of the cases. The tongue, when protruded, is usually markedly tremulous and there is often tremor of the hands.

The speech is hesitant and tremulous; there is elision of syllables and articulation is blurred. There is fine tremor in the writing and an ataxic paresis in the fine movements of the pen. In the first stage the motor troubles of the limbs in gait and station and for habitual manual operations are usually only slight or they may be entirely absent. The muscles at first are not wasted, but the knee-jerks are usually exaggerated on both sides. Ankle clonus and the Babinski sign are very rarely present. As the disease progresses the movements become more enfeebled and the gait becomes shuffling, shambling and tottering. Seizures are liable to occur more often than in the prodromal period; they may be of the congestive, apoplectiform or epileptiform type, and one fit may follow the other so rapidly that the condition is one of status epilepticus.

Psychic Symptoms. The mental symptoms of general paralysis occur early in relation to other signs of disease. The most constant symptom is a slow and progressive dementia. The patient gradually loses the faculty of criticizing his own acts, behaviour and conduct. Moreover, besides this loss of auto-criticism, he is unaware of the profound change which has taken place in his own personality and of his intellectual decadence, even when confronted

with the most obvious proof. There is progressive loss of judgment and of control, as well as of orientation in time and space. The mind enters into a state of disordered and unconscious automatism. This psychic automatism occasionally exists combined with a dementia which renders the paralytic incapable of deliberation, judgment and highest control.

Delusions. The delusions of general paralytics usually derive colour from current events, consequently aeroplanes, flying ships, wireless telegraphy, Dreadnoughts, etc., would at the present day afford subjects for their fantastic fabrication. This grandiose delirium has always been recognized as a special feature of the disease, but there is always a small percentage of cases in which there is marked depression and delusions of persecution. Delirium, with either exaltation or depression, may persist through the whole course of the disease; the one state may alternate with the other or the one may permanently depose the other. Sooner or later the patient, if he has not succumbed to some complication or intercurrent disease, passes into the second and terminal stages which are characterized by progressive mental and physical deterioration.

Diagnosis. There occur at times functional and organic diseases of the nervous system, *e. g.* Korsakoff's syndrome, neurasthenia, hysteria, hystero-epilepsy, arterio-sclerosis, disseminated sclerosis, cerebral tumour and syphilis of the nervous system in which the symptoms may simulate those of the early stages of general paralysis. A true diagnosis can only be obtained by careful clinical investigation, and by the examination of the blood and cerebro-spinal fluid by the Wassermann test. The cerebro-spinal fluid should also be examined for a lymphocytosis. In general paralysis the Wassermann test gives a positive result with the blood serum in practically every case, and is positive with the cerebro-spinal fluid in ninety to ninety-seven per cent. of the cases. There is almost always a marked excess of lymphocytes in this fluid, which can be discovered by microscopic examination.

Course, Prognosis and Treatment. The disease usually begins insidiously and progresses continuously; the course may be protracted, but epileptic or congestive seizures usually cause the disease to become rapidly progressive. Remissions may occur, in some cases these may be so marked as to cause doubts as to the correctness of the initial diagnosis. The patients may be discharged, but their return to social life, with the excitement entailed thereby, usually soon causes a retrogression to their former state. Some patients die within a few months after the onset of symptoms, from the exhaustion of mania, or some complication, *e. g.* pneumonia or

tuberculosis. The average time is about two years in men and three years in women; but those who have not had seizures may live many years. Death occurs from inanition, bed-sores, cystitis and pyelo-nephritis, pneumonia, tuberculosis and institutional dysentery. Death may also occur in consequence of subdural hæmorrhage or in the status epilepticus. The prognosis is that the disease is certainly fatal.

The *treatment* of true general paralysis is most unsatisfactory. I have very seldom seen anti-syphilitic treatment followed by any good results, though it may be tried in the early stages, and apparently with some benefit; especially should a trial be given in cases which have never been properly treated. It is doubtful whether Salvarsan possesses any advantages over mercury, and it is not altogether free from danger. The only thing to be done in the majority of cases is to place the patient under suitable care, either in an asylum, in a home for single care, or with attendants in his own home. The method to be adopted will depend on the pecuniary position of the patient, the wishes of his friends, and the symptoms manifested by the disease; for example, a case with delusions, marked motor restlessness and seizures will necessitate asylum supervision more than a case of paralysis associated with a progressive dementia.

The mechanical restraint of a padded room is infinitely better than the continuous use of narcotic drugs. Care must be taken to avoid accidents and complications; attention must be paid to the bladder, and if necessary a sterile catheter must be passed. Benefit has been found in the use of urotropin in general paralysis. It is known that this drug passes into the cerebro-spinal fluid, and the improved condition that follows its use has been ascribed to this; but it is probable that by preventing secondary infection of the urinary system it delays or arrests secondary septic infection of the blood.

All solid food should be well minced or mashed so as to guard against the possibility of a large piece of unmasticated meat becoming lodged in the back of the pharynx, interfering thus with respiration and causing sudden death by suffocation. The bowels should be regulated, for regular efficient purgation will materially aid in reducing the number and severity of congestive and epileptiform seizures. Restlessness and sleeplessness may require drugs in the acute stage, but their continuance is to be deprecated. Sulphonal, trional and paraldehyde are useful drugs in modifying the acute and maniacal excitement of the first stage, but they should be discontinued as soon as possible. Under certain circumstances hyoscine may be given hypodermically when other measures are unavailing.

Paralytics require most care when they are

bedridden, and when they are suffering from seizures. No attempt should be made to feed patients by the mouth when they are unconscious, lest fluid get into the bronchial tubes and cause broncho-pneumonia. In epileptiform seizures it is advisable first to clear the lower bowel of scybalous masses by enema and then to allow a certain amount of water to be absorbed by the rectum to replace the loss of fluid caused by perspiration and the pyrexia which is usually present in the attacks. The intensity of the fits may also be lessened by the rectal administration of chloral hydrate and bromide. If there be signs of heart failure cardiac stimulants will be indicated. The greatest care must be taken to prevent bed-sores, to which these patients are very liable.

Morbid Anatomy and Pathology. The following are the chief features found post-mortem in a patient dying from the exhaustion of general paralysis. The body is emaciated, and there is wasting of all the viscera. The lungs usually show evidence of broncho-pneumonia, gangrene or tuberculosis. There is usually atheroma or nodular fibrosis of the aorta. The signs of antecedent syphilitic infection are usually slight and often absent. The ribs are brittle. The diploe of the calvaria is denser than natural. A thin laminated membrane of recent or somewhat old deposition, caused by extravasation of blood, may be found beneath the dura mater (pachymeningitis hæmorrhagica). This is rarer than is usually supposed. The pia-arachnoid is oedematous and opaque, especially over the fronto-central convolutions, and its vascularity is increased. The process of stripping off this membrane causes erosions of the cortex, especially if rigor mortis has occurred. There is excess of cerebro-spinal fluid. There is usually marked wasting of the cerebral hemispheres, especially of the fronto-central convolutions, out of all proportion to the wasting of the pons and cerebellum. The grey matter of the cortex is diminished in thickness, its vascularity is increased, and the normal striation is hardly perceptible. The white matter is softer than usual, and the ependyma of the lateral ventricles and of the whole of the floor of the fourth ventricle commonly shows fine granulations on the surface.

Microscopic Examination. The following are the most characteristic features—

1. Increased vascularity of the cortical grey matter.
2. Marked cell infiltration of the perivascular lymphatics with lymphocytes and plasma cells.
3. The presence of rod cells (Stäbchenzellen) described by Alzheimer.
4. Increase of neuroglia cells and marked sub-pial felting of the neuroglia fibres.
5. Disintegrative changes of the cells of the

cortex, varying from distortion to complete disintegration; similar changes may also be seen in those of the basal ganglia, medulla and spinal cord.

6. There is atrophy of the fibres affecting quite early and especially the tangential, supraradial and intraradial fibres.

F. W. M.

INSANITY AND ORGANIC DISEASE OF THE NERVOUS SYSTEM (ORGANIC INSANITY)

Under this heading are included those forms of mental disorder, excluding idiocy and imbecility, which result from lesions of the brain sufficiently gross to be detected upon the post-mortem table.

Syphilis.—Foremost among these should be considered *general paralysis*, a metasyphilitic disease of the cerebral cortex and the pia-arachnoid covering it. This is described in a separate article, but it is important to recognize that there is also a chronic syphilitic variety of *meningo-encephalitis* which may be indistinguishable from general paralysis by ordinary clinical examination. Mott, however, lays stress on the persistence of the autocritical faculty in syphilitic meningo-encephalitis and its absence in general paralysis. Both conditions lead to an incurable form of dementia, but they differ in that syphilitic meningo-encephalitis does not necessarily lead to an early death as does general paralysis. The diagnosis depends upon the presence of a positive Wassermann reaction and lymphocytosis in the cerebro-spinal fluid of general paralysis and their relative absence in that of syphilitic meningo-encephalitis.

Gummata may give rise to mental disorder similar to and indistinguishable from that caused by other tumours in similar situations.

Lastly, *syphilitic endarteritis* may lead to insanity identical with that caused by other forms of degeneration of the cerebral arteries. These will be discussed later, but a differential diagnosis can be made by paying due attention to the age of the patient and to the presence or absence of a history of past syphilis.

Cerebral Tumours and Abscesses.—These give rise to three classes of symptoms—

1. Those due to increase of the intracranial pressure, viz.: headache, vomiting, optic neuritis, convulsions and stupor gradually deepening to coma.

2. Those due to intoxication of the nervous system by products of its own disintegration, viz.: anæsthesia of the hands, forearms and legs, general imperception or agnosia with disorientation in time and place, hallucinations (especially of vision), confusion of ideas with incoherence of speech, loss of will-power, apraxia and failure of memory, or, in a few cases,

paramnesia or the remembrance of events which have never occurred.

3. Localising symptoms due to destruction of some portion of the brain; *e. g.* "witselsucht" or "moria" (inability to regard matters seriously and a tendency to joke about them) and apraxia in lesions of the frontal lobes, visual imperception or agnosia in lesions of the angular gyri, and inability to understand spoken language in lesions of the temporo-sphenoidal convolutions.

Tumours of the corpus callosum are invariably associated with such profound mental symptoms as suggest a condition of advanced dementia. Speaking generally, tumours of the anterior half of the cerebrum more frequently give rise to certifiable mental disorder than tumours of the posterior half. The possibility of multiple tumours or abscesses must not be forgotten in cases of this kind when the disturbance of mentation is disproportionately great in comparison with the intensity of the intracranial pressure.

Disseminated Sclerosis.—Although multiple tumours give rise to pronounced mental symptoms in sixty per cent. of such cases, it is remarkable that disseminated sclerosis is very rarely found in asylums. I have such a case under my care at the present moment suffering from depression with suicidal tendency. Usually the chief mental symptom is excessive emotional reaction with liability to laugh or cry without sufficient reason.

Chronic Cortical Atrophy occurs either idiosyncratically as part of the process of senile decay or from malnutrition as a result of degeneration of the cerebral arteries (endarteritis, fibrosis from renal disease, etc.). The mental symptoms are the same in both conditions, but differential diagnosis can usually be made from such general considerations as the patient's age, the history of past syphilis and the condition of the urine.

The chief mental symptom in these patients is disorder of perception, especially inability to form an idea of particular movements (apraxia). There is agnosia or inability to recognize objects or pictures of them or to apprehend the nature of familiar sounds or to identify odours. Apraxia may be consequent on this imperception (agnostic apraxia) or primary (motor apraxia). Perseveration or ideational inertia occurs characteristically in this disease; the patient being capable of identifying the first object shown to him but giving subsequent objects the same name, or of indicating the use of the first object (*e. g.* a knife) but using subsequent objects in the same way (*e. g.* using a pencil or matchbox as if it were a knife).

The disease is progressive, and no amelioration can be expected. Even syphilitic cases fail to respond to antisiphilitic remedies, although

these may sometimes prevent further progress of the disorder.

Cerebral Thrombosis is a condition in which mental symptoms sometimes develop. There may, of course, be at first a certain amount of mental confusion which rapidly disappears, and there may be symptoms of chronic cortical atrophy due to the same arterial disease as caused the thrombosis; but in a few cases one meets with a variety of mental depression scarcely distinguishable from ordinary melancholia. According to my experience the prognosis in such cases is unfavourable.

Traumatism.—Injury to the head gives rise in the first instance to symptoms of cerebral concussion, but there is no form of insanity characteristic of traumatism, except perhaps "traumatic hysteria" (including so-called traumatic neurasthenia). Traumatism may prove the exciting cause of an attack of mania or melancholia in maniacal-depressive insanity or it may be a contributory factor of dementia præcox or general paralysis. Focal symptoms naturally arise in cases of localised injury to the cerebrum. Patients who have once had cerebral concussion are afterwards, as a rule, unusually susceptible to the influence of alcohol.

Huntington's Chorea is a rare disease somewhat resembling Sydenham's chorea; but the movements are slower, there is progressive dementia and the disease is incurable. It tends to occur in several members of the same family, and the lesions of the brain present a remarkable resemblance to those of general paralysis.

Details of the several conditions here mentioned are described under their respective headings, together with details of treatment suited to particular cases. W. H. B. S.

INSANITY AND BODILY DISEASE

There is a common popular idea that mental disease is a thing unique in nature and essentially unconnected with bodily disease. The whole trend of modern investigation into the etiology and pathology of insanity is against this view. The strongest stimulus towards the investigations into the nature of mental diseases during the last hundred years has been the realization that it is itself necessarily and without exception a disease of the brain. An enormous step in its study and treatment was made by Griesinger when, in the fifties, he established wards in the Charité Hospital at Berlin for the treatment of nervous diseases—the term including mental disease, and the patients suffering from meningitis and other neuroses not being separated from the insane. This was afterwards found to be practically inconvenient, but the idea on which it was founded was a distinct step in advance. The

old method of regarding and studying insanity as a disorder of the spirit has been long given up, its place being taken by the modern methods of experimental physiological psychology, which has its basis on the theory that all mind is necessarily exhibited and conditioned, in this world at least, through brain. While modern psychiatry is founded on the assumption that the immediate symptoms of mental disease must necessarily result from disorder of the brain cortex, it pursues its inquiries into the diseases of the whole organism, of every kind, and their possible effects on the mental functions of the brain. In the present article I shall confine my attention chiefly to bodily diseases outside of the brain which have a pathological relationship to attacks of insanity.

Looking to the general bodily condition of patients who suffer from attacks of insanity, I find that, out of fifteen thousand cases that have been under my care, only ten per cent. were put down by me as "in good bodily health." Looking further into the actual bodily diseases diagnosed to be present in those cases, I find an enormous list of physical ailments of most various kinds. Many of those might fairly be put down as direct causes of the insanity, while many had only a secondary, predisposing or accentuating relationship to the psychoses present. They acted on the condition of the brain cortex in various ways, and this is not surprising when we consider that the brain is the true centre of the whole organism, and that its mental function is by far the highest, and is indeed the ultimate aim of all evolution in biology. We must also keep in mind the mutual relationships of the brain cortex to every other organ and function in the body. They are all represented locally in the cortex, disturbance of any one of them affects its working, while, on the other hand, most cortical disturbances have an effect on their nutrition and action. In some cases toxins and irritants are created in the peripheral organs which, carried to the brain cortex by the blood, affect its work. In other cases reflex irritations of an injurious kind are exercised by those organs. In yet others the general malnutrition and poverty of blood caused by bodily diseases affect the mental working of the brain cortex secondarily.

Diseases of the heart and lungs, singly or combined, are responsible for a considerable number of cases of insanity, taking the forms of delirium, confusion, hallucinations of sight and suicidal impulse. Pulmonary tuberculosis, in about two per cent of the cases of mental diseases sent to asylums, is their chief cause, which manifests itself in melancholia, morbid suspicions, asocial manifestations and dementia. I called this form "Phthisical Insanity."

Bright's disease is sometimes accompanied by attacks of mania. The continued fevers are sometimes followed by attacks of insanity, commonly of a melancholic type, scarlatina being the most frequent cause. Diabetes has a special form of mental disease of a melancholic type. Myxœdema is always accompanied by mental symptoms, sometimes assuming the degree of technical insanity, accompanied by confusion, excitement, delusions and hallucinations of hearing. Exophthalmic goitre commonly produces mild mental changes in the patient's condition, sometimes aggravated into attacks of mania. Mental attacks resulting from this and myxœdema are cured in the one case by use of thyroid, and in the other by suitable treatment for the disease. Various blood diseases, especially pernicious anæmia, tend towards attacks of melancholia. Influenza has been probably the most potent destroyer of nerve and mental energy of any disease during the last twenty years. Influenzic insanity is melancholic in type in by far the larger number of cases. Alcohol is the most frequent single cause of mental disease, and in a large number of cases we have the motor and sensory symptoms of alcoholism along with the mental symptoms. Curiously enough, Dr. Mott has found, from a large experience, that in the cases where alcoholism is accompanied by mental symptoms it has not attacked the liver or kidneys, and *vice versa*. The pain from long continued neuralgia, in some neurotic subjects, sets up attacks of insanity, and when this happens the neuralgia usually disappears. The syphilitic poison is responsible for two per cent. of all the cases of insanity, not taking into account general paralysis. Of all the bodily diseases directly connected with insanity, epilepsy is the most frequent and the gravest. In its nature it is most allied to mental disease, because they are both diseases of the brain cortex. In many cases the two conditions depend so much on a common etiology, namely a defect in brain development, that it cannot be said that epilepsy is the cause; in reality, in such cases, it is a necessary accompaniment of the disease. Epileptic mental disease takes two forms, the one, weakness of mind, epileptic dementia; the other, a violently maniacal state with homicidal tendencies, vivid hallucinations and acute maniacal excitement. Far more than half of all epileptics are associated with mental disease. Treatment of the mental disease in those cases is the treatment of epilepsy. To go into the relationship of mental disease with the innumerable forms of neuroses now described by the modern neurologist, would not be in accordance with the scope of this article, but it may be said, generally, that a very large number of them may be complicated

with mental symptoms, if there is a strong neurotic hereditary tendency in the patient. In fact, one can say that in the case of any person with an inherited tendency towards mental disease, any bodily disorder whatsoever may act more or less strongly as the determining factor in an attack of insanity. T. S. C.

WEAK-MINDEDNESS, IDIOCY, IMBECILITY, FEEBLE-MINDEDNESS

(Congenital and from Early Life)

Description. There are probably about 150,000 weak-minded persons, apart from those certified to be insane, in England and Wales. In the ordinary and popular sense weak-mindedness is a very wide and comprehensive term. It connotes a deficiency in the observing and reasoning powers which is evinced in the appearance and manner of those affected, and it denotes all persons who are mentally infirm. It thus includes within its category those of the insane who, through mental infirmity arising from age or from the decay of their faculties, are incapable of managing themselves or their affairs; and it also includes others who, by arrested development or by disease dating from birth or from an early age, have their mental faculties so weakened that they fall short of the ordinary standard of normal self-control. The certified insane are controlled by the provisions of the Lunacy Acts, 1890 and 1891, the certified weak-minded by the Idiots Act, 1886.

In insanity the characteristic mental symptom is a *perversion* of the normal standard; in weak-mindedness the chief feature is an *arrest* or a defect; and in this article the term weak-mindedness will be used in the latter sense, and will apply only to those who are thus defective. The conditions usually described under the term weak-mindedness are recognized to occupy a position different from those covered by insanity, yet the transition is so gradual from the normal person to the lowest depths of arrest, that it is often difficult to detect the slighter forms of weak-mindedness, these defects not being always recognizable in early life. There is really only one defect, but there are several grades, viz. the idiot, the imbecile, the feeble-minded, the epileptic with weakened mental powers, those deprived of sight and hearing but also weak-minded, and there are also the morally defective; of these grades there are many types.

As the definition of insanity in regard to any individual just turns upon the question of *conduct*, so the definition of weak-mindedness turns upon the question of *self-preservation*. It measures the child by its ability and capacity to care for itself, and this measure is applied to the common affairs of life. The one criterion of mental arrest suggested by the Royal Commission on

the Care and Control of the Feeble-minded is the competitive one, viz. the test whether a child has the power to earn its livelihood under favourable conditions. But this test ignores the difficulty there is in its early recognition, as it is impossible to predict if a child will ever earn its living, and it also overlooks the impossibility of applying such a criterion to all grades of social levels. Therefore some other test has to be considered, and probably the best is the one of the capacity or power a child may have to care for itself, *i.e.* in the sense of avoiding the common dangers of life.

Definition. Using the term weak-mindedness to include all cases of arrested development, it is necessary to differentiate between some of its grades, and the "idiot" is considered to be of the most profound mental defect, so deeply defective that he or she—from birth, or from an early age—is unable to guard against any ordinary danger, unable to acquire the simplest accomplishment, unable to wash or dress, to feed, speak, or respect the amenities usually observed—even by children. Often the idiot is unable to walk, or only with a shambling, shuffling gait, and it remains permanently in the condition of the very young who cannot safely be left alone. The "imbecile" implies a milder mental defect, and is described as the equivalent of a person who is capable of guarding himself against common dangers, but is incapable of earning a living owing to mental arrest which exists from birth or from an early age. The next class, that of the "feeble-minded"—a subdivision of the genus "weak-minded"—implies a yet slighter grade of mental defect, also existing from birth or from an early age; and under favourable circumstances members of this class may be able to earn their living, but not on equal terms with normal persons, and they are unable to manage themselves or their affairs with ordinary prudence unless with the help of disinterested persons. The prodigal who is a spendthrift and a "ne'er-do-weel" would be included in this class, as the "facile" (his northern equivalent) is under Scottish law. Another class of the weak-minded is the person described as the "moral imbecile," who from an early age exhibits some slight mental defect which is associated with decidedly vicious or criminal tendencies, and against which punishment seems to be of little or no avail. It certainly has no deterrent effect, for persons suffering from this form of weak-mindedness are incorrigible, and their vicious tendencies may take the direction of cruelty, lust, theft or untruthfulness. They will lie, pinch other children, throw the cat on the fire, hide and steal things, such as jewellery, private letters, and other objects they may have no use for. In many cases such children are bright,

their memory is excellent, they are quick in mental reaction, responsive and often plausible. They have good "shop windows" and they are frequently cunning, yet their *general* mental attainments are below the average, and mostly they exhibit some slight limitation of intellect; they are certainly—many of them—unimprovable, the majority of them being incapable of benefit by ordinary methods of education and needing the specialized methods of teaching suited for the defective. As they grow older their deficient will-power often causes them to yield to the gratification of the passions, they become immoral and may haunt public places, they may drink and become the chronic inebriates, and they may—and often do—swell the lists of the recidivists in the criminal courts. The weak-minded persons who yield to habits of intoxication and intemperance without doubt help to form the inebriate class, members of which appear and reappear in the police courts. A further special class of the weak-minded is the epileptic, the child whose early life is complicated with fits, either the *grand mal* with convulsions, or the *petit mal* with loss—temporary—of consciousness only. It is not the degree or the severity of the fit which is especially destructive of mental powers, but the repetition and frequency, so that frequent *petit mal* is more injurious to the developing mind than the *grand mal* with tonic and clonic spasms. Epilepsy will cause idiocy in infancy, imbecility in more advanced youth, and dementia in later life. Further, there are varieties of weak-mindedness associated with blindness or deafness, the weak-mindedness in such cases being more than the degree which the mere absence or the deprivation of a special sense would itself alone account for. Lastly there are other conditions of weak-mindedness associated with injuries, specific fevers, special poisons or cranial deformities which will be referred to when considering the types.

Sex. There are more males than females who are weak-minded, and in institutions the proportion is usually about two to one. Possibly this may be partly accounted for by the fact that afflicted girls are less difficult to manage and therefore longer tolerated in the home, also by the hope that a boy submitted to early special training may so far improve as to be of help to himself in later years, and he is therefore sent away. It is not because the head of the male child is larger than that of the female and is thus more liable to danger at birth, for statistics do not bear this out.

Etiology. It is the fashion to cultivate a spirit of doubt as to attributing the causation of mental weakness to any single factor, and it is possible that so complex a condition must be brought about by several converging

influences. One in particular has been the influence of parental intemperance, but it is doubted by some if drink in the parents can ever be the cause of arrested mental and physical development in the offspring, for the germ-plasm is "continuous" and is stated to be unaffected by the body-plasm; but general experience supports the opinion that any factor which is capable of lowering the vitality of the parent may also prove detrimental to the offspring. In any case no one can doubt that habitual drinking in the parents leads to neglect and ill-usage of the children, who in consequence suffer severely both in health and development. Of all cases of weak-mindedness probably about seventy per cent. are so from or before birth, and it is convenient to discuss etiology from the birth standpoint as therefore pre- or post-natal; although there is no doubt that a small percentage of cases occurs at the actual time of birth. If the period of birth were especially dangerous, then the first-born male would be more likely to suffer, but first-born males who are weak-minded exist in the proportion of twenty-three to twenty-five females, and the proportion of first-born males was only twenty-three per cent. of the total—which negatives this as a factor in causation, as the average family is four. Pre-natal causes resolve themselves into hereditary defects, which most commonly are insanity, or epilepsy, ill-health, intemperance, and phthisis or syphilis in the parents. The latter is probably responsible for the cases of juvenile general paralysis, but stigmata of secondary syphilis are rare among weak-minded children, and it may be interesting to know that rarely among imbecile children is the Wassermann reaction positive, although in cases of general paralysis this is so (one might almost say) without exception. Hereditary predisposition is found upon careful examination in the histories of twenty per cent. of all cases. Consanguinity of parents, when there is an hereditary predisposition, is a strong converging influence, and has been noticed in about six per cent. of cases. Phthisis or a phthisical tendency in the parents is recorded in about twenty per cent., and old age in one or other parent, or in both, is found to be the only antecedents in the Kalmuck or Mongoloid type. Tedious births, the child being born almost asphyxiated, has been recorded in about five per cent. of cases; especially is this the case in the antecedents of those with organic injury, in which brain laceration or hæmorrhage has left a permanent lesion, such as hemiplegia or athetoid movements. Mental shock to the mother or an accident during gestation is recorded in a not inconsiderable number, and must be presumed to have a detrimental effect upon the child through maternal influences.

The post-natal conditions are, firstly, epilepsy after birth, which is known to be associated with weak-mindedness in about a fourth of all cases. Indeed, epilepsy is so common among the weak-minded class, that when absent as a cause it may be almost looked upon as its natural termination. Among other post-natal factors are those occurring during the developmental period, such as scarlet fever, measles, whooping-cough and other febrile illnesses; poor and improper food; falls, injuries and accidents; or, among the better classes, a bad wet nurse, these are all causes which operate against the healthy mental and physical development of the offspring.

Varieties. There are many kinds of the grades of weak-mindedness, and it is important to identify these, as help in prognosis and treatment is thus afforded.

1. The so-called Mongolian type, with features said to resemble the Kalmuck race. That there is this type is known to all observers. The members of it are of short stature, they have gruff voices, small round heads, flattish noses, rough skins, short thin hair, straight eyebrows, fissured tongues, square hands, short thick fingers and loose joints. The circulation is feeble and they are chilly beings, very liable to tuberculosis and therefore short-lived. Mentally they are very happy, placid little persons, fond of music, very imitative, but incapable of improvement beyond routine acquirements.

2. Cretinoid, or myxoedematous or of the sporadic cretin type. Short, stumpy little people, hair dark, thin, coarse and dry; thick lips, tongue protruding, eyes puffy-looking, cheeks flabby. They have, as a rule, no thyroid glands, only "fatty" lumps above the clavicles on each side, the abdomen is tumid, they are noted for slow movements, with a lethargic and clumsy gait. They are observant and smiling, with a merry twinkle in the eye when pleased. The features are quite characteristic in these two types, and so long as the patient takes thyroid extract, improvement continues in the cretinoid variety, but no recovery occurs.

3. The Microcephalic type, with a receding small forehead and head of sixteen or seventeen inches in circumference. The brain may weigh as little as eight ounces. These have been likened to the Aztec race. They are not unintelligent—indeed much more so than their appearance suggests. They require much attention and they usually succumb to epilepsy. They are very subject to chilled extremities, even in the warmest months, when temporarily underclothed or if not well covered at night.

4. The Hydrocephalic cases with large heads—round in contrast to the square shape of hypertrophic idiocy. The brain may weigh sixty-eight ounces; skulls are often widest from side to side. Such children have limited utility, but can be

taught moderate acquirements, best in the open air and in farm or garden work.

5. The Epileptic type. These constitute a fourth of all cases of weak-mindedness. There are about 40,000 sane epileptics in England and Wales and 20,000 insane who are certified and in institutions. Usually there is one epileptic to about 1500 of the population, although in some localities there are as many as two to every thousand. Some of these children recover after prolonged bromide treatment, but most of them deteriorate mentally. They may fall suddenly in fits and often sustain severe injuries, and therefore they require constant guarding. They are listless and dull, with occasional periods of excitement which is impulsive and uncontrollable. Often they are affectionate but suspicious; imagining harm when none is meant. As a class they are very touchy and resent reference to their "fits," especially when these seizures are likely to interfere with any prospective pleasure. They are also as a class unimprovable. A diet free from meat makes no difference to the fits. Frequent laxative medicine is indicated, and it is very important that their sight should be examined, and errors in refraction corrected, also their teeth must be kept clean.

6. The Choreic type. Some weak-minded children are subject to athetoid movements, to chorea or various kinds of tremor. Their spasms are more alarming than dangerous. Such cases date from or about the time of birth. They are capable of much improvement by useful training, and of all the weak-minded they are usually the most sensible. They may have paralysis of one or other side, or it may be of one limb.

7. The Paralytic type. These are allied to the previous class, in which they might be included. They are characterized by motor lesions and consequent deformities following upon poliomyelitis, porencephaly or cerebral lesions resulting in hemiplegia, and such cases are also liable to fits.

8. Simple Imbecility. Cases in which as a rule there are no marked bodily abnormalities although the body is heavy, lethargic and dull, and their facial expression partakes of these characters also. The eyes look but do not see, the ears listen but hear not. There is retarded mental reaction as well as physical, and often their saliva dribbles. It is difficult to enlist or fix their attention and there is a difficulty in remembering what is said or taught to them. Sometimes, and paradoxically, the brighter the child in appearance and looks the greater is the mental backwardness and the less is the prospect of improvement under training. They often suffer from chilblains, and they tend to suffer from sluggish digestion, partly because they do not masticate properly.

9. Accidental or Traumatic type—following injuries, such as a fall or a blow on the head.

The symptoms depend on the nature of the brain lesion and the age period when the injuries were received. There is the usual difficulty in fixing the attention and in remembering what is said to them, but some improve markedly under training, in spite of the occurrence of epilepsy.

10. Syphilitic type. Two types are recognized in this class:—(a) Cases with congenital syphilitic symptoms, keratitis, cataract, scars around the angles of the lips, deafness, notched teeth, prominent forehead and a flat nose; and (b) juvenile general paralysis—symptoms appearing about the age of twelve to fourteen, when they begin to feel the stress of the lesions. The Argyll-Robertson pupil, lymphocytosis of cerebrospinal fluid, the Wassermann reaction and congestive seizures are pathognomonic.

11. Inflammatory type. Following specific fevers, such as typhoid, influenza, measles, scarlet fever, or whooping-cough. The symptoms depend upon the amount of nervous damage. As a rule such children benefit greatly by special educational treatment.

12. Weak-mindedness, Imbecility or Idiocy by deprivation of sense. General obtuseness, lack of expression, vegetative animal life. If there is no weak-mindedness then there is—as in the cases of Kasper Hauser, Meystre and Laura Bridgman—great capacity for education.

Other varieties are the hypertrophic and that described as progeria, where adult physical conditions are found in the young.

Diagnosis. In early life and even in infancy the diagnosis of the slighter forms of weak-mindedness is extremely difficult, but as development proceeds the recognition becomes easier, and the deeper grades are less difficult to discover. The general aspect of a backward child gives some clue to the amount of mental deficiency. There is not the same readiness to raise the head and the power to grasp the finger is impaired. There is less spontaneity in the movements, although in some cases of convulsions and eclampsia there may be an undue response before the fits. Sometimes the child seems to become stiff and to curl itself up suddenly, with an intensity unusual in the healthy who possess more complete muscular control. There may, on the other hand, be a general flaccidity or want of tone, the child drops things, and cannot pick up fine objects like a pin, a marble or a coloured plaything. The manner in which the child takes its nourishment and swallows it may rouse suspicion. The form and size of the head, which may be large and round, as in hydrocephalus, or square, as in hypertrophic idiocy, yields a clue; and also its symmetry and the closure of the fontanelles, the shape of the palate in conjunction with other physical signs, such as the need to be supported or propped up, all yield information; also the

manner in which the eye follows objects in front of it, and continues to watch them, or the way it listens to sounds. Definite habits and inability to respond to natural calls, the presence of fits, the condition of the circulation, shown by the presence of chilblains, and the state of the digestion are to be noticed. Mentally the presence of emotional instability or unaccountable fits of temper and passion and wanton destructiveness all indicate a want of mental balance and development, but especially confirmatory is the comparison with a healthy child of the same age or build.

Prognosis. Bodily deformities, strabismus, athetosis and spasms are unfavourable symptoms. Epilepsy is always an unfavourable complication, as it destroys the memory and deteriorates the intellect. Rocking movements of the body, or to and fro movements of the hand or fingers (stereotypy) before the eyes, are unfavourable symptoms. Late standing or walking, and late speech are not by themselves unfavourable indications. The appearance of morbid projects, of imperative ideas, of egotism, or the presence of excitement towards the period of puberty may augur the onset of mania, and the complication of juvenile insanity is of serious import. The development of moral perversions, not yielding to discipline and kindness, is unfavourable, as is that of destructive tendencies. In these cases the period of puberty is a critical one, and the appearance of obesity about this time is also unfavourable. Many of the weak-minded become phthisical about this time and die in early adolescence—most frequently from asthenic and low complications, cardiac failure, exhaustion of dropsy, diarrhoea and broncho-pneumonia.

Pathology. Of the mentally unsound the “inherent durability of the neuron” is shortest in cases of weak-mindedness, for there is no “brain power” to live; all the vital functions are at a low ebb. The pyramidal cells of the cortex are deficient in number, irregular in size and incomplete in development. There is often also an immature and incomplete development of the convolutions of the brain, the pattern being simple, often rudimentary in comparison with the normal. This is especially the case in microcephaly. Post-natal conditions may show traumatism, unilateral atrophy or meningitis; the lateral ventricles may be dilated with fluid because of blocking of one of the openings by chronic inflammation of the ependyma or the meninges. Tumours, often tubercular, may be present, and areas of softening, the result of a feeble circulation and stasis. Increase of neuroglial elements and encroachment of these upon the neuron structure characterize cases of amaurotic idiocy, which runs in families. Death among the class of the weak-minded occurs generally from asthenia, or what

has been paradoxically styled "juvenile senility,"—they die because of a low durability of the neuronic elements.

Treatment. This is (a) personal, (b) general, and (c) special or educational. The educational treatment of the weak-minded has received so much study that only in special institutions can the requisite treatment be carried out. This is the only chance of improving them, and the age to commence should be about seven. In the slighter forms home treatment based on these lines may be tried; but it is very expensive, as the supervision and training must be distinctive, and there are few teachers who have the special knowledge and experience. Articulation classes, walking and general muscular exercise to music, singing, associated with bodily movements, hand use by bean-bags, peg-boards, moulding clay, making baskets, copying interesting objects, and play of an organized kind are all most valuable. A liberal dietary, gentle exercise and homes on a good site, with warmth and good ventilation, are requisites. These, together with the emulation and encouragement of others, are the general and best lines of treatment.

R. J.

VOLITIONAL INSANITY

Disorders of the will have ever been productive of discussion because of our inability to come to terms of agreement as to the real nature of the "will" and the psycho-physical mechanism involved in "conduct."

With regard to the question as to the existence of a will, it seems fair to state that there are no grounds to assume that a will exists for us independent of physical or physiological activities. Matter, life and mind are for us empirical correlative states, developed in a parallel series, and capable of manifesting their existence by activities which are respectively equally complex. Any attempt at an explanation of the one in terms of the other results only in confusion, or in an implied causal influence. The fact that the point to which the will is directly applied is always an idea is no proof that the idea always determines the application of the will. The idea itself is the mental equivalent of the instrumental means whereby the fiat becomes realized. Were this otherwise, the responsibility of remembering, comparing and determining action would rest upon an idea. The struggle for survival among ideas is not one in which one idea has summed up the perfections or imperfections of other ideas and has decided that its action is the one best fitted for the conservation of the organism. It does not, without the word of command, ride astride its material basis of "stable mobile equilibrium of atoms," and merely inform the ego of what

it is doing. That the idea immediately precedes the action, we believe; but that it causes the action is another matter. The ideas are the elements in consciousness from which the ego derives its knowledge of conflicting influences. It would be difficult to demonstrate that ideas themselves possess the faculty of comparing themselves with other ideas, or that the continuity of a life experience is only an integral part of an idea. Just as in the leading principles in modern natural philosophy the terms attraction, gravitation, cohesion, etc., are used to represent the various manifestations of material movements, and just as the terms currents, mobile equilibrium of atoms, inhibition, etc., are used to represent physiological manifestations of what we symbolize as life, so the terms intellection, emotion and volition are used to represent psychical manifestations of what we symbolize as the individuality or the ego. The outcome of the contentions is one of vast importance both to speculative theology and to science.

Impairment of Will may manifest itself as (1) **Irresolution.** This may be due to weakness of motives or incitements, to various states of doubt as to the nature or result of the action to be performed, or to excessive number of ideas which tend to delay or counterbalance the impulsion to act in a definite direction. Disorders of the will have been divided into two principal classes according as the will is impaired or abolished. Impairment may be due either to lack or to excess of impulse. When a patient is able to "will" to act, or when the desire is present but the impulsion to carry out the act is absent, the condition is known as **Aboulia.** In this condition the patient may be able to understand and reason upon ordinary experiences without any observable impairment of intelligence. There is, however, inability to put into effect the result of the deliberations, and the desire to react to circumstances is therefore ineffective. Sometimes there is a belief that their will is taken possession of by others, or that their actions are inhibited by some mysterious influence. The muscular system and the organs for movement are probably intact and the impediment does not arise from them. The automatic activities which constitute the ordinary routine of life usually persist. The difficulty appears to be in passing from the consciousness of a desired end to the action which would, presumably, acquire that end.

The psycho-physical explanation of aboulia is doubtful. It is possible that the affection may be due to impairment of the psycho-motor regions in the brain and that it is the connecting apparatus which is at fault. Ribot maintains that there is principally an impairment of

incitements to action. Certain it is, however, that in some cases there is not necessarily any deficiency in "guiding sensations" or ideas of the movements which cannot be performed.

The condition is not due to the want of desire to act, and we do not agree with Ribot that the aboulia invariably results from the absence of states of feeling and sentiment which normally accompany every sensation and idea. True it is that in some cases of aboulia—especially in melancholia and stupor—there is diminution or even absence of general sensibility, but in other cases there is not only an intense desire to perform certain actions, but the individual may be highly sensitive or morbidly susceptible to the emotional accompaniments of ordinary sensations. In dream states we sometimes experience the condition of aboulia. Under the terrifying influence of some illusion we experience intense emotion and the desire to act, but we are unable to effect the desired end. In the hypnagogic state when there is reaction to some terrifying incitement there may be the committal of some crime as the result.

The performance of an action itself is purely physical, but the perception of the accompanying sensations is psychical. We can hardly suppose that a pure state of consciousness is by itself capable of producing, or of prohibiting, action; and, were we to eliminate the various psychical phenomena included in and symbolized as "will," the complicated adaptive, delayed and purposive actions performed by the human being would be nothing short of miraculous. In fact the purely physiological theory of will must ever be unsatisfactory.

Aboulia may be due to defects in the mechanism of attention to ideas which may differ in degrees of pleasure or pain—*i. e.* there may be complete indifference to the ideas of pleasurable or painful results of an action. In health these states of feeling attract comparison and lead to choice, but in melancholia, for instance, there is loss of all pleasurable quality in the incitements to action, or the ideas may be painful and thus act as deterrents to action. Sometimes, as in degenerative states, suspicions or doubts may prevent the fixation of choice, so that the simplest actions may be deterred. In such instances the painful state of doubt and hesitation may be attended by a considerable amount of mental agony and distress. In these cases there is no failure in the process of attention, the ideas may have painful or pleasurable qualities and the power of comparison may be present, but there is merely inability to fix upon the action to be performed.

In some toxic maniacal states the extreme rapidity of incitements to action may prevent deliberate comparison of ideas essential to choice of action. In muttering delirium the

automatic responses to sensations, ideas, or emotions, are apt to be so rapid as to prevent the formation of distinct volitions. In progressive paralytic dementia and in other states of brain degeneration there may be anæsthesia, hyperæsthesia or paræsthesia, with consequent alteration in perception of pleasure and pain; hence there may be absence of the corresponding incentives to action.

Inability to form a motor image for the execution of an idea is not uncommon in states of depression, and there are many variations possible in the transition from a volitional fiat to the actual performance of an action. These conditions must be distinguished from those in which there is impaired volition from sheer want of nervous energy essential to this highest form of action or from impairment of the motor conduction apparatus.

In delusional states a dominant idea may deter from action. Similarly, any of the almost endless varieties of phobias may entirely inhibit volition. In prolonged attacks of mental inhibition, stupor, primary dementia, melancholia attonita, as well as in dementia præcox and terminal dementia, volition becomes seriously impaired or even entirely abolished.

Sometimes the will is impaired in consequence of conflicting emotional states, or by reason of mere confusion of ideas. In the *stadium cœnæstheticum*, which accords with disagreeable or even painfully depressive sensations, the will-power may be morbidly affected.

Similarly in the *stadium acutum* of mental disorders there may be profound disturbances of the will owing to a variety of psychical and physical factors. It is in the third stage (*stadium debilitatis*), however, that aboulia manifests itself most commonly, and it is important to note that aboulia due to exhaustion after the acute symptoms have subsided may either disappear as the *stadium convalescens* is entered upon, or it may become intensified if the *stadium dementiæ* supervenes.

Affections of the highest motor level, in the left frontal lobe, with consequent failure in forming a clear idea of the action to be performed, result in conditions known as **Apraxia**. This apraxia may be sensory or motor in type. The sensory types are those in which there is imperception, or failure in the psychical elements which in health enable the individual to appreciate the nature of objects used (*e.g.* a pencil for writing, etc.). In the motor types, on the other hand, there may be loss of memory of, or failure in the recall of, guiding sensations for movements, or of the result of similar actions previously performed. When the Rolandic areas are affected, as in coarse brain lesions destroying the motor areas, there is paralysis of voluntary movement, which may occur

without any obvious or noticeable impairment of the ideational or emotional faculties. In various types of neurasthenia, hysteria and allied conditions, impairment or retarding of the venous return from the surfaces of the convolutions to the venous sinuses may give rise to groups of symptoms or syndromes, which vary according to the localities affected by the backward pressure. Mention must also be made of the various degrees of anæsthesia due (1) to toxins such as alcohol, etc., which may prevent the formation of incitements to action, or (2) to failure in forming ideas of the guiding sensations of movements.

The sense of fear may act as a deterrent to action. In such cases the incitement to act is not necessarily absent. The power of reacting to circumstances seems, however, to be entirely in abeyance. Often there is no cause for the fear, but the motor apparatus is thrown completely out of gear for a time. Agoraphobia, for example, is a condition of anxiety which renders a person powerless when he sees an open space. The writer has mentioned elsewhere¹ a condition similar in its effects to that of fear sometimes witnessed among troops of men on active military service, and more particularly during the course of a fatiguing march. Suddenly, and without any apparent cause, a panic seizes the men, and they halt in almost breathless silence. An old Indian officer has narrated many instances of this to the writer, and he stated that the panics were usually only momentary, for at a word from the commanding officer the men generally pulled themselves together, and, with a laugh, again fell into step. Fear is also apt to determine excessive activity of the mechanism of impulsion, and the individual may, in spite of his wishes to the contrary, be an agonized witness to the cowardice of his own physical mechanism.

Hyperboulia is the term applied to excessive activity of the mechanism of impulsion. The degree of consciousness of the operation varies considerably with different cases. Thus the impulse may be sudden and without any forethought. The individual performs an action which is closely allied to the instinctive. In epileptics, hysterical maniacs, and in some forms of weak-mindedness with sudden outbursts we find numerous instances of such excess of impulsion. Some patients, after an attack of acute mania, will volunteer the information that they were conscious of their actions throughout the whole attack, and that they could not account for the extraordinary things they did. Others are fully conscious of their own condition, and feel bound to perform certain actions which they at the same time condemn. The writer has recorded the case of

a patient who was brought to Bethlem bound hand and foot, at his own request, in order to prevent self-mutilation, which proved an ungovernable impulse to him. Another patient begged and implored that mechanical restraint might be employed to prevent him injuring himself. Instances of this kind are numerous; and not infrequently patients will state that the employment of some restraint to their actions has been a great source of relief. The fear of committing suicide, or of killing some one, often prompts patients to place themselves voluntarily under restraint. Thus, for instance, a barber admitted to Bethlem, felt an almost irresistible impulse to cut the throats of his customers while shaving them. Other examples, such as those of pyromania, kleptomania, etc., are so common that they need scarcely be referred to. It is important to note, however, that kleptomania is extremely frequent at the menopause.

Intoxication by alcohol is especially productive of excessive impulsions. The usual explanation is that the power of inhibition is impaired, and that the reflex actions become excessive or violent, as the case may be. The numerous cases recorded as instances in which the higher regions of the brain have been injured and the brain impaired have furnished several writers with the idea that the will-power occupies a distinct locality in the brain. Ferrier has recorded a case in which, through injury to the prefrontal region of the brain, a patient lost the balance between his intellectual faculties and his instinctive tendencies. He became nervous, disrespectful and grossly profane. He showed but little politeness to his equals, was impatient of contradiction, and would listen to no advice that ran counter to his own ideas. At times he was exceedingly obstinate, though capricious and indecisive. He would make plans for the future and forthwith reject them and adopt others. He was a child intellectually, a man in passions and instincts. Before the accident, though he had not received a school education, he had a well-balanced mind, and was regarded as a man of good natural ability, sagacious, energetic and persevering. In all these respects he was now so changed that his friends said they no longer recognized him.

Clinically, we have to note the following types of morbid impulse—²

(1) General impulsiveness, or the tendency to react immediately to all sorts of external or internal stimuli. Patients of this type break windows, strike others, and are continually getting into mischief. (2) Epileptiform impulses, which are unconscious in character, or in which, at any rate, the patient is unable to recall the reasons for, or the nature of, the impulsive act. (3) Sexual impulses, which include the excessive

¹ *Mental Physiology*, p. 450 *et seq.*

² Clouston, *Mental Diseases*.

tendencies towards sexual intercourse, onanism, bestiality, etc. (4) Morbid appetites, in which patients are unable to resist eating and drinking all sorts of filth. (5) Homicidal impulses. (6) Suicidal impulses. (7) Dipsomania, kleptomania, pyromania, etc. (8) Impulsive conditions which alternate with forms of intellectual or moral insanity.

In some instances the morbid impulse is preceded by an aura similar to that of epilepsy. According to Bevan Lewis,¹ the morbid sensation is often peripherally referred, is of sudden accession, and may rapidly pervade distant parts of the body. Taylor,² Skae, Pinel and Maudsley³ have described the occurrence of various auræ, such as burning heat in the epigastrium, constriction of the throat, colicky pains, flushings of blood to the brain, cold waves on scalp, etc. At certain critical epochs of life—e.g. puberty, climacterium, and at menstrual and puerperal periods—there is often a tendency to excess of impulsiveness. According to Bevan Lewis homicidal impulses may prevail in one of four conditions in the epileptic subject, viz—

(1) In epileptic furor or mania, associated with hallucination or delusion; (2) in the so-called "epilepsia larvata" (Morel), the "masked epilepsy" of Esquirol; (3) in the dreamy state of epilepsy; or, lastly, (4) as a simple impulsive derangement during the inter-paroxysmal period.

In the insane the various forms of morbid impulse are commonly found as follows:—(1) The impulse to destroy—in mania, imbecility, moral insanity and dementia; (2) epileptiform impulse—in epilepsy, early stages of general paralysis, and in the neuropathic diathesis generally; (3) sexual impulses, satyriasis in the male, nymphomania in the female—in maniacal states, at puberty, adolescence, climacterium, and at the senile epoch; (4) morbid appetites—associated with menstruation, pregnancy, puerperium and lactation, in acute mania, general paralysis and in imbecility; (5) homicidal impulses—in imbecility, masturbatory insanity, puerperal, epileptic, traumatic, alcoholic, religious and delusional insanities.

Aboulia is commonly found in simple melancholia, or in the early stages of mania or of general paralysis. Hyperboulia is usually manifested as a condition of wilfulness in states of mental exaltation with excitement; also in some forms of weak-mindedness and delusional insanity.

In hyperboulia in the insane the excessive action manifested is due either to hyperactivity in the impelling mechanism or to failure in the highest powers of the will which restrains, co-ordinates, or inhibits ideas or actions. The condition can therefore in some instances be com-

pared to the phenomenon of exaggerated reflex action due to loss of cerebellar or cerebral control.

Paraboulia is a term used to designate perversions of will whereby faulty actions are performed. These faulty actions may arise from defect in the psychical functions or from disorders of the co-ordinating mechanism.

Imperative or Impellent Ideas may arouse vivid motor images and impulses to make certain movements, to touch certain objects, to speak or act foolishly, to shout, to strike or to break something, or the impulses may be associated with, or suggested by, ideas or emotions of so many types and characters that it would be impossible to even attempt to enumerate them.

T. B. H.

MORAL IMBECILITY

If the definition of insanity is always difficult, and according to some impossible, by so much the more is that particular variety of unsoundness of mind which passes by the name of moral imbecility. The point at which criminal or immoral conduct has to be treated as disease and to be regarded as no longer amenable to the law is in dispute between two schools of thought. There is the school which regards the doctrine of the freedom of the will as exploded, and the school which still holds that man is not merely the helpless plaything of the Fates, but is free, within limits, to do as he pleases. According to the first school the peccant individual is to be regarded as the necessary result of his heredity and environment, and it is to prophylaxis directed towards these factors that it would draw attention; while so far as the individual is concerned it would withdraw him from troubling the world and place him in the charge of the skilled psychologist. The second school would, in brief, inflict such penalties upon the sinner as would deter him from repeating his offence, or at any rate would deter others from committing similar acts. By general consent the times are not ripe for carrying the theories of the determinist school into practice, though they have so largely obtruded themselves into our jurisprudence that there is a constant tendency towards leniency where any sort of medical evidence can be adduced to suggest that the prisoner is not wholly responsible. There are certainly those whose insanity is so obvious that no judge now-a-days would sentence them to any sort of punishment, while there are many others whom perhaps none but a psychologist would regard as insane, and whom the world at large and the judges in particular consider only as dangerous criminals. Between these two extremes there are many, presenting all grades of moral obliquity, who are regarded as more

¹ *Textbook of Mental Diseases*, p. 180.

² *Medical Jurisprudence*, vol. ii. p. 553.

³ *Responsibility in Mental Disease*, p. 141.

or less responsible according to the tribunal before which they appear. It is not for us here to discuss the question of responsibility, either limited or unlimited, but to point out that at any rate errors of conduct have sometimes a medical significance. The possibilities of an inquiry such as this are enormous, and it would be desirable to range over the whole field of human conduct were space at our disposal, but it is our intention to confine ourselves to certain manifestations of insanity occurring in the domain of morals.

Among the commonest aberrations are those connected with sexual matters. It not infrequently happens that in the early stages of exalted and excited states the patient gives the rein to his instincts, and behaves sexually in a manner which is entirely foreign to his character. Such cases are, as a rule, of a sufficiently obvious character, and being accompanied or succeeded by other symptoms and signs, the patients are speedily brought under care. To such cases we shall make no further reference, since they do not fall within the category at present under consideration.

Aberrations of conduct are, again, not infrequent among the feeble-minded, the epileptic, the alcoholic and the partially demented, and in such cases the diagnosis sooner or later becomes obvious, while the various immoral actions which have been perpetrated are a part and parcel of the general mental degradation. In the case, however, of moral imbecility the faults at issue cannot be regarded as symptoms of some other affection, but are the phenomena which constitute the particular clinical entity, and for the most part indeed are often the solitary manifestations of abnormality. It is true that in a proportion of cases there are accompanying somatic abnormalities constituting the stigmata of degeneration, but in many of this class of patients these are present no more prominently than in many normal individuals, and the weakness of the "will" and the absence of all altruistic sentiments are the outstanding characteristics. Not that these two defects cover the ground, for there is often also present a fantastic perversion of appetite wherein gratification is sought by eccentric methods. Where weakness of the "will" is the predominant feature we find in many cases a good-natured individual who is quite appreciative of the harm which wrong-doing produces, but to whom the slightest temptation is an absolutely compelling force. On the other hand, among those in whom altruistic sentiments are lacking we find individuals who not infrequently display considerable power of will, but who exhibit a callousness to the physical and moral suffering of others which in some cases is perfectly startling. Among children

there are those whose pleasure seems to consist in the infliction of torture upon animals or upon other children, while among older persons there are those whose schemes of pleasure or aggrandisement take no thought of the suffering entailed by them. In some ambition may be alleged as something of an excuse, while in others the goal does not seem so much to consist in financial or political aggrandisement as in the satisfaction of a lust for power which expresses itself in acts of otherwise purposeless cruelty. This class merges by gradual gradations into that in which the gratification of some perverted sexual appetite is carried out at the expense of another's happiness or life. Not that every pervert displays anti-altruistic traits, and hence the need in classification for a division in which neither the want of will-power nor the absence of altruistic sentiments is the marked feature. Indeed, among the perverts it is not uncommon to find those whose will-power is good and who are of unselfish character, but whose morbidity appears in the extraordinary nature of their appetites. We have no space to enter here upon a detailed classification of the varieties of sexual morbidity, nor for the purpose of this work is such necessary. It is sufficient to indicate that the abnormalities most often met with are those of perversion and inversion, while it occasionally happens that sadism, or the combination of sexual lust and the lust of blood, is of medico-legal interest, and may account for the atrocious crimes reported from time to time, and associated in recent years with the name of Jack the Ripper.

Crimes of aggression against the person or against property are at least not infrequently the work of the morally insane. A character in which the traits of egoism and absence of control over the emotions are marked is one which, given an environment in which neither are checked, predisposes to crime. If these traits exist, as the result of heredity or of faulty educational influences, in an abnormally developed degree, and if such opposing forces as are usually sufficient in the majority of individuals produce no effect, we may then class the conduct as being morbid. Such a rough-and-ready definition is plainly open to objection, but we believe that it is impossible to draw any hard-and-fast line dividing the insane from the sane, and that in fact no such distinct cleavage exists as would permit of any closer definition. The child who, vain, restless and irritable, has its wishes gratified at every turn may, if in that station in life in which gratification of any whim is possible, turn out to be a moral though wellnigh intolerable member of society, while another in a station in which the gratification of desire can only be had at the price of theft will turn out a criminal.

In the condition which is known as kleptomania there may be present one of several abnormal traits, or they may be conjoined. In the presence of a normal desire for certain articles there may be an absence of self-control, so that an impulse which in the normal individual would be easily controlled is, in the case of the patient, at once given way to. On the other hand the patient may be in possession of a self-control which is normal, but which even so is unable to make a stand against impulses which are in the nature of obsessions and are absolutely imperative. Lastly, there may be absent from the character of the patient those sentiments of altruism whereby civilization is in large part kept together. Along with the absence of the altruistic sentiment there is often an absence of other features of the normal character. The patient may be without shame, and care neither for the good opinion of those of near relationship nor of the world at large, and, conversely, may also be incapable of admiration of good qualities in others, attributing in all cases meritorious conduct to sordid motive. We would insist that these hard-and-fast divisions, though adding clarity to our conceptions, are seldom found in individual cases, and that they are in fact usually conjoined.

In sound education lies our best hope for the mitigation of the severity of the symptoms. Education in certain utilitarian directions may be better than no education at all, but the education of character is that which is, at any rate for our purpose, of supreme value. Such education can in part be carried on at the school, but fundamentally depends on the parents of the child and their sense of responsibility towards him. It is astonishing how often the character of an absent mother can be accurately diagnosed by the conduct of the child, and how comparatively seldom it is that children of good and wise parents turn out badly. The inculcation from the cradle of habits of self-control and of consideration for others, if necessary for the normal child born of a good stock, is even more important when the child inherits tendencies towards the abnormal. Unfortunately, it is in just such cases that the child is least likely to get a proper training. In consequence of this it often becomes important that the medical adviser should recommend removal from home surroundings. Treatment taken in hand early in life may eventuate in the correction of immoral tendencies, but the later it is commenced the less likely is good to be effected; so that in adult life it is, unfortunately, too frequently the case that it must be directed rather towards preventing the immoral tendencies from finding opportunities for expression than towards their correction

or eradication. In the case of the sexually perverted, treatment is extremely difficult and, indeed, is in most cases only sought when scandal threatens. The fear of exposure is often sufficient to limit the range of satisfaction of the patient's appetite, and if it is not it becomes the duty of the physician to place the patient where he shall be least exposed to temptation, and to endeavour to practise the various psycho-therapeutic means and methods at his disposal. In some cases hypnotic suggestion is of value.

M. C.

E. D. M.

MANIACAL-DEPRESSIVE INSANITY

Maniacal-Depressive Insanity is a form of mental disorder characterized by the occurrence of attacks of mania, melancholia and anergic stupor. Mania and melancholia are the most common phases; anergic stupor is rare.

Attacks of true mania, melancholia and anergic stupor occur in no other disease, and the diagnosis of any one of these conditions is equivalent to the diagnosis of maniacal-depressive insanity. It will therefore be seen that "maniacal-depressive insanity" is the correct diagnosis for a patient suffering from mania, perhaps his first attack, although he has never had an attack of melancholia, as well as for a patient suffering from melancholia, perhaps his first attack, although he has never had an attack of mania. Moreover, the diagnosis of "maniacal-depressive insanity" is correct for a patient who has suffered from many attacks of mania during the course of a long life without ever an attack of melancholia, because such a diagnosis recognizes the fact that such a patient is at any time liable to an attack of melancholia. And, vice versa, there are patients who have had many attacks of melancholia but never mania; yet the diagnosis of "maniacal-depressive insanity" is correct because it recognizes the fact that such a patient is liable at any time to a maniacal outburst.

There are two varieties of the disease, viz.—(1) **Periodic Insanity** and (2) **Intermittent Insanity**. There appears to be no difference between the constituent attacks of the former and those of the latter; but it is important that the two varieties should be distinguished because, as will be seen later, the course and ultimate prognosis of the two conditions are essentially dissimilar.

Etiology. The disease makes its appearance at any time of life, but seldom before adolescence or after fifty years of age. When once the disease has become established, however, the patient is for ever afterwards liable to recurrences. Females are more frequently afflicted than males.

Heredity is an important etiological factor,

inasmuch as patients suffering from the disease usually come from a neuropathic stock. More often than not the hereditary influence is "similar," that is to say that other members of the patient's kindred are afflicted with the same disease.

Maniacal-depressive insanity sometimes arises as the result of previous excesses, such as alcoholic and drug intemperance, and individual attacks of mania and melancholia are liable to be precipitated by general ill-health, especially such exhausting influences as pregnancy, parturition and lactation. A few cases may be ascribed to traumatism and mental and physical shock. The reader must, however, be cautioned against supposing that every attack of mental disorder induced by such causes is a phase of maniacal-depressive insanity; the diagnosis must be made by careful consideration of the symptoms described below and under the headings of *Mania*, *Melancholia* and *Anergic Stupor*.

Within the last few years it has been discovered that, as in hysteria and psychasthenia, some cases of maniacal-depressive insanity are directly traceable to some forgotten mental shock or "psychical trauma" of years ago, usually during early puberty and not uncommonly of a sexual nature. In such patients the nature of the "psychical trauma" is elicited by psycho-analysis, and it is claimed that bringing the offending incident back to memory and clear phenomenal consciousness suffices to cure the disease; but this matter is still *sub judice*.

Periodic Insanity.—Patients suffering from this disorder are subject at regular intervals to accesses of mania, melancholia or anergic stupor, each access being an exact replica of former attacks. Seven or eight varieties may be recognized—

In **Recurrent Mania** the patient has periodic attacks of excitement of the same duration as the last, the intervals between the attacks being likewise identical in duration. When, in a case of this kind, an access of melancholia occasionally replaces one of the maniacal recurrences, the condition is known as **Recurrent Mania of Irregular Type**.

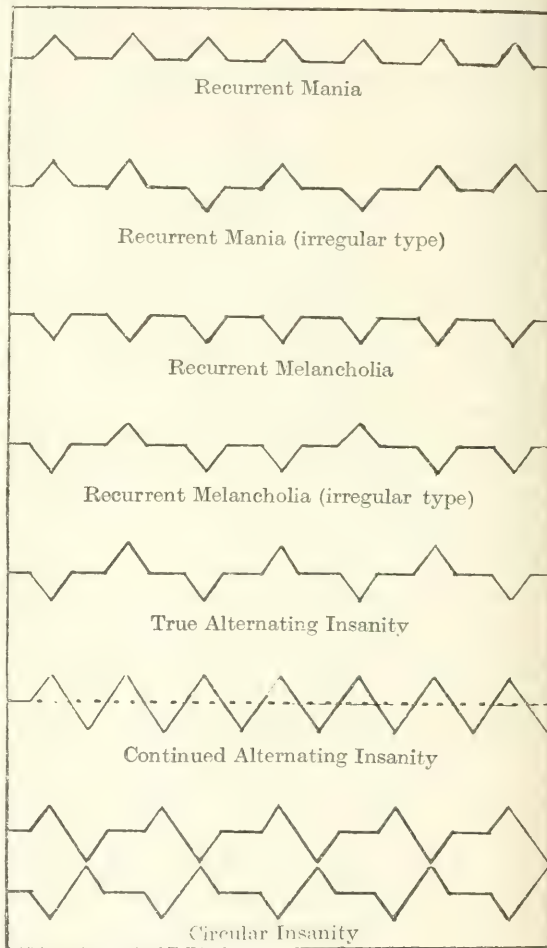
The same remarks apply to **Recurrent Melancholia**, except that the patient has attacks of depression instead of excitement. And when, in recurrent melancholia, the depressive phase is occasionally replaced by an attack of mania, the condition is known as **Recurrent Melancholia of Irregular type**.

In some patients melancholia alternates with mania in regular periodicity, but there is no intermission during which the mental state may be considered normal. Such cases are known as **Continued Alternating Insanity**. There are yet other patients who suffer from similar alternation, with the difference that each attack

of mania and melancholia terminates in temporary recovery and apparent mental health. This is **True Alternating Insanity**.

Lastly, there is the condition known as **Circular Insanity**, in which mania is succeeded by melancholia and melancholia by an interval of health. Mania then recurs, and this sequence is continued throughout life. In another variety of circular insanity the melancholiac phase precedes the maniacal, while the interval of normal mentation comes after the period of excitement and before the depressive phase.

These different forms of periodic insanity will readily be comprehended on reference to the accompanying diagram.



In any given variety the maniacal phases are always of the same duration, and the same holds true of the melancholiac phases. Similarly the interval of sanity always lasts about the same time, so that in any case it is possible to forecast with certainty the onset of another attack, even to the day, when the cycle is of short duration. In true alternating insanity

it will be observed that there are two spells of normal mentation in each cycle which do not correspond to one another. These, therefore, are not necessarily of the same duration, but those following the maniacal stages are always of the same length, and those following the melancholiac stages are exactly similar.

Similarly, in any given variety of this disease the mania is not necessarily of the same duration as the melancholia, nor is either sure to be the same as the interval of sanity.

The whole cycle occupies the same length of time in any one patient, but it differs in different patients. It is not unusual for the whole cycle to occupy less than three weeks, more commonly it takes three months to two years, and I have known one patient who had an attack of melancholia lasting about eight months every eleven years, viz. at the ages of nineteen, thirty, forty-one and fifty-two. In this case there is strong probability that the patient will, either from auto-suggestion or from some other cause, have another attack of melancholia at the age of sixty-three.

It is uncommon for the periodicity of maniacal depressive insanity to coincide with that of menstruation. This is noteworthy in view of the fact that the latter function frequently has mental concomitants, even in normal people.

Although it occasionally happens that one phase of this disease gives place to another by a gradual change or by a kind of temporary oscillation from one to the other, it is far more frequent for the mutation to be absolutely sudden and nearly always in the early hours of the morning; so that the practitioner must be prepared to find a patient in a maniacal state of excitement, whom he had left the previous evening in the depths of melancholiac despondency; and vice versa.

Now the striking resemblance between the successive cycles of periodic insanity, so far as their duration is concerned, is no more remarkable than the similarity of the clinical pictures.

If the preponderating emotional tone during the maniacal phase has on previous occasions been one of hilarity, it is certain that hilarity will predominate in subsequent attacks of excitement, and if a patient has presented a strong tendency to injure himself by repeated attempts at suicide during previous attacks of melancholia, the practitioner must be carefully on his guard to prevent suicide during recurrences of this phase of the disease, for he may be sure that the patient will seize every opportunity for self-destruction.

This similarity between the successive attacks is nowhere better exemplified than in those cases in which the judgment of the patient is markedly affected, and delusions of the same kind recur on each occasion. A patient at

present under my care for the third time suffers from the delusions that she is persecuted and poisoned and that her mother is not her mother. These were her delusions also in her previous attacks, the only variation being that during the second attack she thought that her father was not her father. In this connection I well remember a patient who had a maniacal attack every eighteen months in which the first symptom was always extravagance. Being an undischarged bankrupt he would take rooms at the most expensive hotel in London, on the principle that "it was cheaper in the long run." Then he would fall in love with his own daughter. Then every trivial incident indicated to him that he was a member of the Trinity and the Messiah returned to earth. Knowing the successive phases of his illness, I endeavoured from time to time to repress his delusions before they became established, but all in vain, for their development was inevitable. They persisted until the appointed time for their disappearance, about five months from the onset of the attack, when they vanished almost in a moment and he was well. During the intervals he could recount the various stages of his illness with perfect lucidity, would point out the absurdity of his fancies and deplore the fact, which he fully realized, that he would be unable to escape their thralldom in the future.

Perhaps the most remarkable feature of all these varieties of periodic insanity is that they do not lead to dementia. Many patients may be seen in our county asylums who have suffered from frequent recurrences of mania, melancholia or stupor for thirty or forty years and yet show no signs of mental deterioration during the intervals between their attacks.

In a few cases it happens that one or other phase of the disease persists, and the case becomes one of chronic mania or chronic melancholia.

Intermittent Insanity.—This form of maniacal-depressive insanity differs from periodic insanity in that the accessions of excitement and depression recur at irregular intervals and there is a tendency for these intervals to become shorter and shorter. In a typical case, for example, the patient has attacks at the ages of twenty, twenty-seven, thirty-one, thirty-three and thirty-four, subsequent paroxysms occurring with such frequency that the sufferer must remain under permanent care. There is no certainty as to the nature or duration of forthcoming attacks, so that the practitioner is unable to prophesy as in periodic insanity. Moreover, this variety of the disease differs from periodic insanity in the fact that it almost invariably terminates in dementia with loss of memory, failure of judgment, imperception, disorientation and degraded habits.

Prognosis. It will be gathered from the above descriptions that the outlook for any particular attack of mania or melancholia is favourable, and the practitioner is justified in saying that the patient will recover. On the other hand, it must be recognized that such a patient may have a relapse at some future time. In some instances this relapse is postponed for twenty or thirty years, or even longer.

Indeed it is probable that a few patients live to a ripe old age and yet escape a second attack altogether; but such cases must be rare.

From the study of a first attack it does not appear to be possible to forecast whether recurrences are likely to be periodic or not. If, however, a second attack is an almost exact replica of the first, the practitioner is safe in forecasting periodicity. This, of course, becomes more certain when he finds that the interval between the second and third attacks is equal to that between the first and second.

The *differential diagnosis* of maniacal-depressive insanity is discussed under the headings of *Mania*, *Melancholia* and *Anergic Stupor*.

The *treatment* of the accesses is considered under the same headings. Otherwise treatment consists of attempts to break the periodicity and tendency to recurrence. Apart from maintaining the body weight and general health of the patient with due attention to regulation of sleep and rest, the only suggestion I have to offer is to give the patient a change of air and scene immediately before the appointed time for the next attack. My experience of this method, however, is that it merely postpones the inevitable.

Some writers claim that they have effected a cure by psycho-analysis, but this method of treatment has been in vogue so short a time that judgment must be suspended until we know the subsequent history of patients thus treated. It must not be forgotten that instability is the essential, often inborn, characteristic of maniacal-depressives, and any method of treatment which ensures their stability seems too much to expect. For this reason, and on account of the strongly hereditary nature of the disease, marriage of these patients should always be discountenanced. W. H. B. S.

ACUTE CONFUSIONAL INSANITY

An acute psychosis of distinctive form, ranging in severity from states of simple mental confusion to a condition of hyperacute delirium; an exhaustion insanity, febrile in its pronounced types, with well-defined prodromal and associated somatic disturbances and with characteristic psychic phenomena; ending in a large proportion of cases in complete recovery, but sometimes terminating rapidly in death from

collapse, from cachexia, or from some intercurrent pulmonary or infective disorder.

Described by Meynert under the above title, alienists have more recently come to regard this affection as a psychosis in which exhaustion is the prime factor, and in which mental confusion, which is the keynote of the condition, is induced either by cerebral malnutrition or by the reaction on the cortical centres, especially those of ideation and perception, of some toxic or infective irritant (probably acting chemically) engendered by a general state of exhaustive denutrition (Kraepelin).

The essential diagnostic evidences of the presence of any of the grades of this exhaustion psychosis are:—(a) *mental symptoms*: a more or less confusional obscuration of consciousness to environment, a greater or less degree of disorder in the associative arrangement of ideas, defects of perceptive function, defects of attention, and defects of will; and (b) *physical symptoms*: general prostration, emaciation, anorexia, insomnia, febrile evidences—varying according to the severity of the malady, cardio-vascular atony, and gastro-intestinal implication.

The predisposing causes, or rather precedent elements, of the different phases in intensity of the affection are numerous. Such a mental and physical upheaval may occasionally be the earliest sign of an acute infectious malady, the physical shock of infection of severe and malignant form dashing the subject in a few hours, especially if he be debilitated and of very delicate nervous constitution, into a wildly delirious type of confusional excitement; with this exception the syndrome almost invariably appears as a sequela: it may arise during, or follow on, one of the acute exanthemata, or specific fevers or infections; or it may ensue upon some simple gastro-intestinal affection of long standing; it may result from enforced loss of sleep, any form of physical or mental shock, severe hæmorrhages, accidental or post-operative, any post-operative cachexias, the puerperium at any of its stages, and from lactation or any other prolonged exhausting physical influence or malady. Its subjects generally are of neurotic or actually insane heredity, usually in the early prime of life, young females of hysteriform type, or young males who during puberty and adolescence have exhibited a vague emotionality, a nervous unsettlement and instability, who are spare and delicate constitutionally and of low physical tone; it may occur even before puberty and after the climacteric, but its incidence at such comparative life-extremes is rare and the age period almost invariably lies between eighteen and forty.

For purposes of description confusional

insanity may be classed thus : the *subacute form*, the *acute delirious form*, the *acute stuporous form*, and the *hyperacute or delirious collapse form*.

In the *elementary form*, which is of rare occurrence, there are the following constant evidences. Prodromal signs : general malaise, restlessness, headache and disinclination for food, which are succeeded by (a) *in the mental sphere* : a benumbed consciousness, the patient is befogged, preoccupied, bewildered, undecided and unable to collect his ideas; any mental operation necessitating effort, *e. g.* the exercise of the will, or the pursuit of a definite line of thought, appears partially paralysed; he is in a dreamy obfuscated uncertainty as to the identity of those about him, is in doubt as to his environment, he is mixed as to time, his associative memory is blurred and he is full of vague apprehensive fears. He is, however, quite cognisant of his abnormal condition, and his automatic mentality, his reflex mental arc, appears untouched—he can quite correctly tell his age, his name, his occupation and so forth, but all his replies are given in the stilted emotionless tone of a dreamer, and often only after loud and repeated questionings. His facial expression is anxiously perturbed, he moves aimlessly to and fro with shuffling, stumbling, staggeringly careless gait, and he is partially and at times wholly irresponsive to external impressions; he reiterates senseless queries and utters verbigerative complaints as to his feeling of malaise and distress, and with this moderate degree of psychic dislocation he exhibits (b) *various somatic symptoms* : he is sleepless, completely anorexic, his tongue is furred and his bowels constipated, his pulse is of low tone and quick; but what rise there may be of his temperature is very slight and his physical prostration is not pronounced. Ere his loss of body-weight can become marked he will, if his treatment be prompt and appropriate, soon begin to improve, and in a few days he may revert to a normal condition. Generally the prognosis of this minor form of the affection is quite favourable.

But the phenomena that more frequently are presented are those of a much higher degree of psychic and somatic implication. Upon the symptoms of the subacute form of intenser grade there are imposed (1) an exaggeration of the functions of the automatic psychic arc, ranging from a greater or less degree of aimless mobility to turbulent motor excitement; (2) delusional presentations; (3) subjective sensorial percepts (hallucinations and illusions); and (4) a tumultuous and incoherent flight of ideas; these are as it were grafted upon the state of increased confusion. Certain prodromal symptoms, both mental and physical, usher in the attack. Where the onset of the

malady is remarkably sudden such premonitions may in part or altogether be absent, but as a rule warnings of the inception of the disease are given by insomnia, cephalalgia, nervous purposeless restlessness, an inability to concentrate attention, slight memory defects, a fear of being alone, with an obsession of horrific ideas; anorexia, epigastric distress, furring of tongue and constipation : these will for four or five days precede the characteristic symptom-evolutions. A rapid evolution of his psychophysical phenomena then ensues. His consciousness becomes more and more clouded; his associative memory more disturbed; his attention, at first evanescently held, presently can be fixed only with difficulty; he looks miserably dejected, apprehensive and horrified; a bewildered and dreamy confusion appears to envelop him, and his environmental determinations become profoundly affected; he begins to give utterance to senseless scraps of sentences; he becomes subject to ideal and sensory presentations which progressively and rapidly rise to all-dominating power; and finally he reaches the acme of psychic and somatic automatism. External influences are now of but little account to him, and internal stimuli sway him with riotous predominance; he chatters incessantly, generally vociferously and at random, sometimes in whispers, sometimes merely with soundless lip-movements, while by pantomimic exhibitions, facial contortions and dramatic gesticulations he gives representation to the agonizing, enraging, exhilarating or disgusting hallucinations that invade and ruthlessly occupy his consciousness. His subjective auditory precepts, at first simple and subordinate, presently become startlingly composite and actual, and finally distinctly complex in character; the threats and mockings of fiends, devils and persecutors, the amorous cooings of houris, the celestial songs of angels, and the gorgeous crashing music of military bands—while his visual phantom-presentations march and flit and dance before him in will-o'-the-wisp and ever-changing array, a phantasmagoria of grotesque, mystic, awful, soul-freezing or sensuous visions. The incoherence of his ideal expositions has now become marked : confused alliterative assonances, half-uttered threats, fragmentary allusions, interrupted quotations, and absurdly dislocated scraps of colloquial or vernacular verbiage tumble over each other in frantic haste for utterance. His objective percepts are not, however, totally ignored, for visual and auditory illusions will in sudden gusts overmaster him—those around him become to him devils or angels or syrens to be assaulted or worshipped or erotically fondled, and the sound of the rushing wind or the spoken voice or the closing door he mistranslates into

the terrible howls of demons, the commands of the Deity or the discharges of guns. His motor activities are surprisingly impulsive; for the greater part they are the expression of his flittering delusional and psycho-sensorial presentments, under whose promptings he launches into violent explosions of aggressive, destructive or often purposeless activity; but occasionally no connection between his ataxic psychisms and his motor unrest can be traced, and his acts then become a series of automatisms purely. As the disease progresses his delusions and sensory disturbances take on a more definite and stable form—a form mainly of a distressing type (ideas of persecution, damnation and culpability), or more rarely beliefs in an altered personality or notions of a grandiose and magnificent character. The physical symptoms of his condition have meanwhile marched to full development: insomnia due to the hyper-irritation of his psycho-sensorial centres (fitful snatches of disturbed sleep, unless such be induced, being all the reparative rest he obtains); temperature elevations (of irregular or sometimes intermittent form but never of more than 1.5° to 3.5° F. above the normal, a higher degree of febrility being seen only in the hyperacute grade of the malady); nutritional disturbances (a progressive emaciation due to defective assimilation and insufficient alimentation as well as to the exhaustion which antedated the disease); nausea and often vomiting; a densely coated tongue; offensively foetid breath (like rotten seaweed); obstinate constipation; his skin clogged with a profuse sticky perspiration of sour mousey odour; his hair harsh and staring; his lips, teeth and gums covered with a tenacious ropy secretion; his pulse small, quick and of low tension; often pronounced cardio-vascular atony, as exhibited by his cold and cyanosed extremities, oedema of his feet and ankles, and the presence of severe chilblains; his urine scanty, high in specific gravity, with traces of albumin and sugar, its uric acid increased and its chlorides diminished; he may have quasi-epileptiform attacks or, as in one of my cases, apoplectic seizures of mild form; his reflexes exaggerated; his appetite completely absent; and, of the greatest importance of all, he exhibits an ever-present tendency towards general collapse—of this, especially in the initial stage of his malady, he is in constant danger, in the severer forms of the disease it may with almost certitude be expected after only a few days of violent excitability—and all in treatment that goes to counteract this disposition is remedial.

Involvement of the automatic psychic centres crowds on the confusional condition the phenomena of stupor. In these *stuporous forms* of the affection the patient lies in motionless and

helpless attitude, with a semi-vacant, semi-bewildered facial expression, his mouth half open, his unseeing eyes roving restlessly to an fro, while he mouths and mumbles inarticulately; he is irresponsive; he displays not the least emotional concern; but his automatic reflexes are not paralysed, they are merely stupefied, for they may be roused by loudly shouting at him, by pricking him, or by firmly handling him—manual suggestions with vigorous commands are often effective in getting him to sit up, walk or eat—but all his performances are mechanical and quasi-hypnotic, and as soon as the suggestive stimulus is removed he reverts to his lethargic apathetic torpor. He is sleepless, his facial muscles quiver and twitch, he has spasmodic tremblings of muscle-groups of his extremities, while his other physical symptoms are identical with those of the agitated form of the malady; but with him the tendency to collapse is greater, for he is probably of asthenic type, and thus an easier prey to the overwhelming toxic irritations of his disease.

Conceive the symptomatic evolution to be of an intensity greater even than this; picture the individual completely disoriented and totally unimpressionable from without, with an unceasing violence of motor activity, his face drawn and pinched, glaringly hollow-eyed, raging with frantic, infuriated whirlwinds of determined ferocity, dashing himself on the floor or against walls, attacking with wild fury, bellowing in transports of agonized horror, incessantly singing, howling and gesticulating with supra-boisterous passion by day and night, presenting in this psycho-somatic tornado the picture of a hyperacute intoxicative delirium; with respirations shallow, panting and laboured, his skin harsh and dry, his tongue furred, parched and cracked, his lips and teeth encrusted with sordes, his pulse thin, weak, rapid, irregular and intermittent, his temperature at or over 105° F., his nutritional state rapidly falling and his strength fast sinking, subject to incessant vomiting or diarrhoea—and one can hardly have any doubt as to the issue. Fortunately such appalling outbursts of tempestuous violence are very rare, but when they do occur the patient's chances are exceedingly small—they seldom fail to kill outright after their persistence for but a few days. Such cases as may survive the severity of so gross an attack run the course of the acute form, which extends, with oscillatory diminutions and intensifications, over a period of from six weeks to five or six months, or even longer, with, in many cases, occasional brief periods of lucid calm, which may last for some hours or even a whole day at a time. In favourable cases the improvement may be gradual with mild recrudescences (this is the more auspicious mode of recovery), or sudden

(but here there is danger of relapse), while such as take an unfavourable course succumb from collapse, or from a progressive loss of strength due either directly to the malady or to some associated symptom, or from some complication such as pneumonia.

The *diagnosis* rests on the pre-existence of certain etiological factors, all of exhaustive type, the appearance as a primary symptom of confusion, the association of definite physical phenomena and the rapid denutritional involvement. It is very important to differentiate the malady from *acute mania* as early as possible, not only because the line of treatment to be pursued is essentially different for each disease, but also because of the prognosis, immediate and future. Both are recoverable maladies, but mania is almost always a recurrent psychosis, which confusional insanity certainly is not. The distinction is not difficult if one notes that the excitement of the maniac is always purposeful and objectful, that it is influenced mainly by what occurs outside himself, that his agitation, which is nearly always offensive and directly the result of an exalted supercilious arrogance, is demonstrative because he is so intensely hypersensitive, that his attention is ever keenly on the alert for minutiae, and that he is an aggressive euphoric in a constant state of irritability, morally toneless and devoid of decency; while his physical evidences are distinctly the antithesis of those of the confusional insanities which are primarily physical and but secondarily psychic disorders, while mania is pre-eminently and primarily psychic. The stuporous form of confusional insanity can be separated from the stupor of *dementia præcox* by the knowledge that the former is a non-katatonic stupor, and that in antecedents, physical symptoms and psychic elements it is wholly unlike that disorder.

The gravity of the *prognosis* is, speaking generally, directly proportionate to the severity of the attack; it is therefore almost hopeless for the hyperacute type and most favourable in the subacute form, while the intermediate groups—the acute and stuporous—must be prophesied on with caution. About one half of the acute and stuporous forms recover, and recover completely; some that emerge from the mental storm drift into chronic incurable insanities, or insanities of curable form but protracted type; and about thirty per cent. of them die. During the progress of the disease a more positive forecast can be made, favourable if the patient continues to be of sthenic type, retains and assimilates his food, begins to gain in weight, preserves a steady cardiac action and maintains a pulse of good tone; but if he is asthenic, progressively loses in tone and weight, has incessant vomiting, uncontrollable diarrhoea,

recurrent attacks of cardiac weakness and a persistent physical hankering after collapse, the outlook is grave. Three comforting assurances can be given to the friends of a patient who is doing well: (1) that he will not remember any of his symptoms save those of his later convalescence; (2) that he is very unlikely ever to have a recurrence; and (3) that they and his other near relatives need not concern themselves about this malady, for it is not a degenerative psychosis, it is merely an accidental mental occurrence due to an exhaustive physical malady.

Treatment. As this is a disease in which collapse, or a gradually progressive cachexia—apart from any intercurrent complication—may be the main cause of death we must set to work promptly and energetically to combat this disposition on the part of the patient. He cannot with any safety and probably with but little success be treated at home; not only is it most difficult to adapt a private residence to the imperative needs and obtrusive symptoms of the patient, but the number of nurses required, the special provisions to be adopted against accidental self-injury, the particular routine line of management and nursing, and, last but not least, the presence of interfering relatives, all strongly militate against such a course. Transfer him immediately to a private hospital, a medical home or a good asylum, where his crying needs for energetic nursing and careful medical supervision can find special provision and full attention. No half-hearted or slovenly measures can have any place in the scheme of his treatment, and there is no disease in which a firm interference will be found to give better results. If he is not to be sent to an asylum select a good nursing-home, place him in a well-ventilated airy bedroom, situated if possible away from traffic and other disturbances, with another apartment in communication (preferably a bathroom) for keeping all requisites for treatment; screen the windows with protective wire-netting and block the sashes so that they cannot be raised or lowered more than eight inches; have nothing in the main apartment that is not immediately required there, strip it of all unnecessary carpets, furniture, ornaments, etc., and, if the weather be inclement, well warm it with a fire securely screen-guarded; keep the doors locked, permitting only the nurses on duty and yourself entry; provide a sufficient number of capable nurses so as to afford relief, for the observation having to be continuous is trying, and, if the patient is a male, a properly qualified male nurse to assist them. The principles of treatment then resolve themselves into (a) close and careful nursing and constant supervision; (b) overfeeding; (c) a keen watch for collapse,

and (d) the induction of calm and sleep. The general rules of nursing must necessarily most rigidly be observed, especially in view of the easy occurrence of decubitus owing to the patient's denutritional condition. His impulsivity of action must be guarded by the most vigilant surveillance; he should never for a moment therefore be left by himself, not because he is purposefully suicidal, but because his activities are of the violently unexpected order and he may suddenly do serious harm to himself or others. He must be kept in bed continuously. His strength must from the very outset persistently be maintained by excessive feeding—the great mistake in these cases is to imagine that enough is sufficient—and if he will not eat and drink everything given him he must promptly and without delay be fed through the nasal tube; should he refuse all nourishment absolutely, artificial alimentation five or six times in the twenty-four hours at regular intervals must conscientiously be carried out. At the commencement and during the first three weeks give him in the twenty-four hours sixteen to eighteen eggs and a quart of good cream, with milk or thickened barley-water and meat extract, or strong soups, or liquid calves' feet jellies or almond soup (blanched almonds well mashed up with milk and the liquor extracted under a strong press) in six feedings, *i.e.* every four hours, each diet to measure three-quarters of a pint, and to each to be added, for the first three or four days, half an ounce of good brandy or whisky, and an occasional dose of strophanthus—repeat the alcohol and strophanthus whenever there should be cardiac need. After the first three weeks reduce the number of feedings but keep the quantity the same, ringing the changes in dietary regularly with the occasional addition to a feeding of a tablespoonful of brown sugar. Do not forget that your patient may be thirsty, so give him a good drink of water by the nasal tube now and then. Do not be nervously timid of renal and gastric complications, but just press the feeding until the body weight increases. Let his nurses swab his mouth out frequently to rid it of the foetid, sticky, ropy secretion that accumulates about his teeth and lips. Should there be vomiting, persistent and severe, give him three or four nutrient rectal feedings per day with repeated trials of nasal feeding; but slight or occasional attacks of vomiting need not cause cessation of nasal alimentation if this be done properly. Constipation must be met by enemas rather than by purgatives. Collapse must be looked for, watched for and anticipated at the earliest moment, and for this always have at hand alcohol, digitalis, strychnine for subcutaneous use, ether, camphor, coffee—they are all of aid, but the most efficient remedy of all is the high rectal injection of warm

saline solutions. For sedative and hypnotic effect rely only on routine warm baths at a temperature of 95° to 98° F., the heat being maintained at a constant height throughout each bathing. Let the first bath last fifteen minutes, immersing the patient up to the shoulders, and carefully watch the cardiac effect; increase the time gradually until he can be kept for three, four or five hours in the bath—the number of baths and their duration depending entirely on the degree of excitability and their effect, and they must be regulated accordingly. After four or five such administrations their sedative influence can be noticed; he will be in a state of comparative quiescence so long as he remains immersed, and this alone is of value as a strength conservator; but his baths will also act as sleep-inducers, and after he has been well rubbed down and put to bed he may have a valuable sleep for an hour or two. If his cardiac state be one of peril, or if his physical exhaustion be extreme, use saline transfusions and the warm pack—or employ the warm pack alternately with warm baths. Use no mechanical restraint at all, let the warm pack take its place—if he is very violent the effect will be far more speedy as well as more remedial. If hypnotics must be given, though the baths generally are quite sufficiently calmative and soporific, they are best administered in small doses during bathing—paraldehyde, trional or bromides being the best. Never use the cold bath or cold pack; and for hyperpyrexia use warm saline infusions.

When the patient after weeks of this persevering treatment has maintained a sthenic condition many of his motor and psychic phenomena will lose their grave intensity, but the flooding with food must continue until the body weight persists on the up-grade. One day he will fall into a deep natural sleep instead of the induced and fitful somnolences of his excited phase, and he will wake up to commencing convalescence; little recrudescences need not alarm his watchers, they will see a progressive abatement in his symptoms until his environmental consciousness begins to clear. And now another danger will have to be weathered: unless the greatest pains be taken to guard against the induction of the least fatigue there will most probably be, as I have unfortunately seen in a good many instances, a distressing relapse, with all the close and careful attention and care and hard work to be gone through again; he must be kept completely at rest in bed for at least a week after the disappearance of his mental symptoms—then and then only can one begin to experiment, with slow gradations, in activities. This being an exhaustion psychosis it is imperative for some time to avoid undue exertion, as imperative as to be

cautious in the dieting of a recovering typhoid case. Under the very best conditions convalescence will be protracted. J. F. G. P.

DEMENTIA PRÆCOX

It is to Prof. Kraepelin of Munich that we owe the conception of dementia præcox in the form now generally adopted. The introduction of the term, however, disturbed the established ideas of classification and traversed the old conceptions of mania and melancholia so that they became restricted in meaning, whilst the significance of the word dementia, as generally understood in this country, was modified so that it did not necessarily convey the idea of permanent mental enfeeblement. It was, therefore, not surprising that at first the new generalization provoked controversy and resulted in a certain amount of confusion.

A generation ago it was commonly taught that the chronic demented patients in our asylums were for the most part wrecks, over which the storm of some acute mental disorder had passed, leaving them permanently disabled and unable to withstand the stress of circumstance. Now, we find that the majority of them have arrived at their present condition through a slow process of mental decay. Kraepelin has shown that these patients usually present characteristic symptoms, which frequently appear early in the course of the illness, and which, taken together, form the syndrome, dementia præcox.

At present this syndrome or symptom-complex can hardly be called a disease. Its cause is unknown, there is no certain pathology or morbid anatomy, its clinical course is uncertain, its symptoms are extraordinarily diverse, and though the prognosis is generally looked upon as bad, every physician of experience has met with cases presenting typical symptoms, which ended in recovery. There is, moreover, no definite basis for diagnosis, and consequently dementia præcox cannot always be distinguished from other mental disorders. But, in spite of these difficulties, there is no doubt that Kraepelin's conception has marked a distinct advance in psychiatry, and is of great value from a clinical point of view.

Etiology. In the great majority of instances dementia præcox begins between the twentieth and thirtieth year, and though it may occur at any age, it is very rare after fifty years. There is reason to think that it is especially common among the educated classes. It sometimes attacks those who have successfully passed competitive examinations and others who have exhausted their nervous energies in working at undue pressure. Both sexes are equally subject

to it. In many cases it is attributed to self-abuse, but there is little evidence in support of this hypothesis. Hereditary predisposition is a powerful factor, and a bad family history is found in seventy per cent. of the cases in which the antecedents can be properly traced. One form of the disorder (the hebephrenic) is almost always due to innate mental instability.

Clinical Varieties. Three varieties of dementia præcox are described, viz. the *hebephrenic*, the *katatonic*, and the *paranoid*. Although some authorities look upon these as distinct and independent mental disorders, I do not think they can be satisfactorily differentiated from each other to this extent. In describing the symptoms of dementia præcox I have considered the disorder as a single symptom-complex; but I propose, in the first place, very briefly to outline the chief features of the clinical varieties in question.

The *hebephrenic* variety usually begins insidiously, often at puberty or in early adolescence. The progress of the disease is slow and rarely interrupted by attacks of excitement. In the early stages there is often headache, sleeplessness and symptoms resembling neurasthenia, and the gravity of the case is frequently overlooked. Suicidal impulses are not uncommon. The course downhill is undulating, and the prognosis is bad.

The *katatonic* variety is usually marked by depression, followed by excitement or by stupor, and the initial depression is frequently mistaken for melancholia. As a rule the onset is more acute than in the previous variety, and occurs most commonly in early adult life though sometimes later. The symptoms tend to be more severe, the course more rapid, and the prognosis somewhat better than in the hebephrenic variety.

The *paranoid* variety is distinguished by the prominence of chronic delusions, often associated with hallucinations. The dementia advances more slowly than in the preceding forms. It must be understood that katatonic symptoms are apt to appear in the course of hebephrenia, and that the latter may pass into the paranoid form.

Of these clinical varieties, the paranoid seems to the writer most open to criticism. The inclusion of such a heterogeneous medley of chronic delusional cases under the head of dementia præcox makes this syndrome too indefinite and thus tends to limit its usefulness.

General Symptoms. It will be well in the first place to consider those symptoms which are almost invariably present in dementia præcox. They may be described under four heads.

1. *Dissociation of the Mental Faculties.* There is an absence of harmony between the emotions, the thoughts and the actions.

Impulsive acts occur for which no reason can be given, or there may be meaningless emotional disturbance. Mental dissociation is a leading feature of dementia præcox, and the disorder has received other names, such as intra-psychic ataxia, dementia sejunctiva, schizo-phrenia, emphasizing this. All these terms denote a splitting up of the mind and an absence of proper correlation between the mental processes.

2. *Emotional Indifference.* The patient is careless of what happens, and is unmoved by the anxiety of friends. He loses interest in the affairs of life.

3. *Mental Inaccessibility.* It is difficult, if not impossible, to ascertain the patient's thoughts. Sometimes there is abnormal poverty of ideas.

4. *Selective Decay of the Mental Faculties.* In spite of the symptoms mentioned, in the early stages of the disorder the memory is good, the perceptions are clear, and there is no disorientation or failure to understand what goes on around. In all cases there is, nevertheless, slow intellectual decay, which in many cases progresses to a low-grade dementia.

Onset. Although dementia præcox may develop with dramatic suddenness, it will be found as a rule that for a long time previous to the actual breakdown there has been a change in disposition. At first there may be no sign of intellectual defect, and the school work may be well done; but the boy is moody and retiring, making few friends, is probably disinclined for games and generally is looked upon as peculiar. On leaving school this solitary disposition becomes more marked, and he may suffer from attacks of depression, or acquire the habit of indulging in reverie and day-dreaming. Gradually he becomes less able to attend to his work, and possibly throws it up without notice. Emotional indifference creeps on; and the nature of the malady is recognized when some unaccountable freak of conduct gives the alarm.

In another group of cases the patient is looked upon as hysterical. Strange and impulsive acts pass for mere girlish waywardness due to temporary causes, and this view is strengthened by the fact that the patient is worse at the menstrual periods—indeed, at other times there may be little amiss.

In other cases the early symptoms are more distinctly neurasthenic. The patient is always tired, suffers from pains and aches, lacks energy and interest in former pursuits, and becomes a nervous invalid. But months, or even years, may elapse before the mental deterioration is manifest. Many of these patients suffer from obsessions leading them to perform stupid acts. Others are troubled with imperative ideas: *e.g.* blas-

phemous or obscene thoughts obtrude themselves upon the mind.

Dementia præcox may also begin with an attack of depression closely resembling the depressed stage of maniacal depressive insanity. There may be mental retardation, accompanied by feelings of intense misery, with possibly delusional interpretations of mental suffering. In one such case it was ascertained during a remission that for fully six months before the disorder was recognized the patient had concealed from her relatives and all who knew her definite obsessional impulses to commit suicide. It was noteworthy that when she relapsed there were obvious symptoms of maniacal excitement.

In other cases katatonic excitement is the earliest symptom, and for a time the condition of the patient closely resembles acute mania. Sometimes, as noted above, the attention of relatives is first roused by some peculiar act for which no adequate reason is forthcoming. Thus a medical student sent a telegram to his mother stating, without the slightest foundation, that his grandfather was dead. One girl suddenly struck a complete stranger, whom she saw on the platform of a Continental railway station, because she believed she was about to murder her; and another, without warning, threw a teacup at a clergyman during family prayers!

Sometimes the first symptom is a suicidal attempt, though the patient may not be seriously depressed, nor labour under any overmastering emotion. Sometimes an outrageous and grotesque statement is made, indicating an absurd delusion, or there may be vivid and terrifying hallucinations. But careful analysis of the past history of the patient almost invariably shows such outbreaks are not the true beginning of the malady.

Symptoms in the Emotional Field. We have seen that there is usually apathy and lack of interest in the affairs of life. In many cases, however, before this emotional indifference is developed, there are attacks of depression or of exaltation. Sudden and violent outbursts of weeping occur, apparently causeless, and sometimes accompanied by suicidal impulses. A more frequent symptom is senseless laughter; or perhaps the patient smiles to himself quietly, as if at some amusing idea. On being asked to share the joke with others, however, he gives no answer, or one that is quite irrelevant.

As the disease progresses the lack of interest noted above increases. There is a growing neglect of the claims of duty. The feelings of those near and dear are ignored, the appeal of love is unheeded, and ambition is no longer a spur to action. Speaking generally, the whole emotional level is lowered.

A young man or woman, who a few months ago seemed full of promise and enthusiasm, has

so changed that a mother's visit scarcely awakes any response. No interest is taken in family affairs; an occasional silly laugh crushes attempts at conversation, and it is evident that, though the body remains healthy, the complexion good, and even the expression of the face little changed, the beloved child is no longer there. What is left is an incoherent complex of memories and associations, working automatically in a physical machine strong enough to last the average span of human life.

The *intellectual* faculties, as already explained, undergo progressive degeneration, though for some time there may be no obvious disorder of perception or of memory, and the ability to understand what goes on may be normal so long as little mental effort is needed.

The most prominent intellectual defect is a weakening of *attention*, which usually accompanies the emotional indifference. The patient cannot fix his attention in the normal manner, nor can he grasp new conditions and adapt himself to circumstances. On the other hand, his attention may be morbidly fixed upon one subject to the exclusion of others—a mental condition sometimes called “fascination”—or states of reverie occur, in which external affairs are ignored, and the thoughts wander undirected by the conscious will.

In *katatonic* excitement the sequence of ideas is frequently strangely mixed. Words or fragments of words are jumbled together into new words or phrases called “neologisms.” These are generally devoid of sense, and the result is a condition of verbal incoherence which the term “word salad” aptly describes. Corresponding to this intellectual incoherence there is a high degree of excitement.

In the early stages *hallucinations* of any of the senses frequently occur, but they rarely continue throughout the course of the disease.

It would serve little purpose to describe the various *delusions* that may occur in the paranoid variety of dementia præcox. They fall into three groups:—(1) melancholic, (2) persecutory, (3) grandiose. Not rarely all these occur in the same patient in successive stages, and they are frequently accompanied by hallucinations. In some cases the delusions relate to sexual matters, e.g. that unseen agencies at night commit abominable outrages. Or the experiences may be pleasurable, as when mystical visitations are experienced, leading to elation or ecstasy.

In other cases strange grotesque delusions develop. Thus, a youth stated that there was air in his veins and that he wanted them opened in order to let the ventricles go round. A lady who had been talking to herself explained that she had been talking to the “holy viper”; and another, without the slightest reason, accused her father of impossible and grossly indecent

conduct. It will be noticed that these delusions do not arise from an exaggeration or distortion of actual occurrences, but are the vagaries of a mind which is unable to offer criticism or resistance. No doubt the hallucinations and the delusions of dementia præcox, like dream thoughts, may be symbolically distorted representations of memory pictures and repressed wishes, but in no other mental disorder are the ideas so bizarre and so remote from the realm of ordinary experience.

As time goes on the intellectual decay progresses until a permanent state of dementia is reached. The degree of this mental enfeeblement varies greatly. A few patients are able to return to ordinary life, and some recover sufficiently to be useful members of society under guarded surroundings, but the majority sink into a low-grade dementia, and of these many need continuous care on account of their impulsive tendencies and degraded habits.

Disorders of conduct are the most frequent and the most striking symptoms of dementia præcox, and as a rule they seem to be automatic and without conscious sanction. The patient is not, however, really unconscious, but knows what he is doing, though he can give no satisfactory explanation of his peculiar behaviour. These disorders of conduct occur in great variety. They may be divided into inactive states, imitative and repetitive movements, and impulsive actions.

Inactive states may be passive or resistive. *Stupor* is common. It generally occurs early, especially in the katatonic variety, but rarely lasts more than a few weeks without modification. It may be looked upon as an incident in the development of the disease, and usually follows or precedes an attack of excitement.

The condition of a patient in katatonic stupor is remarkable. No sign of recognition is given, no interest is taken, whatever happens. The events of the day, the changes of nurses, the visits of friends, the examination by the doctor, are all unheeded, and he is apparently insensible to pain. Food is not taken unless it is placed in the pharynx, when it is automatically swallowed. In some cases tube-feeding is required to prevent starvation. The dejecta pass unnoticed, and saliva dribbles from the mouth. The patient appears to be completely indifferent to the normal requirements of life.

Many such patients are *cataleptic*. If a limb be raised it remains uplifted, and speaking generally, any attitude in which the body is placed is maintained. This condition has been termed “*Flexibilitas cerea*” and depends upon a morbid susceptibility to suggestion. More frequently the cataleptic condition is less pronounced, and though an upraised limb remains

for a short time in a constrained attitude, it slowly sinks to a more comfortable position.

Stupor is not inconsistent with intelligence, and the mind is more active than it seems. One lady suddenly startled a colleague of mine by exclaiming one morning, "Well, Dr. K——! You have got your reward!" These were the first words that an almost inanimate object had spoken for four months. On being questioned she explained that a short time before she had heard the nurse complain of the trouble involved in the tube-feeding, and that Dr. K—— had responded, "We shall have our reward some day." Similar incidents are not uncommon, and it behoves nurses and others who come in contact with such patients to be extremely careful as to what they say in their presence.

In the condition called *negativism* patients resist suggestion. If left alone they give little trouble, but when asked to do anything there is immediate resistance. They will not get up, or dress, or go out, or come in, or go to bed, without opposition; and the daily routine can only be carried out by force. Many have to be forcibly fed, though they will often take food within reach if they think they are unobserved. In like manner they take a furtive interest in what goes on, and very likely read letters or newspapers that are left about.

Mutism, the refusal to speak, is a comparatively common symptom, and may last for many years. Occasionally patients who decline to speak write excellent letters to their friends.

Refusal of food may also persist for months. One patient who recovered sufficiently to go home could not give any reason for this persistent refusal. She appeared to have no particular delusion, and was not depressed.

The refusal to get out of bed, regardless of the convenience of others or of the claims of duty, is another common symptom in the early stages.

Imitation of words heard (echolalia) or of acts performed by another (echopraxis) is occasionally observed.

Repetitive acts of various kinds are more common. Words, phrases or sentences are constantly and monotonously repeated (verbi-geration). One lady reiterated many hundreds of times a day, "I want to go out on to the wet grass," with the occasional variant, "Give me the key and let me go out on the wet grass."

All kinds of movements of the limbs or of the body may be repeated in the same stereotyped way. Thus, one patient invariably steps high with one leg when walking, another constantly rubs her hands, until corns are produced, and another, at every visit, is found dancing on one leg and at the same time holding up the opposite hand and touching the wall.

In other cases peculiar habits in writing appear. Printed matter is copied with scrupu-

lous care into manuscript books, or the handwriting becomes strange and new characters are introduced; or more commonly page after page is covered with senseless repetitions of phrases or sentences.

Mannerisms, grimaces and antics occur in such great variety that a detailed description is impossible. Many patients shake hands in a way that betrays them, extending the hand stiffly and awkwardly, and not grasping that of the visitor. Others hold themselves in some peculiar attitude, which becomes habitual. Some put out their lips and nostrils in a characteristic fashion known as *schnauz-krampf*.

Impulsive actions are especially common. Suicidal attempts are by no means rare. They do not arise out of intense misery, nor from a desire to escape danger or disgrace; but are apparently purposeless, or if any cause be assigned it is trivial. Occasionally we meet with a complete cessation of the wish to live, and the patient may, nevertheless, be well occupied and even cheerful. Sometimes, chiefly in recent cases, some vivid and overpowering hallucination awakens a blind impulse towards self-destruction.

As the malady develops the conduct of precocious demented frequently becomes troublesome in the extreme. Many are destructive, wantonly pulling things to pieces, tearing up clothes or pulling down curtains. Many are faulty in their habits, and some unspeakably perverse. Towards nurses and other patients they may be violent and even dangerous, kicking or striking in a perfectly gratuitous fashion. Needless to say, their care involves constant anxiety and endless trouble.

Physical Symptoms. Much has been written upon the physical symptoms of dementia præcox, but none of these are sufficiently constant to give much help in diagnosis. One group are the stigmata of degeneration, which may be found in any variety of mental disease as well as in the sane and healthy.

Alterations in the reflexes, irregularity of the pupils and other nervous symptoms have been observed. Dermatographia is common in katon tonic stupor. Somatic disorders, indigestion, constipation; altered conditions of the skin and hair; slow capillary circulation in the extremities; alterations in the number of leucocytes in the blood, and other signs of ill-health occur, especially in the early stages. Not infrequently, however, patients are attacked whose general health, judged by ordinary standards, is excellent and even robust. Moreover, the existence of serious mental infirmity generally alters the habits and manner of living so that some concomitant physical disability must be expected.

Pathogenesis. Very little is known of the

morbid processes underlying the development of dementia præcox. There are, however, three views as to the essential nature of the disorder, viz. that it arises from toxæmia, from structural defect, or that psychogenous factors are all-important.

Toxæmia. According to this hypothesis an endogenous toxin or some noxious agent produced by metabolic changes poisons the nervous tissues. The fact that many patients are decidedly out of health in the early stages supports this view, as does the frequency with which loss of flesh, skin disorders and abnormal sebaceous secretion occur. But nothing definite is known of any such toxic agent, and the attempts to trace alterations of glandular function have met with little success.

Structural Defects. Some authorities have observed deficiency of cortical elements and, in particular, a degeneration of intracortical association fibres. Others assume an innate instability of the nervous mechanism, which breaks down when exposed to the stress of adolescence. It must, however, be admitted that as yet no histological changes have been demonstrated which can be considered peculiar to dementia præcox.

Psychogenous Factors. In contrast to the preceding, but not necessarily inconsistent with them, is the belief that dementia præcox is largely the result of psychological causes. From this point of view, the disorder resolves itself into a failure of the mental faculties to adapt themselves to the conditions of life. The mental make-up is such that conflicting instincts instead of developing the personality, break it up, and secondary products appear in the shape of impulses and habits of an abnormal kind, unchecked by any controlling influence.

Psycho-analysis has demonstrated that the symptoms in dementia præcox can generally be traced to past experiences and repressed desires, so that the grotesque actions may be said to resemble the vagaries of dreams and hysterical symptoms in consisting of symbols of wish-fulfilments. It becomes evident that the peculiarities of this disorder are not so isolated and incoherent as they appear, but are dependent upon "buried complexes" and arise from the impossibility of realizing desires and instincts in a way that satisfies the personality in its social relationships.

It must be remembered, however, that psycho-analysis is especially difficult in dementia præcox, and though it has done much to explain the origin and meaning of symptoms, little light has been thrown upon the fundamental problems: *e.g.* why these patients cannot adapt themselves to the difficulties of life; why they react in this extraordinary way; why they, unlike hysterical and psychasthenic patients, pass into

dementia in the great majority of cases; and, lastly, why it is the rule for this to be arrested after a time and an equilibrium reached at a lower level of intelligence?

Diagnosis. In many cases it is impossible, at a single interview, to make a correct diagnosis; indeed, as Kraepelin has pointed out, it is frequently necessary to watch the course of the disorder over a considerable period. The difficulty of diagnosis chiefly appears in respect to hysteria and psychasthenia, maniacal depressive insanity, confusional insanity and paranoia.

In the early stages there may be obsessions resembling those in psychasthenic states and the impulsive conduct of patients is often thought to be due to hysteria, an explanation less apt to be resented than that of mental infirmity. But, if a careful inquiry be made into the history, the grave nature of the malady is usually perceived. In dementia præcox as a rule patients are not anxious about themselves and have little insight into their condition, whilst in the neuroses, on the contrary, emotional indifference is extremely rare.

In those cases of dementia præcox in which the symptoms remit from time to time, the difficulty of distinguishing it from maniacal depressive insanity is great. Pre-occupation, reverie, smiling without reason, dullness, the presence of faulty habits, and especially any sign of mental dissociation, and the presence of grotesque delusions, lead one to suspect the former.

In acute confusional insanity there are at the outset, disorientation and loss of memory, symptoms which appear late in the course of dementia præcox. The bodily condition is rarely good and fleeting hallucinations are more frequent.

In paranoia the delusions are more systematized than in the paranoid variety of dementia præcox, and planned acts of violence are comparatively common, whilst the appearance of dementia is longer delayed.

It must be admitted that in the absence of clear indication of mental deterioration, the diagnosis of dementia præcox is often difficult, as it is unwise to place too much stress on the mannerisms and other striking symptoms, which are by no means pathognomonic. Still, if the history be trustworthy, and if there have been opportunities for watching the case for a long time, all uncertainty generally disappears. In the early stages, however, especially when the symptoms are acute, it is best to defer giving any opinion as to the nature of the case.

Prognosis. It is stated that eight per cent. of the hebephrenic cases and thirteen per cent. of the katatonic recover sufficiently to return to home life; but very few indeed of the paranoid cases improve.

Some authorities maintain there is never complete recovery, and that dementia præcox

always leaves its mark in some defect or mental twist. A considerable number of the hebephrenic and katatonic cases greatly improve and attain mental stability on a lower plane than normal. They may lead useful lives under sheltered conditions.

But in the majority of cases the disorder progresses until an extreme degree of mental enfeeblement is reached.

It is, unfortunately, impossible to forecast the course of a particular case with any degree of confidence. Those presenting considerable mental dissociation are usually the most unfavourable; whilst acute katatonic cases, whether of excitement or stupor, frequently do surprisingly well.

Treatment. So varied are the symptoms of dementia præcox that any satisfactory discussion of its treatment involves the discussion of the treatment of all forms of mental disorder. It may be necessary to deal with sudden waves of despair, with furious excitement, with apathy, or with obstinate resistiveness.

Unfortunately, no specific mode of treatment is known, nor does success attend empirical methods of combating the various symptoms. In the great majority of cases the disorder progresses in spite of all efforts to arrest it, and it seems to make little difference in the long run whether asylum care be secured early or late, or whether special remedies, *e. g.* Weir-Mitchell treatment, electric baths, massage, gymnastics and so forth be adopted. Drugs are of little service, whilst the use of sedatives is often hurtful.

There is reason to think that careful individual treatment with frequent changes of scene tends to delay mental enfeeblement, and that the re-education of patients already demented is possible to a certain extent. On the other hand, not a few patients deteriorate progressively until intelligence completely vanishes in spite of devoted and unremitting care.

In the few cases reported, psycho-analysis seems to have had no therapeutic value. Some cases of improvement after the administration of thyroid extract and other preparations of animal tissues have been recorded; but, although these have been extensively used, this line of treatment has proved very disappointing.

At present, therefore, we can do little more than provide good hygienic surroundings and ensure careful nursing and supervision, whilst trying in every possible way to awaken fresh interests in life.

Few diseases are more discouraging to the physician; few more costly to society. B. P.

INSANITY AND ALCOHOLIC INTEMPERANCE

The frequent association of alcoholism with insanity is shown by the statistical tables of

the Lunacy Commissioners, from which it appears that alcohol was assigned as a cause of the insanity in 22.1 per cent. of male and 8.7 per cent. of female patients admitted into asylums in England and Wales during the years 1907, 1908 and 1909, while in five per cent. of all cases of insanity there was found to be a family history of alcoholism. The incidence appears to be greater in the pauper than in the private class and in both classes greater in men than women. Intemperance may be the expression of inheritance of an unstable nervous system, and undoubtedly in some cases where insanity has been attributed to the effects of alcohol, intemperance has been merely the first symptom of mental disorder. The report of the inspector under the Inebriates Act for 1909 shows that of 800 women admitted to reformatories at least 436 of the parents were either insane, epileptic or inebriate, while the tables of the Lunacy Commissioners show that of the average number of patients admitted to asylums where alcohol was attributed as a cause twenty-seven per cent. of men and thirty-one per cent. of women had a family history of insanity, epilepsy, neuroses, eccentricity or alcoholism. In private practice I have found this percentage as high as forty-six. Again, a very large proportion of women admitted under the Inebriates Act are found to be defective in mental capacity. In estimating the importance of inherited tendency in the production of alcoholism the factor of example and environment generally must not be overlooked. Undoubtedly many acquire in childhood, by example, the habit of taking alcohol to excess, and in others defective care and insufficient education as to the dangerous effect of alcohol, or a life of excitement in which alcohol is taken for pleasure or to "stimulate" or soothe a tired nervous system, lead to disaster. The effect of alcoholic excess on the nervous system varies greatly in different individuals, some being able to take large quantities for years without damage, although perhaps at the same time the vascular, renal, gastric or hepatic organs are seriously affected, while in others the nervous system will be injured by comparatively small quantities and other organs be almost unaffected. Dr. Mott has drawn attention to the infrequency with which cirrhosis of the liver is found in those dying of insanity the result of alcoholism.

Alcohol may act as a direct poison and cause an acute toxic insanity, or may act indirectly by inducing degenerative changes in the brain and nervous system and other organs and so lead to chronic mental disorder.

Although drunkenness is not technically looked upon as insanity, yet the law in some respects regards the drunken person as insane.

He cannot while drunk make a valid will or enter into a binding contract and, if violent, he may be excused from having had evil intention.

It is not necessary to consider the form of acute alcoholic poisoning of the mind known as drunkenness, further than to say that one man is drunk and disorderly, another is drunk and incapable or even "dead drunk," one is maudlin and depressed, another is talkative, boastful and excited, and another simply fuddled and stupid, and that these differences are reflected in the various forms of alcoholic insanity.

1. Of the acute insanities from drink the first and most familiar is **Delirium Tremens**, an acute toxic insanity coming on in the chronic drinker often conditioned by trauma or other acute illness, occasionally febrile and characterized by marked tremor, insomnia, busy delirium with very active hallucinations of sight and hearing associated with terror, incoherent chattering or shouting, disorientation of time and place, and violent struggling and resistance to food and other attentions, often leading to exhaustion. The patient, if neglected, may commit suicide either accidentally or purposely. As the attack usually subsides in a few days under treatment at home or in a hospital, asylum care is not often needed, but may be necessary if there is great violence or danger or if the attack does not pass off in a few days but continues, as it may do, into an insanity lasting some weeks.

2. Closely allied to delirium tremens are cases of **Acute Delirium** from alcohol. In such cases the attack begins with confusion of mind, restlessness and insomnia, and there is often some rise of temperature. There is frequently gastritis and temporary albuminuria. The speech becomes incoherent and there are hallucinations of the various senses, especially of sight, hearing and taste, without, however, the characteristic terror of delirium tremens and with much less tremor. Disorientation is marked, refusal of food is common, the tongue becomes dry and brown, the pulse feeble and rapid, there is loss of control over bladder and rectum, and prostration which may end in coma and death. The course is not short and rapid like delirium tremens, but may continue for some weeks, recovery taking place slowly. In some cases the acute delirium is found to be associated with peripheral neuritis, and is then the forerunner of Korsakoff's disease (*q. v.*).

3. Another acute alcoholic insanity of great medico-legal importance is **Acute Transitory Mania**, or "mania à potu." The individual after perhaps a comparatively small quantity of alcohol becomes quarrelsome, angry, impatient of the least opposition, pugnacious, violent, destructive and homicidal. He raves and struggles in blind fury, and consciousness is

profoundly affected, so that when the attack has passed off, perhaps in a few hours, the patient has no knowledge or perhaps only a blurred memory of his conduct, and may find that he has sustained an injury or has committed a homicidal act which he cannot remember.

4. **Acute Insanity** from alcoholism may arise in those who have been drinking for a longer or shorter period, and may take either the form of maniacal excitement of varying degrees of intensity or of melancholic depression. The maniacal states, however, are the more common. Chronic drinkers are liable to have attacks, in which a gradually increasing irritability leads to excitement, **insomnia**, hostility to those about them, often ending in impulsive violence or destructiveness or an impulsive suicidal attempt. Hallucinations and delusions may arise, with a varying degree of confusion and incoherence, and there is total inability to follow occupation. Such attacks may quickly pass off if the patient can be restrained from taking alcohol, and even if sufficiently bad to be certified as insane he may rapidly recover but remain resentful and litigious about the steps which have been taken for his care.

In other cases, however, the excitement is sufficiently intense to justify detention for some months, and is accompanied by insomnia, incoherence, hallucinations and confusion of mind. In many there is great exaltation of ideas, at first suggesting the early stage of general paralysis; but in purely alcoholic cases the pupils act to light and are rarely unequal, the speech, although blurred, has not the characteristic affection of general paralysis, the tongue and face show only fine tremor, the writing, though tremulous, does not show defects in spelling or omission of letters, the knee-jerks, if altered at all, tend to diminution rather than exaggeration. Hallucinations are far more common in alcoholic insanity. Moreover, with abstinence from alcohol the disorder is commonly recovered from, whereas general paralysis is progressive and is almost invariably associated with a previous history of syphilis. Almost all acute alcoholic cases are resentful of control, being among the most troublesome cases in asylums, and apt to be litigious on release and to relapse on returning to former habits. In some cases, however, an acute insanity from alcohol is such a severe warning to the patient that he becomes an abstainer.

If the attack be one of mental depression it is most likely to be accompanied by suspicion, especially as to the fidelity of husband or wife, and by ideas of persecution which are based on hallucinations. The impulsive suicidal tendency frequent to all alcoholics is especially likely to be present where there is mental depression.

5. **Chronic Delusional Insanity** often results from chronic alcoholism. In such cases the mental disorder, although it may assume any of the groupings of delusions of persecution is often of the "physical persecution" type, the patient believing himself to be electrified, X-rayed, "pumped up," murdered or drugged. The paræsthesiæ resulting from changes in the peripheral nerves or cortex are misinterpreted by the patient, hence illusions and hallucinations of all senses are especially prominent. Such patients are likely to be hostile and dangerous to their supposed persecutors. Although there may be remission at first with abstinence from alcohol, the disease eventually becomes chronic.

6. Many alcoholics pass into **Chronic Dementia**. The soaker who is, as it were, constantly hardening his brain in alcohol may suffer from a gradual onset of dementia without passing through any of the acute psychoses from drink. His memory gradually becomes enfeebled, his business capacity diminished, he is neglectful of all duties to himself or his family, becomes untidy, dirty, untruthful and degenerate, his moral sense being entirely blunted. He will do anything to get more drink. Eventually he is totally unable to manage himself or his affairs and is likely to have to pass the end of his life in an asylum and demented. He degenerates physically as well as mentally, he may suffer from epileptic seizures, his gait is enfeebled, his speech tremulous, his expression vacant, his knee-jerks diminished, his arteries and kidneys and, perhaps, his liver diseased, but he remains mentally a chronic case instead of progressing as does the general paralytic. In other cases dementia supervenes after one or several acute attacks of insanity.

7. **General Paralysis of the Insane** is often associated with a history of alcoholic excess.

8. **Dipsomania** is a recurrent condition of defective will-power associated with a craving for alcohol, and not a true alcoholic insanity, although it may result in it.

Treatment. In all cases abstinence from alcohol is essential, but in some cases of delirium tremens or other delirious states a certain amount of alcohol may be necessary if there are signs of cardiac failure. Otherwise cutting off the supply of alcohol and the constant supervision of skilled and reliable nurses is essential. The treatment of the maniacal, melancholic, delusional or demented states is otherwise the same as in insanity from other causes. In most cases only the enforced detention and abstinence from alcohol which are possible in asylum care will result in recovery, but as the law does not permit of compulsory detention of the drinker against his will until he becomes definitely insane, many patients are irretrievably damaged before they can be thus treated.

R. P. S.

CHRONIC DELUSIONAL INSANITY (PARANOIA)

This form of insanity is characterized by the predominance, in the fully-developed disease, of disorder of the intellect in the direction of fixed delusions, which become organized or systematized so that the whole life of the patient is dominated by them. The onset is as a rule gradual, the progress is slow and ends in chronic insanity. As emotional disturbance is not prominent in the developed disease, this condition has been regarded as a primary intellectual disorder in contradistinction to the more acute psychoses in which emotional disturbance is marked.

If, however, the early history of such cases is inquired into, it is found that the delusional state has developed upon a basis of hypersensitiveness in which there has been a tendency to the association of deep feeling-tone with circumstances which would not similarly affect normally constituted individuals. In those who subsequently develop fixed delusions of persecution, the temperament has commonly been one in which the patient has been specially liable to feel acutely any slights or reverses or failures in his projects, to meet trouble half-way and to be on the look-out for insults, while in those in whom the final state is one of fixed delusions of exaltation there has been often a buoyant, conceited and self-satisfied or grandiose frame of mind. In some groups of cases sexual feeling often perverted into abnormal lines has been the basis. Many cases also have a history of stress, perhaps lasting for years before delusions are evident. The term "Paranoia" was originally applied to denote primary intellectual disorder, emotional disturbances being regarded as secondary, but its meaning was gradually extended so that eventually it included on the one hand such borderland cases as faddists and cranks of all sorts, obsessions and imperative ideas, and on the other such conditions as acute hallucinatory confusion, "delirium acutum," and alcoholic delirium tremens, which were looked upon as examples of "Acute Paranoia." It has been recognized more and more that there can be no hard-and-fast lines between intellectual and affective psychoses, and that undoubtedly some cases of chronic delusional insanity follow an acute psychosis of the "affective" type. The term "paranoia," if used at all, should in the writer's opinion be limited to cases of chronic systematized delusional insanity, whether of the depressed or exalted type, and whether originating by gradual onset or after an acute psychosis. The synonymous term "intellectual monomania" has become obsolete.

Etiology. Neurotic or insane inheritance has been present in fifty-five per cent. of my cases. It is more common in males than females, and I have found the average age of incidence to be forty, being slightly higher in females. The cases beginning in adolescence formerly included in this group are now usually classified as instances of the paranoid variety of dementia præcox. It may develop at one of the crises of life, such as parturition or the climacteric, and occasionally appears first in old age. It may result from alcohol, syphilis or other constitutional disease, chronic renal disease, chronic deafness, and occasionally from epilepsy or organic brain disease. A history of former attacks of mental disease is rare, but occasionally there has been a remission of symptoms and apparent recovery for a time, or at the onset there may be an acute affective psychosis. In males there is often a history of masturbation.

Symptoms. The disease is usually described as presenting (1) an incubation period; (2) a period of insane misinterpretation; and (3) a stage of fully developed delusions which become systematized and fixed.

In the incubation period the patient is shy, solitary, mistrustful, retiring, sensitive and perhaps hypochondriacal. Gradually he misinterprets the motives of those associated with him, and endeavours to explain his painful feelings or non-success in life by assuming that others are hostile to him. His sleep is disturbed or he dreams of hostility or opposition, and is apt to confuse what he dreams or imagines with real experiences. The attitude of expectancy leads him to be on the look-out for slights or insults, he thinks that gestures or remarks or glances not intended to refer to him are meant to annoy him. He easily misinterprets what is said or what he sees, so that illusions of the senses develop, though hallucinations are rare in the early stage. He becomes more and more suspicious, and thinks that what he observes indicates a widespread plan to do him harm. He may still be following his occupation and keep his ideas to himself, so that it is difficult to get him to confide his suspicions to any one or to certify him as insane. His conduct may betray his condition, one of the more common indications of suspicion being a tendency to change lodgings or residence so as to avoid the neighbourhood of those whom he suspects, or he may write letters or postcards which show his mental state, or appeal for protection to the police. Occasionally in this stage he may strike a blow or make an attempt at suicide. Meantime, external expression of emotion may be suppressed, the memory good, the speech coherent, the patient's knowledge of his affairs and his capacity for

transacting his business normal, his volition, where not interfered with by his erroneous judgments, unaffected. If the disorder is to develop from the beginning into the exalted type, the patient, instead of being shy and suspicious in the incubation period, will probably be boastful, full of the importance of himself, his family, his capacity, his inventions or his mission in the world, and may attempt to gain audience from exalted persons. If of the amorous type, there will be longing towards a person of the opposite sex. The earlier stages may cover some years. When chronic delusional insanity is fully developed, the type of delusion may be divided broadly into two groups, the depressed and the exalted, each being subdivided.

1. *Depressed Group.* The majority of these cases are those marked by delusions of a persecutory nature. The patient has become convinced that his early suspicions are based upon fact. He develops the belief that there is a plot against him to injure his character, health, life, honour or property, by imaginary enemies. Sometimes the enemies are his own immediate relatives, but more commonly some body of people, for instance the police, detectives, spies, political parties, freemasons, secret societies, anarchists or religious bodies such as Jesuits or clergy. The patient is always on the watch for indications confirming his delusions, he infers that paragraphs in the papers refer to his case, people in the street seem to follow him, he expresses himself as being "dogged" and watched, mocking remarks are heard, people cough at him or spit or make indecent gestures as he passes. Birds and railway whistles seem to have special reference to him. Other patients or chance passers-by are regarded as enemies and their identity is often mistaken. His food appears to taste as if poisoned or to look as if poisonous dust were flicked on to it. He may have it analysed to verify his ideas. Voices may call him thief or masturbator or accuse him of sodomy or other crimes. He looks out for signs in the sky or elsewhere. He complains that slanderous reports have been spread about him, or that he is insulted or libelled and blackmailed. Other people seem to read his thoughts or to mesmerize him. His thoughts seem to be audible, he may complain that he "cannot get his thoughts silenced," that they are known to others or are controlled by others, or that he has "articulated thought." He thinks he is "snapshotted" and hunted; he may imagine he hears shots fired.

Delusions of physical persecution form an important group. In these cases the enemies appear to the patient to persecute him by various machines or apparatus. He speaks of

being "machined" by mechanical or electrical appliances often worked from underneath his bed at night, and by which he imagines his genitals to be torn, his spine dislocated, his head crushed, his bowels stopped up or removed, and his body brought to a state of wreckage or mutilation. Sometimes the apparatus appears to be one for causing intense heat at night, the smell of the "battery" may be complained of and the voices of the operators and noise of the apparatus heard. In other cases offensive or poisonous gases seem to come through tubes. Such cases are often alcoholic in origin, but the same condition may occur independently of alcohol.

In some persecuted cases the patient is markedly hypochondriacal, and may have delusions as to his internal organs, attributing their condition to the action of enemies or to drugs administered unknown to him.

Delusions of sexual persecution are not uncommon in women, sometimes developing at the climacteric, the patient believing that she is "tampered with" or raped at night when under the influence of drugs or chloroform, or that by electrical or hypnotic influence the sexual organs are thrown into a state of excitement from a distance. This may be associated with hallucinations of hearing of an indecent type. In men there may be delusions that the genitals are interfered with or mutilated at night. Such patients are often very dangerous.

Delusions of jealousy may arise in either sex, in men advancing in life or in women at the climacteric, with fixed belief that the partner in life is unfaithful. This may also arise from alcoholism or as a post-connubial insanity. The patient will watch for signs which seem to confirm the idea of neglect, and there may be hallucinations and perverted sexual sensations.

All patients suffering from delusions of persecution are liable to be homicidal, and they are the more dangerous that their general conduct often does not betray their condition until the act is committed. The patient may for a long time await his opportunity if he has fixed upon the individual whom he supposes to be the centre of the conspiracy against him. Suicide may also result from the misery the patient experiences at being unable to escape his persecutors.

2. *Exalted Group.* Fixed delusions of exaltation may arise by transformation from delusions of persecution in about one-third of the cases. Sometimes this occurs gradually, in other cases suddenly, the patient assuming a haughty and "royal" demeanour and demanding instant obedience to his orders. Delusions of exaltation may, however, arise primarily or concurrently with delusions of persecution, the patient gradually believing that he or she is divine, or

of royal or aristocratic descent, or the possessor of a title, or is an emperor, king, queen, prince or prophet, deprived of his rights.

In another group the exalted delusions are of religious type. A life of religious contemplation is sometimes followed by delusions as to the relationship of the Deity to the individual; the patient becomes "God's chosen servant," who is to be exalted at the expense of those who are persecuting her. Special revelations appear to be received by auditory hallucination. The "bride of Christ" may mix sexual thoughts with her religious exercises, and believe that Christ speaks to her or has sexual relationship with her. Hallucinations both of hearing and sight are constant in such cases. One patient told me of frequent sexual intercourse with the Deity, and consequent imaginary pregnancy.

In "erotic paranoia," which occurs chiefly in women, the patient fixes upon some person of the opposite sex whom she imagines is in love with her or has made some advances or paid special attention to her. Very often she has never spoken to or does not personally know the individual, who may be a royal prince in a foreign country. In such cases she may believe that some communication has been made (hallucinatory) from a distance, and that marriage is prevented by enemies. Very often, however, it is a clergyman or a doctor known to the patient who is the object of affection and who is totally unconscious of the fact. In such cases remarks made in the pulpit are applied personally, and she is always on the look-out for some symbolic indication that her affection is returned. The clergyman may be pursued to his vestry for frequent conversation, the doctor to his consulting-room, the lawyer to his office for repeated consultations on trivial matters. The patient seeks every pretext for meetings, and perhaps begins to write letters or to speak of the attachment or even of impending marriage to others. The rudest rejection does not convince the patient of her error, and eventually the persecution becomes intolerable. In similar cases in men the patient may leave his wife and family to pester some lady far above his social status with his attentions.

The last group to be referred to is that of "querulants" or litigants. In these cases the patient commonly has had some slight real grievance to begin with, in which he has suffered some detriment for which he applied for legal redress. The result not having been to his satisfaction, he begins to pester magistrates or judges, nearly always conducting his case personally, and being convinced that his views and his methods are the only right ones. He may squander money in printed statements of

his case which he distributes broadcast. He is egoistic and conceited, and cannot see the other side of the matter; he may have delusions as to his importance, and may give himself a title such as "Chancellor of English Law." Homicidal tendency may develop if the patient finds he gets no redress from the law. It is not always easy to certify these patients as insane, and when under care they continue their methods, constantly writing to the authorities and to committees and demanding special personal interviews at great length.

Treatment. Cases of chronic delusional insanity can only be safely cared for when treated as insane and detained under certificates. The danger of homicide is always to be remembered in the persecuted cases, and short of this the patient's condition may render him unfit to follow his occupation, or his delusions may cause him to persecute others in various ways, as shown above. The disorder when fixed and organized is incurable, but is compatible with good general health and long life in asylum care. No medicinal treatment is of use. R. P. S.

DELIRIUM

Delirium may be shortly defined as a disturbance of consciousness. The ordinary mental reaction to external stimuli is interfered with and, if the patient drifts into a state of coma, completely abolished. As a rule, however, the consciousness is merely clouded. The power of attention is lessened, the memory, especially of recent events, fails, and there is general mental confusion and incoherence. Usually the patient has no idea where he is, and he may in addition suffer from illusions and hallucinations. There is often also considerable motor unrest.

Delirium is usually the result of toxæmia. It is caused by various forms of poisons, among which may be first mentioned, as most important, the specific toxins of the acute infectious diseases. It is possible that the pyrexia usually associated with these fevers plays some part in assisting the production of the condition, but it must nevertheless be remembered that in the apyretic types of enteric fever and of influenza, delirium may be very well marked. The toxins of these diseases are therefore capable of causing delirium without the assistance of elevated temperature. Other poisons, notably alcohol, cause delirious states, and in this connection may be mentioned belladonna, salicylates, bromides, choral, morphia and cocaine. Delirium may also occur in states of profound exhaustion and wasting, after severe loss of blood, after epileptic convulsions, and in the course of chorea. It is met with also in diseases which affect metabolism, such as uræmia and

diabetes. It is present in some cases of cardiac insufficiency, and seems to be readily produced in the aged by any acute disease. Children also are liable to become delirious when the temperature has been moderately raised by almost any trivial cause.

Patients may be extremely delirious and yet, post-mortem, nothing is to be detected in the brain. The functions of the brain cells suffer without damage to their structure. A similar state of affairs is noted in the condition known as "meningism," in which the sufferer has symptoms of meningitis such as strabismus, inequality of the pupils, head retraction, a cerebral cry and so forth, and yet presents no definite post-mortem lesions. Toxins therefore are capable of poisoning cells connected with both intellectual and motor processes, and in both instances want of co-ordination and of inhibition seem to be the outstanding results.

The delirious forms of insanity are considered elsewhere. In ordinary practice delirium is likely to be met with in one of three forms, the excited type, the low muttering type or the alcoholic type (delirium tremens). These may now be described.

1. **Excited Delirium.**—This is more likely to be observed in the early stages of some of the fevers and as the result of certain drugs. The patient becomes restless and excited and often wishes to leave his bed. He talks loudly and incoherently and has no correct idea of his surroundings, or else, appreciating perhaps the fact that he is in hospital, is persuaded that he ought to be carrying out his ordinary avocations at home. Often he has definite delusions regarding the nature of his surroundings, the identity of his nurses, and so forth, and will sometimes give quite logical reasons for desiring to get out of bed and go elsewhere. The face is usually flushed and the eyes somewhat wild. The patient can often control himself for a few minutes at a time and answer questions fairly coherently. A particularly intense form of excited delirium is the so-called **delirium ferox**, not infrequently seen in typhus fever, and more rarely in other conditions. The excitement is in this case maniacal, and it is almost impossible to control the patient, whose strength seems to be absolutely supernatural. He is irritable, suspicious, and a source of danger both to himself and others. He resists furiously any attempt to keep him in bed or to give him medicines, and is very likely to assault his nurses or to throw himself from a window. The condition may last two or three days, but often before that time has expired the patient has drifted into a state of low muttering delirium or actual coma. Delirium ferox is only apt to occur in the early days of an acute fever before the toxæmia has caused prostration. It is most

often observed in male alcoholic subjects and may be regarded as of fatal augury.

2. Low Muttering Delirium.—This, sometimes called "typhomania," is perhaps the most common type of delirium. It is frequently met with in the acute fevers, and is often associated with profound prostration and with the condition known as the "typhoid state." The patient is not very restless, that is to say he shows no particular desire to leave his bed. He lies quietly enough, usually upon his back, and mutters incessantly to himself. His motor unrest is evidenced rather by such signs as subsultus tendinum and by picking at the bed-clothes, and more rarely there may be considerable tremor and occasionally choreiform movements. His talk is incoherent, but sometimes seems to refer chiefly to some particular subject which worries him. Thus broken sentences may suggest that he is concerned about his business, his profession or his amusements. He is quite heedless of his surroundings, except that occasionally some external stimulus may give a new direction to his incoherent ramblings. He is often able to collect himself sufficiently to attempt to put out his tongue when asked. Some patients seem to suffer from intense mental anxiety and distress, and many unquestionably have hideous dreams and imagine that they are undergoing dreadful experiences. Usually there is little or no recollection afterwards of the thoughts and illusions which haunted the patient during his fever, but some are able to give picturesque accounts of the horrors which they experienced during their delirium.

3. Delirium Tremens.—In many fever patients who have been in the habit of indulging too freely in alcohol the delirium takes this particular form. It usually sets in early, often after one or two sleepless nights. The patient is not as a rule wildly excited or violent. He is often extremely talkative and may be quite logical in his conversation. He cannot, however, discuss one subject for long, changing his topics constantly. He is always restless, and usually anxious to leave his bed and to engage in his ordinary pursuits. He suffers from illusions and hallucinations, and is particularly liable to see things crawling in the room, snakes, rats and mice being particularly complained of. He is often suspicious, and may object to take food or medicines. He is never still, his hands constantly moving, and tremor is a well-marked symptom. His tongue, in particular, is always tremulous, and he often grasps at imaginary objects.

All forms of delirium are apt to be first noticed at night, usually in the intervals between sleeping and waking. During the day, especially in the early stage of illness, the patient may be quite sensible and coherent. Insomnia plays a con-

siderable part in the causation of delirium, which is not very likely to be well marked in patients who sleep well or who are given suitable hypnotics. It must be remembered that many patients who are apparently free from delirium, and who can talk coherently and apparently rationally, have no recollection afterwards of their illness, their consciousness being to some extent clouded, if not actually deranged. Others, again, who show no sign of active delirium suffer from definite delusions, which they are sometimes able to discuss quite rationally.

Management of Delirium. A few words on the management of these disturbances of consciousness may not be out of place. In the first place, much may be done in the early stages of fever in the way of securing an adequate amount of sleep for patients. No fever patient should be allowed to be sleepless for two consecutive nights, and in the case of an alcoholic subject it is well to take no risks but to administer a hypnotic as soon as he comes under treatment. Much subsequent trouble is saved by early treatment, as insomnia is apt to become almost intractable. When delirium is declared, provided a reasonable amount of sleep is obtained, drugs are unnecessary unless the patient is very restless when awake. If, however, he is constantly trying to leave his bed it may be necessary to think of mechanical restraint, although this should be avoided at all costs if at all possible. A judicious nurse can often succeed in quieting an unruly patient, and in some cases it may be permissible to allow him to walk about the room or ward, if he takes the fancy, until he gets tired of it. This is probably better than the struggle which so often follows an attempt to tie him down. In delirium ferox, however, the safety of both patient and nurses must be considered, and strapping down is the only possible treatment.

It is important to examine daily the bladder of a delirious patient. The calls of nature are often neglected, and an over-distended bladder, with resulting incontinence or retention of urine, is a probable result. Nurses should be instructed to give the patient frequent opportunities for micturition. Again, delirious patients do not ask for water, and even the well-trained nurse will find difficulty in forcing sufficient upon him. Yet nothing combats the toxæmia and reduces the delirium so efficiently as large supplies of cold water to drink.

As regards drug treatment the indications will differ in different cases. In delirium tremens chloral and bromides are often the most efficient remedies. In excited delirium the writer has had most success with sulphonal, 25 gr. for an adult, given in the late afternoon, and supplemented if necessary about four hours later by full doses of paraldehyde pushed

until the patient is asleep. The advantage of sulphonal is that, though its action is often much delayed, it will usually secure a quiet day afterwards, and it also makes the patient more easily controlled, even if he sleeps but little. Hyoscine injections are very useful in some patients but absolutely fail in others. The great requisite in all cases is prompt treatment with a view of securing sleep. To wait to see if a patient will sleep is to lose valuable time and to make treatment more difficult.

C. B. K.

HYSTERIA

The discussion of hysteria is for the moment rendered difficult by the state of flux in which medical opinion finds itself on the subject. The very title of the syndrome of symptoms constituting the affection has had considerable scorn poured upon it, but no one has hitherto suggested a better, while it is strange that there is now distinctly a tendency, initiated by Freud and his school, to revert to an explanation which assigns to most cases a sexual origin. Up till a few years ago the borders of hysteria were constantly enlarging, and innumerable affections, some functional and some now known to be organic, were placed within this category. Beside the paroxysmic phenomena there were described disorders of motion, simulating every form of organic palsy; contractures occurring about joints or in such muscles as the diaphragm or the recti abdominales; spasms, tremors, clonus and choreiform movements; disorders of sensation, hyperæsthesiæ, paræsthesiæ and anæsthesiæ; limitation of the field of vision, achromatopsia, subjective sensations referred to any part of the body and pain; polymorphic disorders of the gastro-intestinal, cardio-vascular, respiratory, urino-genital and nervous systems; skin affections; joint affections; pyrexia, gangrene and mental symptoms. Indeed, so many have been the organic affections which hysteria has resembled, that it earned in the days of Charcot the title of "*la grande simulatrice*."

Along with this prodigious catalogue of symptoms, which we have only attempted to outline, the anatomical and clinical-pathological findings have been meagre and discordant. Some investigators have sought to ascribe the paroxysmic phenomena to insufficient phosphatic excretion. Others have supposed defect in the internal secretions of certain glands or in their ill-adjusted interaction with the secretions of other similar glands. Anomalies in the fibrin content of the blood have been described, while defect in metabolic processes resulting in endogenous poisons has been suggested by certain observers as an efficient cause in some cases. Anatomical alterations in the brain have been reported, and improper interrup-

tions between neighbouring neurons surmised. Investigations and conjectures such as these have, however, resulted in findings so discordant and so seldom confirmed by further research, that but very little reliance can be placed upon them.

The conception of hysteria which dominated medical opinion during the last half of the nineteenth century was that the multiform physical states found in the syndrome were of the very essence of the disease and not merely adventitious manifestations. In this way arose the extensive symptomatology referred to above, in which symptom piled upon symptom resulted in descriptions almost conterminous with the entire field of organic disease. By a gradual transition the conception of hysteria has passed from the attribution of its morbid phenomena to organic somatic disease to regarding it as a neurosis, as a psycho-neurosis, and finally to a position in which it is considered as a pure psychosis. Hovering between the neurotic and psycho-neurotic explanations we find hypotheses incriminating the dynamics of the nervous system and suggesting undue excitation and undue inhibition of cortical and sub-cortical reflexes, with the consequent production of a dissociation among the cerebral functions. Grasset, in particular, expounded the theory of a separation of inferior centres from communication with those superior. By an almost natural transition appears the explanation of Pierre Janet, who has defined hysteria as a "psychosis belonging to the group of maladies due to cerebral insufficiency; it is, above all, characterized by moral symptoms, of which the principal is an enfeeblement of the faculty of psychological synthesis." Elsewhere Janet has defined hysteria as "a form of mental depression characterized by the retraction of the field of personal consciousness and a tendency to the dissociation and emancipation of the systems of ideas and functions that constitute personality."

Many authorities ascribe the symptoms to "suggestion" coming either from others or from the patient's own self, and they affirm that such phenomena as anæsthesia or dyschromatopsia are occasioned by medical examination. According to M. Babinski, who has suggested pithiatism as a title for the affection, "Hysteria is a psychic state rendering the subject who finds himself therein capable of auto-suggestion. It is manifested chiefly by primary troubles and accessorially by secondary troubles. That which characterizes the primitive troubles is the possibility of producing them by suggestion with rigorous exactitude among certain subjects and of making them disappear solely under the influence of persuasion. That which characterizes the secondary troubles is that they are strictly subordinated to the primary troubles."

As a corollary to this definition it may be laid

down that the symptomatology of hysteria has been unduly enlarged to include phenomena which have been sought for by the physician and by his search have been suggested to the patient. But though it may be conceded that hyper-suggestibility is a marked characteristic of hysterical individuals, it still remains to be explained why some persons are so peculiarly liable to those sorts of suggestion which appear to issue in morbid phenomena, often apparently remaining at the same time refractory to the influence of all that which would suggest conduct conducive to good health. So marked in some cases is the auto-suggestibility of hysteria, and so readily are symptoms mimicked, that it has appeared to some authorities that the affection should pass into the category of mythomania. Hysteria has indeed cast its net over so wide a field that it has been made at times to include that variety of delusional insanity which goes by the name of hypochondriasis and at the other extreme the mere manifestations of an exuberant emotional temperament. That there are persons who manifest psychic unsoundness by fantastic lying is undoubted, and that the central point round which some weave their stories may be the physical derangement of their own bodies is certainly true, but we do not believe that any useful purpose is served by further complicating the discussion of an intricate problem by placing such morbid manifestations within the category of hysteria. They fall without this syndrome and may well be placed in other groups. The last of the innumerable explanations of hysteria with which we have to deal is the one advanced by Breuer and Freud, and which merits special attention. According to these authors hysteria is due to an affective disturbance which for some reason did not find a normal mode of expression at the time of its occurrence. It is further alleged that the disturbance is always of sexual origin, and it is curious in this connection to recall the etymology of the term hysteria and the classic aphorism "*nubat illa et morbus effugiet.*" At times the initial emotion, bereft of adequate expression, continues for a longer period than is normal and so interferes with the personality of the patient that the ordinary avocations of life are difficult or impossible. With other persons the emotion appears to sink into obscurity, though it in fact preserves an existence apart from the ordinary course of the patient's thought and tends to produce a disorganization in consciousness, eventuating perhaps in hypnoid states or in dreamy melancholy or, by a process of conversion, giving rise to various abnormal somatic phenomena. In yet other cases the disorganization seems to produce a movement of the will towards freeing the patient from the results of the original

disturbance, so that attitudes are taken up by the body which may be supposed to be those which it would naturally assume to avoid damage; or fixed ideas and various phobias evolve which might be supposed to prevent a repetition of the circumstances favouring the occurrence of the disturbance and which indeed indicate the source of the original emotion. That psychic trauma is in certain cases a cause of hysterical phenomena can hardly be doubted, but the theory can nevertheless be scarcely held entirely to cover the etiological field. Psychic trauma is frequent enough, and few escape for long that which in common language goes by the name of shock and which is held to constitute a sufficient cause in those cases in which certain groups of symptoms subsequently develop. Such causes produce, however, not only the symptoms usually associated with hysteria, but also those forming the syndrome of psychasthenia, and whether the one or the other set of symptoms occurs, it appears almost certain that the individuality of the patient will determine whether they shall appear at all or, if appearing, which form they shall assume.

Some short consideration of the hysterical temperament may at this point be useful. The patient, in the vast majority of cases of the female sex, presents much evidence of emotional and mental instability and an inability to keep her emotions in order. Readily roused to laughter or tears, the patient's manifestations of joy or grief are absurdly exaggerated, last too long, and are abated with difficulty, or not at all, until the patient is exhausted. As a rule these emotional manifestations are aroused by the patient being thwarted in doing something she wished to do or in being compelled to do something she did not wish to do, while their character is such as to attract the attention and sympathy of the bystander. It is rare to find hysteria among women who take a due amount of interest in those about them, whilst it is an outstanding feature of the character of the hysteric that she rarely thinks of any one except herself.

The hysterical seizure or fit may conveniently be divided into three stages, the pre-convulsive, the convulsive and the post-convulsive. In the pre-convulsive stage there may, according to the individual character, be irritability, logorrhœa and excitability, or, on the other hand, the patient may become doleful and complaining that nobody understands her or that there is no one to love her. There may be, in addition, such prodromata as palpitation, hiccough, nausea, tremor or muscular spasm. A feeling of heaviness or weight may commence in the epigastrium and appear to the patient to pass upwards to the throat and on arrival there to produce sensations of strangulation. These

various phenomena pass rapidly into the convulsive stage. At first there may be a tonic condition, in which the patient is stiff and of congested facies, but this is soon succeeded by a clonic phase, in which there are large, disordered and rapid movements of the limbs, and during which the patient appears to be in imminent danger of doing herself a hurt, but in which, in fact, she never does come to grief. In this stage there may be a certain degree of attitudinization with expressions of joy, terror, love or ecstasy. After a varying time the movements gradually cease and the patient appears to reawake to her surroundings, though it should be remembered that it is but rarely that a patient so entirely loses consciousness as to have no recollection of what has been going on. In addition to these hysterical outbursts there may occur, as more lasting evidences of the affection, one or more of the symptoms mentioned above, palsies, contractions or alterations of sensibility. Some of these are doubtless due to suggestion emanating from others, while some can only be ascribed to "auto-suggestion," this term apparently covering the unconscious invention of whole series of symptoms.

We have, then, in hysteria a predisposing turn of character, and in those who present such idiosyncrasies of temperament it is a matter of small surprise when we find certain temporary manifestations which may simulate a large number of maladies. From these diagnosis is by no means always easy, and it is to be borne in mind that organic disease of the nervous or any other system is not infrequently accompanied by functional symptoms which may distract the physician's attention. Whatever the system affected it must be remembered that in many cases the symptoms are the immediate sequel of some emotional disturbance or are exacerbated thereby, and that they do not conform to the types we are learning to associate with the various organic diseases. Let us, for example, take a few of the salient features of an organic hemiplegia and compare them with the features that may obtain in a functional hemiplegia. In hemiplegia of organic origin movements of the face do not occur when the ordinary synergic actions are performed: when the patient smiles he smiles with one side of his face only. In hemiplegia of functional origin, although voluntary movement on one side of the face may be totally abolished, synergic movements are very likely to be perfectly performed. The patient suffering with organic hemiplegia, when lying on his back he is told to raise the sound leg from the bed, cannot steady his body by that stiffening of the flexor muscles of the affected leg which would occur in the normal individual and which applies the

leg to the surface upon which it is; the functional hemiplegic uses the paralysed leg in the same way as does the normal individual use the leg which he is not raising from the bed. In the organic hemiplegic the reflexes are, except during the first few hours of a palsy of rapid onset, increased, and clonus and the extensor-plantar reflex will be present; in the functional hemiplegic the reflexes are often not increased even in the presence of a high degree of rigidity, while no true clonus is present and the normal flexor-plantar reflex is elicited. The symptoms in the case of the functional hemiplegic are often disconcerting in the irregularity of their intensity and duration. An arm totally palsied to-day may to-morrow show signs of voluntary movement and on the day following may again be totally palsied, or, on the other hand, may be entirely recovered. In the case of flaccid palsies it may at times be noticed that on an attempt being made by the patient to move the limb the opposing muscles at once come into action and by their action alone prevent any movement. It is quite impossible here to deal with the differential diagnosis between functional affections and all the organic affections which may be simulated, and beyond the above examples it must be sufficient to indicate, firstly, that the temperament of the patient is an important factor in enabling us to form a correct judgment, and, secondly, that the symptoms do not conform in all particulars to types of organic disease.

The psychic definitions of hysteria, if accepted, have at least the advantage that they serve to concentrate therapeutic effort upon the mental side of the disorder. The first indication is to prepare the mental field, so that it is unlikely that upon it hysterical phenomena will develop; while the second is, if the phenomena do develop, to hinder their growth, and indeed to suppress them, by persuasion and by the re-education of the patient's character. The education of the character of the child should consist, at least so far as our present purpose is concerned, in teaching her proper consideration for others, self-denial and the due control of her emotions. In all cases, but especially in those in which there is a neuropathic heredity, there should be no hurry in the matter of purely intellectual education, and the progress of the child should be retarded rather than accelerated, while at the same time every care is taken without attracting the child's attention to her physical health. In the case of the individual in whom hysterical symptoms have developed it must primarily become the duty of the physician to gain her confidence. In too many cases the attitude taken up by the nurse and medical man is that of the moral critic more or less gently and politely scolding the patient for

the supposed absurdities of her conduct. If a diagnosis of hysteria has been made by members of the patient's family it is exceedingly likely that she will be treated by its members with scant courtesy, whereas if no such diagnosis has been made the patient will become the recipient of manifestations of anxious sympathy which are even worse than carping criticism. Between these extremes the course has to be laid down, and the success with which it is kept will depend on the patience and tactfulness of those concerned in the treatment. If, as not infrequently happens, the patient when first coming under observation is in a poor state of physical health, it is imperative that her health standard should be raised. If the symptoms in any way suggest exhaustion she should be put to bed, preferably away from home surroundings, and kept there until these symptoms have somewhat abated. Advantage may be taken of this, and the patient may be isolated—that is, she is allowed to see no one except her nurse and medical attendant. The great aim of this mode of treatment is that a stream of appropriate suggestions may constantly impinge upon her undiluted and not counteracted by suggestions made by those ill-fitted to make them. Hypnotism has its advocates in the treatment of hysteria, but except in a few cases it would appear that it is apt to augment the already hyper-suggestible state of the patient and is not sufficiently radical. It should be the aim of the physician to rebuild the character of the patient from its base and not merely to suppress some of its exaggerated and unpleasant manifestations. This can best be effected by endeavouring to lessen the self-regarding traits of the particular character in question and in substituting for them other-regarding traits which shall issue in conduct at once rational and healthy. Freud and his school have taught us that the abnormal phenomena are, at least in some cases, to be attributed to some emotional event of an unpleasant character which has occurred at some previous time in the patient's life. Such an event may be remembered or forgotten entirely, or if remembered is not connected by the patient or by any one else with her present symptoms. In those cases where such an event has been forgotten it may be elicited by the methods of psycho-analysis. It is not uncommonly the case when the origin of the evil has been discovered, and when its relationship to the present disorder has been discussed and explained, that the symptoms disappear.

M. C.

E. D. M.

NEURASTHENIA AND PSYCHASTHENIA

The term Neurasthenia has been used to

cover many diverse conditions, including the symptoms of nerve exhaustion produced by such morbid states as those of the acute or chronic intoxications, by renal and other diseases of nutrition, by diseases of the gastrointestinal tract or of the cardio-vascular system. Symptoms occurring in the course of, or as terminal features of, such affections, may indeed be neurastheniform, but to prevent confusion it would be better that the term neurasthenia should be confined to those states wherein the patient presents a group of symptoms following upon certain circumstances, having an exhausting effect directly upon the nervous system. It is true that in some cases such circumstances are not obvious, and in the absence of other causes we are driven to the hypothesis of subtle intoxication, the poison being supposed to be derived from the alimentary tract or elsewhere, or to consist in fatigue products; but at least it should be clearly understood that such an hypothesis is of provisional value only, if indeed it is of any at all, and that when once the poison is definitely discovered the affection had best pass into other categories. So also it is wise to exclude from the notion of neurasthenia those neurastheniform states which sometimes are found among persons of faulty nervous family history, which are combined with obsessions and morbid fears and which have of late years been grouped under the title of Psychasthenia.

Having, then, cleared the ground of certain morbid states in which neurastheniform symptoms are a marked characteristic, we are left with a residue of cases which present a syndrome of symptoms, to be described in detail later on, produced by excessive activity combined with some factor which exercises a depressing influence upon the mentality of the patient. Plainly the etiological factors may be very varied. Neurasthenia is an affection widely spread among civilized communities, and especially in those in which the struggle for life necessitates a constant harrying of the nervous system, in time and in space, and if in addition to this over-excitation there may be present professional, business or domestic anxiety or some subtle internal conflict affecting the domain of religion or morals, we have present the causative factors of that particular form of nerve exhaustion which goes by this name. So far as age is concerned neurasthenia occurs mostly during those decades, the third, fourth and fifth, in which the most strenuous part of a man's or woman's life work is being carried on. It is a disease which is found among all classes, but which perhaps has its greatest incidence among members of the various professions. The sexes have hitherto been said to be equally affected, though there are indications that with the entrance of women into the professions a greater proportion of

females is succumbing to the effects of over-work and anxiety.

Symptoms. One of the commonest symptoms, and that which has given its name to the affection, is weakness, and patients complain that the least exertion, whether mental or physical, produces an inordinate sense of fatigue. Lassitude is constant and hinders the commencement of any activity, renders its execution painful, and is so little mitigated by rest that it is by no means uncommon to hear patients complain that they are as tired after a night's rest as when they went to bed. Combined with these feelings of fatigue and superficially in contrast with them there is present a state of hypersensibility both physical and mental which seems to render the patient peculiarly alive to all sorts of sources of annoyance. The ordinary impressions made during everyday life upon the senses, which to the normal individual are pleasant or indifferent, or at any rate easily tolerable, become to the neurasthenic obtrusive evils, while the well-meant efforts of friends, often in the direction of social entertainment and amusement, are so many sources of irritation. The faculty of memory is not infrequently impaired, for the most part because the power of attention is notably diminished, and the patient may complain that he reads and re-reads a page of a book without being able to comprehend the subject matter, however simple. Similarly conversation may become painful, in that the patient may be unable to preserve the thread of his thoughts or to summon up sufficient energy to express them in language. In the normal individual the ordinary affairs of daily life are performed with no undue hesitancy, for of the factors which are to decide courses of conduct some are decisively predominant. In the case of the neurasthenic doubt as to the propriety of some course succeeds doubt, and the consequent slackness of the will displays itself in a species of restless and tormenting inertia. This incertitude particularly affects questions concerning the patient's personal health. His abnormal sensations, besides their inherent unpleasantness, give rise to a series of inquiries as to whether they are not due to serious organic disease, whether this or that trivial circumstance of life does not produce them, and whether this or some other mode of treatment would not be better than the one at the moment practised. The patient appears with a list of symptoms which he has taken care to jot down from day to day on a piece of paper, and this list he will insist upon reviewing in detail. Satisfied for the moment by some explanation of his symptoms which his adviser has been able to give him, he is encouraged, but again rapidly passes into a condition of doubt from which he requires to be rescued perhaps

by the same doctor, but as likely as not by another to whose advice he in turn gives a moment's heed. The mental state is further aggravated by the headache and insomnia which form such prominent features in the clinical picture. The headache is variously described, and may be dull or shooting or throbbing. It may be described as being located all over the head, or at the vertex or in a circle involving the frontal, temporal and occipital regions. In other cases the sensations are rather weird than painful, and the patients describe such feelings as that of a movement of the brain within the skull, or that of the brain being too big for the cranium, or on the other hand of the skull being empty. The headache and other abnormal cranial sensations of the neurasthenic are particularly liable to come on when the patient does any work or when he is at all worried, and on the other hand are relieved by rest and by taking food. Along with the headache there may be extreme tenderness of the hairy scalp, so that in some instances patients hesitate even to lay their heads upon a pillow. Insomnia may occur in several forms. Some patients, feeling tired and sleepy at the end of the day, look for a night's rest, but no sooner are they in bed than they become wide awake, and so remain restlessly tossing about until the early hours of the morning. Others get to sleep in reasonable time and for a few hours do well, but towards one or two o'clock they wake up and remain awake for some hours. In these waking periods noises habitually disregarded by the healthy obtrude themselves upon the notice of the patient. The noise of passing vehicles, the striking of clocks, the barking of dogs, all accentuated by the prevailing silence, keep the patient in a condition of annoyed expectancy. Pillows and mattresses are found to be too hard or not hard enough. Each position reveals a sensitive area and every change of position yet another. The brain is described as being in a whirl, and the thoughts are chiefly of the anxieties or disagreeable aspects of life. On the other hand neurasthenic patients often become very sleepy after food and with difficulty keep themselves awake. Vertigo is another symptom which may occur after food, and especially in those forms of neurasthenia in which gastric troubles are common. It is, however, met with more commonly quite apart from dyspepsia, and before rather than after the taking of food, and may be ascribed to weakness of the apparatus controlling equilibrium. The sensation is as a rule that of the early part of a fainting attack. Surrounding objects appear to be clouded and to be swaying, and the patient feels in need of steadying himself by holding on to something. Giddiness, however, may be more intense, and surrounding

objects may appear to be whirling round, or the ground may seem to rise in front of and towards the patient. Besides the various symptoms of which mention has been made there are those which appear to originate in systems other than the nervous. Dyspeptic troubles are, for instance, of common occurrence, and indeed it is usual to find that the patients attribute their symptoms to defects of their gastro-intestinal tracts rather than to defects of their nervous systems. Digestion in neurasthenia, whatever its intimate character, and whether it be due to a defect in gastric motility, or whether it be due to variation of the quantity and quality of the secretions of the gastric mucous membrane, certainly is not carried on peacefully and unobtrusively. There is rarely that present which may properly be called pain, but the patient complains of abdominal swelling accompanied by rumbling and gurgling associated with eructation. Shortly after a meal, and particularly after a copious meal, the patient experiences sensations of fullness not only about the abdomen but also in the head and occasionally throughout the body. With these sensations there is physical and mental torpor, and the only part of his body which appears to the patient to be active is the alimentary tract. Constipation is usual, though as it alternates with diarrhoea it may not be specifically complained of. On the other hand diarrhoea may be a prominent symptom. In extreme cases much mucus is passed and is an additional cause of anxiety to the patient. Another organ which is not infrequently regarded by patients as being the one particularly affected is the heart. In part the discomfort about the præcordium and the palpitation may be ascribed to the accompanying gastric disturbance, but there is, nevertheless, a residue of cardiac symptoms, such as irregularity and pain somewhat of an anginal character, which connote functional disturbance of the heart itself. The pain is not infrequently diagnosed as being that of angina pectoris with results disastrous to the morale of the sufferer. Abnormal states of the genital organs are sometimes regarded by patients as being the essential cause of their maladies. Sexual activities are depressed with the other functions, and the depression may amount to impotence, or activity may be associated with an undue amount of subsequent fatigue. Among women dysmenorrhœa is not an uncommon neurasthenic symptom, while the mental phenomena usually associated with menstruation are particularly liable to be accentuated. Among other symptoms which may be complained of are pain in the neck or back, accompanied with tenderness along the spines of the vertebræ, and defect in the functions of the special senses, so that the power of

accommodation is diminished and vision appears to be at fault, or the power of hearing to be seriously lessened.

There is a very large number of organic affections whose symptoms are in part also the symptoms of neurasthenia, and from which the latter has therefore to be diagnosed. Various intoxications, diseases of nutrition and organic diseases of the nervous system sometimes present neurastheniform symptoms, and it is of the utmost importance that these affections should be excluded before a diagnosis of pure neurasthenia is made. We may mention that mistakes appear most often to occur when the sufferer is in fact in the early stages of arteriosclerosis, granular kidney, osteo-arthritis, tabes dorsalis or dementia paralytica.

Given the possibility of the removal of the causes of the neurasthenic condition, *treatment* is comparatively a simple matter. Where it is possible to withdraw the patient from the occupation, whether it be of business or pleasure, which has exhausted his nervous system, and from the sources of worry which have depressed his mentality, but little else may be required; but unfortunately it is by no means always possible to procure a withdrawal sufficiently complete or sufficiently long. To remove the cause of the affection may be all that in mild cases may be necessary, but in those which are more severe further measures have to be taken. Since the patient is suffering from exhaustion it is plain that rest becomes of prime importance. Rest should not be prescribed in some hard-and-fast method, as, for instance, by telling a patient at the outset that he is to stay in bed for six weeks, but that amount should be prescribed which results in a minimal sum of the feelings of fatigue. Most patients are only too glad to stay in bed, but others are rendered so irritable and restless that the term "rest in bed" becomes wholly a misnomer. If the resting period can be passed in the open air it is highly desirable that it should be, or if by necessity in a room, air should by every means be encouraged to circulate through it. At the outset of treatment the place of exercise in some cases may be taken by massage, at any rate where the manipulations are not disagreeable. The resumption of active exercise, where it has been dropped, should be very gradual, and if possible the exercise should be of a pleasurable character. It will almost invariably be found that the body weight of the patient is below that which it should be, and the next most important part of treatment must be to endeavour to raise it. In those cases where dyspeptic symptoms are present it is not always easy to do this, and it may be necessary to commence treatment as though a case of gastric ulcer were being dealt with. It must, however, be the constant

endeavour of the physician to increase the dietetic value and the amount of the patient's intake. In the majority of cases in which the circumstances of the patient admit of treatment being properly carried out the removal of the cause, the regularization of rest and exercise and the building-up of the patient's body weight suffice for his cure. In many cases, however, treatment on these lines is wholly impracticable, and other methods have to be employed, or it is found that where it can be practised certain adjuvants are of value. Where nervous irritability is marked the bromides may be of value, and they should be given in doses, small or large, according to the reaction of the particular individual under treatment. It is quite absurd to lay down that so many grains should be given so many times a day, since in this matter every patient is a law unto himself, and it is the duty of the physician to find out what that law is. In some individuals the smallest doses suffice, whilst in others maximum doses produce no desirable effect at all. The bromides may alleviate any insomnia which may be present, but if they are not of value in a given case there is at hand now-a-days a vast catalogue of hypnotics which may supply their place. Hydrotherapy may occasionally be of value, and douches and packs and baths may all be tried, but we are of opinion that no one method can be confidently recommended, and that the personal equation is incalculable until we have learnt by experience whether this or that mode suits the particular patient with whom we are dealing. Similarly with regard to electrical applications. Tempted by the success of the application of some particular form of electricity to some individual, or group of individuals, the physician prescribes the special application for other persons having seemingly similar symptoms, but only to meet with disappointment and to find perhaps that his prescription has done harm rather than good. Psycho-therapy holds no very prominent place in neurasthenia as above defined, nevertheless the attitude of the physician is of considerable importance. The tedious catalogue of symptoms, many of them extremely trivial, must be carefully listened to as the patient time after time laboriously goes through it. Explanations of symptoms need not be very profound, nor, indeed, does the state of our knowledge admit of their so being, but they should be made when asked for, and there need be no hesitation in frequently repeating them. The patient requires constant assurance that his symptoms are not those of serious organic disease, and such assurance inspires him with a hope which at first is but fleeting, but which, as time goes on, lasts longer, until it passes into the certitude of recovery. Where worry has played a prominent place in the causation of the patient's

illness, and where it has been impossible to remove its source, the physician's task becomes a formidable one and may necessitate the exercise of the finest tact, founded upon a wide knowledge of human nature and of the various moral agencies which may be brought beneficially to bear upon it.

Psychasthenia.—Until comparatively recent years there was included under the term neurasthenia a group of cases which from the symptomatic point of view was very similar to the syndrome of neurasthenia above described. As experience accumulated it was noted, however, that from the point of view of family and personal history, certain cases might be differentiated. In some patients of bad family history there did not appear to be adequate exciting causes, such as might result in the syndrome of nerve exhaustion, to account for the presence of their symptoms, while the symptoms proved to a large extent intractable to the methods of treatment ordinarily pursued, and lasted for quite unexpectedly long periods. Such persons it became the habit to call constitutional neurasthenics. More recently still this condition has been particularized by stress being laid upon certain symptoms which almost invariably occur with it, but are of less frequent occurrence and of less marked character in true neurasthenia, and it has acquired the title of psychasthenia, perhaps not one that is wholly satisfactory but at least one that is widely known. These patients, unlike the neurasthenic, are usually in the possession of good physical health. It is of course possible for such persons to fall into a state of poor bodily health, and on such occasions it is the rule that their symptoms exacerbate, but it is impossible to hope in their cases, as it is in the case of the neurasthenic, that with the restoration of the physical health and the removal of the causes of the affection their symptoms will subside. Only too often the symptoms, having appeared, remain for long periods and seem, indeed, to form an integral part of the patient's mental make-up. It has within recent years been suggested that many psychasthenic symptoms may be traced to some antecedent emotional catastrophe, occurring perhaps so long ago that the patient has lost all memory of the occurrence. In some cases the loss of memory has in a sense been encouraged, for so unpleasant was the nature of the occurrence that its reconstruction in memory has been hampered to the best of the patient's power. Nevertheless the impress made by the event remains, and though not obtruding itself on consciousness as a part of the memories of the individual, yet in some occult manner so influences psychic processes that psychasthenic symptoms are produced.

The *symptoms* which especially characterize

the psychasthenic state are obsessions, imperative ideas, morbid fears and want of decision. The morbid fears are of many sorts and the commonest is perhaps agoraphobia. The patient is perhaps only mildly fearful of being alone in an open space, but from this there is a wide range of diversity of fear, amounting in some cases to a degree at which the patient cannot bring himself to pass the threshold of his front door, and becomes a prisoner in his own house. The fear of dirt is with some patients so haunting that contact with the most innocuous articles necessitates thorough ablutions. With this fear may also occur an abnormal terror of catching certain diseases, a fear which may not extend to disease in general but to one or two in particular. Another fear is that of blushing, and may be such as to make it impossible for the patient to work or to play in the society of others. Such are the most common of these abnormal fears, but the catalogue is by no means thus exhausted, and, indeed, it may be said that the number of fears is limited only by the range of the imagination. Aboulia, or enfeeblement, or want of will power, is another prominent symptom, and may be displayed as a mere hesitancy about matters either important or unimportant, or in its extreme degrees in the patient never doing anything on his own initiative. Imperative ideas are such as are obtrusively insistent in season and out of season. They may occupy the whole of the patient's mental field and exclude therefrom the mental processes necessary for the carrying on of ordinary avocations. Akin to these are the obsessions which issue in action, such, for instance, as impel a man to touch every article in a room before sitting down, or to count the letters of an advertisement before catching his train. Other obsessions are of a more ideational character and compel the patient to imagine himself the chief actor in acts of extraordinary obscenity or villainy. Such a condition may well become the cause of acute mental anguish, though happily the mental process as a rule gets no further than the imaginative stage and is not put into effect. The fear of responsibility is another not uncommon symptom, and the unfortunate patient on any occasion upon which he has to assume any, even the most trivial, is filled with alarm lest he should not be the proper person for the task in question, or being the proper person, that he should break down under it, or having fulfilled it, often exceedingly well, that he has left something undone by which the business would have been better carried through. Credulity and an extraordinary hankering after the novel and bizarre are not uncommon traits of character among the psychasthenic, and it is from their

ranks that are drawn a certain fair proportion of the authors and supporters of various social, religious and political extremes.

The *treatment* of this state is a matter of much difficulty. Members of psychasthenic families should be educated from the earliest years with the greatest care and discretion, while if the patient is of mature age a process of re-education may be attempted. If the patient shows any evidence of physical ill-health or exhaustion it is of the utmost importance that he should be treated accordingly, but in the absence of such evidence treatment has to be carried on by psycho-therapeutic methods. It is important to endeavour to direct the current of the patient's thoughts away from himself, his fears, scruples and obsessions. This may at times efficiently be done by organizing the activities of the patient's life, and occasionally also may be effected by suggestion under hypnosis. This last procedure may be used for the purpose of psycho-analysis in the search for the possible emotional catastrophe of bygone years. Psycho-analysis is, however, more usually performed by means of a study of unvolitional trains of thought, time reactions and the examination of dream states, as well as by the more ordinary methods by which attempts are made to obtain knowledge of individual character. If the intimate mental history of the patient can be made out, and if some emotional event to which the symptoms can be traced can be discovered, it may happen that on such discovery being made and on an explanation being offered of the connection between the event and the symptoms the latter clear up. F. W. M.

TREATMENT OF THE INSANE

Prophylaxis. The scope of preventive medicine in relationship to unsoundness of mind is very wide and should involve an examination of the data of eugenics and sociology. Here we must perforce confine ourselves to a brief review of those etiological factors which immediately concern the individual and which we may hope somewhat to influence. A matter upon which the medical man may occasionally be consulted is the question of the marriage of individuals who come of mentally bad stock and who have perhaps themselves been of unsound mind. The problem may be approached from two points of view, firstly from that of the contracting parties, and secondly from that which has reference to their possible offspring. So far as the contracting parties are concerned it is obvious that advice should be given against marriage when one of the parties is insane or when a past attack of insanity has not been wholly recovered from. It is probably also wise to advise against marriage when one

of the parties has suffered from an attack of insanity, unless that attack was purely of the exhaustion type and in a person over thirty, or when the family history is decidedly bad or pronounced stigmata of degeneration are present. In such cases the stresses of marriage are but ill-borne. So far as transmission of insane tendencies to offspring are concerned we have to bear in mind that certain families produce members of successive generations who are insane, and we should at least do well if we advised against marriage where there is a prospect of two individuals of two such families being united. This is, perhaps, particularly the case where there is a family history of epilepsy or alcoholism, or where the type of insanity suggests a degenerating stock.

In the case of the child who comes of an unhealthy or of a mentally weak stock education should be balanced with great care. On no account should the possible precocity of such a child be in any way encouraged, and if any such tendency does manifest itself the intellectual side of education should proportionately be diminished and the physical side encouraged by the cultivation of such quiet outdoor pursuits as do not involve the excitement of games in which many other individuals are included. At the same time special efforts should be made to encourage the growth of those qualities of self-restraint which so largely form the make-up of good character. In the case of the adult there should be an endeavour to impress upon him certain elementary hygienic laws. So far as it is possible members of neurotic families should avoid those occupations which entail much hard work carried on at high pressure, and should above all things be careful that if hard work and worry are unavoidable the consequent fatigue should be neutralized by adequate rest. Among persons predisposed to mental and nervous disorder continuation of work in disregard of the warning symptoms of fatigue is only too likely to end in disaster. Not only is excessive work to be guarded against, but so also is the too active pursuit of pleasure, especially by those methods in vogue in what is called "Society," whereby the jaded body is impelled from one social function to another without regard for proper periods of rest. Food should be taken regularly and should be of sufficient quantity and good quality, and the individual should be directed to endeavour to keep his weight at the amount normal for his stature or perhaps a little in excess thereof.

Too much stress cannot be laid upon the necessity for keeping a careful look-out for early symptoms premonitory of a breakdown. Slight mental alterations should be regarded as of importance, and even before they arise such

symptoms as sleeplessness, a poor appetite, a rising pulse-rate or a falling body weight should attract immediate attention. It is in the prompt observance of such signs and in speedy action being taken at the moment that they are found to be present that the best chance for the patient lies. On the other hand it is far too common a story that such phenomena have been disregarded or, having been observed, have been considered of no importance. Valuable time is in this way lost, and a patient who might have been quickly restored to health undergoes instead a prolonged illness perhaps terminating in chronicity. When symptoms indicating that all is not well have been noticed the patient should, where it is feasible, withdraw from work or at least modify it. He should be careful to rest as completely as circumstances allow, and it may be urged that it is often cheaper to rest in the first instance than subsequently to be laid up for a long period. The nutrition of the body should be most carefully inquired into, the amount of food regulated and its nutritive value increased, and the condition of the bowels and the sleeplessness put right. With these comparatively simple measures patients can not infrequently be again restored to complete health. As a rule, however, prodromal symptoms are misinterpreted or ignored until, the march of the illness having eventuated in some marked disorder of conduct, the medical adviser is at length called in. Treatment will necessarily vary according to the predominance of some symptom. If excitement is the most marked characteristic of the affection the prime indication is that the patient should be placed in circumstances in which the causes of excitement are the fewest possible in number. The patient's room should be in a quiet part of the house and should be large and well ventilated. If the patient is impulsive it is well to check the windows so that they cannot be opened more than six inches at the top and six inches at the bottom. For the same reason all unnecessary articles of furniture, especially such as the patient can throw about, should be removed. It will be found that in most cases excitement is materially reduced by keeping the patient in bed. This procedure has the additional advantage that the patient is easier to control than if he is wandering fully clothed about his room or house, while it impresses upon him that he is ill and that he requires to be looked after by nurses in the same way that a patient suffering from some more definitely physical disorder has to be tended. It usually happens that though the patient may at first resent being put to bed, he rapidly accommodates himself to circumstances and can, if tactfully handled, be kept there for so long a period as

may be necessary. In certain cases, however, the patient will not stay in bed, and under these circumstances it is best to allow him as much latitude as possible, for the only alternative is a forcible restraint upon his movements which is exhausting both to the patient and his attendants. We would lay stress on the various details usually recorded upon a temperature chart being carefully noted. If suitable provision for nursing the patient in the open air can be made, the effect of treatment will be enhanced, but this, unfortunately, is rarely possible except where buildings have been specially constructed for the purpose. A similar remark applies to balneation. The temperature of the bath should be about 98° F., and the length of time during which the patient is in the bath may on the first day be an hour and thereafter be increased until many hours, indeed in some cases the whole day, is spent in the bath. Under these circumstances it is obvious that the patient must be carefully watched and that some simple apparatus must be used to prevent his head slipping beneath the level of the water while he is asleep. In the majority of cases of those suffering from acute mania the patient's somatic health is deteriorated and the various functions of the body are not acting normally. This is particularly noticeable in the case of the body weight, which is almost invariably below normal. The loss of weight is usually found on examination to have commenced some months before the mental symptoms began to be noticed, and the loss becomes more rapid as the symptoms become worse. This may be regarded as an important indication for the necessity for good alimentation. It is not often in cases of mania that there is difficulty in getting the patient to take food. The patients are very liable to bolt their food and it should therefore be given thoroughly well minced up. The usual three meals a day should consist of mince, milk puddings and fresh uncooked fruit, and between these meals smaller feeds consisting of milk or milk with an egg beaten up in it should be given. So far as drugs are concerned, sedatives and hypnotics are indicated. The bromides, chloral, paraldehyde, sulphonal and veronal are those which are most usually employed.

If, on the other hand, the symptoms are those of depression, it must be ceaselessly borne in mind that the idea of suicide is in all probability present with the patient and the utmost vigilance must in consequence be exercised. The points to which the attention of both medical man and nurses must primarily be directed is the removal of everything which the patient could use as a weapon against himself. Handkerchiefs, neck-ties and pieces of string may be used for the purposes of strangu-

lation; pieces of broken glass, nail-scissors and table knives may be used to cut the throat or open a blood-vessel, and poisonous drugs may be taken in dangerous doses. Melancholic patients not infrequently throw themselves from heights, and for this reason windows should be checked and especial care should be taken while the patient is passing up and down stairs. It is desirable that a patient in this condition should not be allowed to go to a water-closet unattended, and it is further desirable that the patient should pass his motions into a commode, where their amount and character can be noted. This is particularly important since constipation is the rule amongst depressed patients and calls for active treatment by drugs and enemata. As in cases of acute mania, so in cases of acute melancholia the body weight will be found to be below the normal, and every endeavour must be made to raise it. Food should be given frequently and should be of as substantial a character as that given in mania. It should be so prepared that it will not be necessary for the patient to use a knife. In many cases the food is only taken under great pressure. The patient has little or no appetite, he has in all probability lost his sense of taste, and is so possessed with misery that the idea of food is abhorrent to him even if he does not actively desire to do himself to death by starvation. In some cases the patient will take no step to feed himself and the food must actually be placed in his mouth. Sometimes, again, the patient will not swallow the food if placed in his mouth and will actively resist any attempt to feed him, and under such circumstances he will have to be fed by means of the nasal or œsophageal tubes two, three or four times a day. At each meal the quantity given should amount to about a pint and should consist of milk, cream, carbohydrate foods, eggs, soups, vegetable extracts and powdered meats. Next to rest, feeding and attention to the bowels, the great consideration is the treatment of the insomnia which is so constant a feature in cases of depression. In many cases it will be found that the regime indicated above will suffice, and particularly will this be so in those cases which it has been possible to treat by rest in the open air. Often, however, hypnotics are indicated and, indeed, must necessarily be had recourse to. Routine treatment by massive doses is to be deprecated and the reaction of the particular patient under treatment must be carefully noted. Some persons will react to small doses of some one drug and unsatisfactorily to others; others will react to small doses and not to large; while others again are wholly refractory and are rendered more rather than less sleepless by drug treatment.

Such in general terms are the principles which should govern the treatment of the states of excitement and depression which are the most prominent manifestations of acute mental disorder. These states are episodal in character and occur in such affections as maniacal-depressive insanity, certain forms of dementia præcox, and the exhaustion and toxic psychoses. It is important when the excitement or depression abate that convalescence should be prolonged and that the patient should on no account forthwith return to his normal routine of life. When the patient's physical health has become satisfactory and his weight has a little surpassed the weight proper to him, while the mental symptoms have passed away, he may be advised in the first instance to go to some quiet country place where he may pass his time in healthy outdoor occupation. If the patient has hitherto had a clean mental medical history he may be allowed to return to his work, being directed on the occurrence of any untoward symptom immediately to seek advice. If, on the other hand, the attack has been an episode occurring during some degenerative process, such, for instance, as dementia præcox, the future of the patient's life must largely be regulated by the mental level to which he has possibly been reduced.

In a disease such as paranoia the progress of the disorder is extremely slow and the evolution of symptoms may go on through a period of many years. Before the delusional stage is reached such patients are apt to be introspective, jealous, vain and suspicious, and it is desirable to endeavour by every means so to educate the patient that he should be able to control the manifestation of these unpleasant traits. Physical ill-health and fatigue is likely to exacerbate symptoms in this as in all other forms of mental disorder, and the patient should be advised to lead as healthy a life as is possible. It is unfortunately only too often the case that the disorder of conduct which eventually occurs as a manifestation of mental delusion necessitates asylum treatment.

It will be noticed that in the foregoing description of treatment as applied to excitement and depression no mention has been made of certification and consequent treatment in an asylum, and the problem set to the medical man and the relations of the patient as to where he can best be treated will now be considered. We wish very definitely to lay it down as axiomatic that there is no essential difference between the treatment of the mentally disordered whether they be in asylums, in mental hospitals, in so-called "private care," or at home. Two main factors govern the situation, the first being that the efficient care of the insane outside institutions is necessarily a

matter of great expense, and the second factor in determining institution treatment being the necessity for such special accommodation as will prevent the patient from being harmful or a nuisance to others or dangerous to himself. If circumstances permit, a special part of his house can be set aside, two or more nurses employed, and the services of a specially skilled medical man can be secured; it may then be possible for the patient to be efficiently treated at home. This can obviously only rarely be feasible. The second alternative is removal of the patient to the private house of one willing to receive him, and the third removal to an institution. As a general rule patients do better away from home, while their symptoms are almost invariably exacerbated by the presence of friends and relations. It must be plain that if a patient is violent or noisy such special accommodation must be provided as is only to be found in institutions. In cases of chronicity and where our therapeutic efforts during acute stages have been of little avail, the circumstances of the patient may be made to depend on his grade of mentality. In cases where there has been very slight mental degradation the patient may quite well live at home or in a private house, and at least take some part in the common domestic life. The boarding-out system as practised in Scotland has been found to be of very great value, and the patients, instead of being herded with their unfortunate fellow sufferers, are brought into constant contact with healthy minds and employed in simple and useful occupations. At a still lower level of mental degradation residence in an asylum is probably best.

Certification. When it has been decided that a patient should be certified, the patient is legally recognized to be of unsound mind by the following procedure. A near relative becomes the "petitioner," that is, he makes an application for certification and fills up a form containing various particulars about the patient's history. The petition and statement, which have to be accompanied by two medical certificates, is presented to a magistrate, who makes an order for the reception of the patient. The medical certificate has to be made out by two qualified practitioners, each of whom must personally and separately have examined the patient, while the examination of the patient must not have taken place more than seven clear days before the presentation of the petition. Neither practitioner must be within certain specified degrees of relationship with the other, nor must he be the petitioner or interested in the payments made on account of the patient to the authorities of the asylum, hospital or house to which the patient is assigned, nor must he be within certain degrees of

relationship with any such authority. Where time presses the patient may forthwith be placed under care by means of an urgency order. In such a case the authority to receive the patient is given by a relation or connection of the patient and has only to be accompanied by one medical certificate filled up by a practitioner who has seen the patient within two clear days of the reception of the patient into the asylum, hospital or house. These are the usual methods of certification and consignment of a patient to the care of duly qualified persons. Other procedures consist in such consignment by an order of a justice of the peace, by order of two commissioners in lunacy or by the process of inquisition.

M. C.

E. D. M.

PSYCHO-ANALYSIS

The method of investigation known as **Psycho-analysis** is of value to the physician both in the elucidation of the symptoms and in the treatment of hysteria and other disorders of the mind. Although it is too early to form an opinion as to how far the claims made on its behalf will be justified, there can be little doubt that it marks a great advance in psychological medicine and has shed light upon many difficult problems in psychiatry, explaining much that was obscure in the evolution of mental symptoms.

Psycho-analysis was first employed by Prof. Freud of Vienna, and dates from the year 1895, when he, in conjunction with Breuer, published *Studien über Hysterie*. Since then literature upon the subject has grown very rapidly, and exclusively occupies several journals. Freud's work has been confirmed and expanded by Prof. Jung of Zürich, who has improved the technique, and has applied psycho-analysis to the study of dementia præcox and other mental diseases.

Several assumptions underlie this new departure. Whilst not ignoring the importance of innate tendencies and the effect of somatic disease, Freud maintained that hysteria and other psycho-neuroses are essentially the result of mental causes and depend upon internal conflicts and past experiences, which, unconsciously perhaps, give rise to the mental disturbance. Psycho-analysis presupposes the existence of a subconscious mind (Freud uses the term "unconscious"). It assumes that, in addition to all of which we are actively conscious or can recall by an effort of memory, there are mental processes which, though they cannot be brought into consciousness, form nevertheless an integral part of each individual personality, and constantly disturb his emotions, influence his judgment, and modify his conduct.

Without attempting to discuss the psychological problems raised by these considerations,

we may safely agree that our actions depend in large measure upon past experiences, though at the moment we may be unable to trace the connection. We must admit that our judgments upon the current topics of the day are unconsciously biased, and that if exposed to any unexpected emergency our conduct will be decided by impulses, the general direction of which is pre-determined, although we may be quite unable to understand how this comes about.

Throughout Freud's work, therefore, we find the assumption that all mental activities, all dream fantasies, everything that enters consciousness, is determined by previous experience. Nothing is spontaneous or arises *de novo*, and if our knowledge were more complete we should find psychical antecedents for every mental symptom, however extraordinary and apparently inconsequent.

One more preliminary remark is needed. In psycho-analysis words are habitually used which, strictly speaking, can have little meaning in relation to mental phenomena. Symbolical expressions which imply that ideas are things which can be moved about and have spatial relations, *e. g.* "substitution," "displacement," "transference," "sublimation," and terms such as "buried complexes," are used, which are only figurative, and can have no literal application to mental processes. Expressions of this nature are unavoidable, as no other words are forthcoming, but, unless their symbolical character is borne in mind, they may give a fictitious sense of precision in dealing with the subject.

The *object* of psycho-analysis is to investigate the trains of thought which, directly or indirectly, have produced a given morbid psychical disturbance. Every one is reminded at times of experiences which are distasteful, and even repulsive, the memory of which we endeavour to ignore; and the mental conflict which this repression involves varies in intensity according to the nature of the experience in question and the temperament and education of the individual. Such memories and emotions are called "complexes," and when they are forgotten and cannot be called into consciousness, they are called "buried complexes." They usually relate to some fundamental instinct or desire, and when circumstances prevent these desires from being gratified some compromise must be reached. Under normal conditions such repressed desires are directed into healthy channels; they are "sublimated," and the energies find outlet in some form of active work, but in some cases no such outlet is found, and the buried complex becomes a centre of internal stress till a "substitution" takes place and hysterical symptoms appear. The patient is probably altogether unaware of what has happened, and sometimes the original desire

cannot be remembered, so successful has been the repression. The end-product may appear to have no relation to the complex, and is frequently so confused and distorted that the task of tracing out its origin may be extremely difficult. In this way arise the many symptoms of hysteria and psychasthenia, palsies, phobias, obsessions, ties, morbid doubting; all of which are regarded by the psycho-analyst as symbolical representations of wish-fulfilments. They produce a certain amount of unconscious gratification, and in a perverted and incomplete manner they relieve the underlying mental conflict.

It must not, however, be thought that psycho-analysis is of value only in hysteria and kindred conditions. On the contrary, it throws light upon the origin of habits and idiosyncrasies of all kinds and upon many obscure problems of everyday life. The instinctive dislikes, which so frequently influence conduct for no obvious cause, mannerisms and odd gestures, uncalled-for explosions of temper, inexplicable waves of sadness, sudden untimely merriment, blind unreasoning prejudices, are to be attributed to past experiences and old conflicts, which, though quite forgotten, may be recovered by psycho-analysis. It is maintained that the method is helpful in dealing with juvenile depravity and delinquencies in the young.

In decided cases of mental disease, such as paranoia, dementia præcox, manic-depressive insanity, this method of investigating the genesis and development of symptoms is valuable, and it has been successfully employed in the treatment of certain cases of melancholia.

The *methods* of psycho-analysis can only be mentioned briefly. Three are chiefly used.

- (1) Free association. (2) Word association. (3) Dream analysis.

Free Association. The patient is encouraged to express frankly every thought that comes into the mind when a given subject is mentioned by the physician, even if it appears irrelevant or unsuitable. When the repressed desires are touched he usually avoids the subject: there is an instinctive resistance which must be overcome. Long delay or hesitation, or continual distress, probably indicate that the line of inquiry involves a buried complex. It is evident that this method of investigation is only useful when the patient willingly co-operates with the physician and has extraordinary confidence in him. It implies the opening up of the inmost secrets of the mind. The discussion of sexual questions, too, is often involved, rendering the situation one of extreme delicacy. Freud uses a special technique, which takes a long time to master, and in any case the inquiry involves an immense expenditure of time.

Word association, first used in this connection by Jung of Zürich, is of great assistance, and

undoubtedly shortens the time required, especially in the early stages. A series of selected words is enunciated each one separately by the physician, and the patient is asked to state as quickly as possible the first word which each of them suggests to him. The time taken is noted in each case. At the end of the series the words are again called over, and any difference in the responses is noted. The way in which patients react varies greatly, but occasionally there is a delayed response, or no answer at all is given. In almost every such case, if the associations be followed up carefully, the delay may be traced to the interference of some thought or idea connected with the repressed complex. The selection of words is, of course, important, and it is desirable to interpolate critical ones between those of little significance. Jung's method, though it may consist to some extent of groping in the dark, often uncovers the repressed train of thought very quickly.

Dream Analysis. Freud has shown that dreams give symbolical expression to repressed desires. The censorship of conscious thought is removed in sleep and in the half-waking state, so that long-forgotten memories appear in strange, distorted forms. Though we may consider some published interpretations of dreams to be far-fetched, there is no doubt that incidents throwing light upon the origin of symptoms may be recalled by the analysis of dreams. The connection between the grotesque dream pictures and underlying past experiences, however, is most difficult to trace, and may require long and patient investigation.

Hypnotism. Although at one time Freud used hypnotism in recalling past memories, he and most of his pupils have abandoned it altogether. Several authorities, however, claim that it is a valuable adjunct; that it saves time, and assists in getting at the central difficulties rapidly and without undue friction, especially in cases of double consciousness, hysterical fugues and other automatic states.

Pulse reaction has been used, it being found that, in the course of association experiments, allusion to a subject connected with the repressed complex immediately quickens the pulse.

Psycho-analysis is of great value in therapeutics, since it not only brings to light the exact nature of the case to be dealt with, but removes many of the obstacles in the way of successful treatment. When disturbing factors that have been repressed or ignored are frankly faced, when the nature of the conflict is fully understood and the whole personality is summoned to take part in it, healthy influences have a chance of prevailing. Psycho-analysis, while it lays bare the cause of the symptoms, prepares the way for their removal. This is essentially a matter of re-education, and, in many cases, resolves

itself into directing the energies towards some higher goal and awakening wholesome activities. Sometimes the fundamental difficulty can be shown to be unreal, and can be cleared up by explanation and frank discussion. In such a case recovery is speedy. It is like the relief obtained by the removal of a foreign body, which has produced not only local, but reflex irritation and pain.

In the present article no attempt is made to report illustrative cases. Unless given in great detail, these are apt to be unconvincing, and it is not easy to describe a case adequately without disclosing confidential matters.

Psycho-analysis appears to be contra-indicated in the following cases: those who are unwilling to submit to treatment and do not give the physician every assistance; those who are confused, who cannot give their attention, or take an interest in the investigation; and, lastly, patients past middle life. It is most useful in young adults who are intelligent and anxious to be relieved, and whose habits of mind are not so confirmed as to make re-education impossible.

Criticisms. Authorities are much divided as to the value of psycho-analysis. Some are whole-hearted supporters of Freud; others deny altogether the truth of his teaching; while others again accept some of his conclusions, especially those in reference to conflict and repression, but are sceptical with regard to his views on sexual questions. It must be conceded that most of those who criticize severely have not had much personal experience of Freud's methods. The whole question demands more exhaustive examination, so that what is of value may be sifted from the rest, and retained. At present the subject is beset with difficulty.

Time and Trouble Involved. The analysis of many of the recorded cases has taken more than twelve months, and some of Freud's cases have taken three or even four years. On the other hand, simple cases may be resolved after a few sittings. The amount of personal attention the physician must give is extraordinary, for the work demands close and unremitting intellectual effort and can seldom be deputed to an assistant. When we remember, too, that the technique of psycho-analysis is complicated and difficult, it becomes clear that very few patients can afford this kind of treatment; and unless its methods are simplified its value will be extremely limited.

The nature of the investigation is generally unpleasant. Freud and his pupils state that every analysis of a case of hysteria reveals sexual complexes. It must be explained that the word sexual is used by Freud in an unusually broad sense, including the maternal instinct, filial and parental love, and much that is artistic and poetical. But the published cases almost always contain details of sexual irregularities

and perversions, and the question arises how far it is wise to endeavour to revive past memories and discuss at length objectionable incidents of this kind. A further criticism occurs in respect to the analysis being pushed to ascertain experiences in childhood. In several of the cases that have been reported the experiences dated from before the fifth year, and Freud and many of his followers think these of supreme importance. But in dealing with memories of childhood many pitfalls occur, and the possibility of exaggeration and of pseudo-remembrance must be borne in mind.

Dr. T. A. Ormerod criticizes Freud's theories as follows:—"Can we suppose that every severe and ingrained hysterical symptom would be cured in this way? About the so-called 'process of conversion,' which is really one of the key-stones of their theory, one would like some independent proof. Is there really evidence to show that hysterical patients possess a peculiar faculty whereby they can substitute a bodily symptom for mental distress? There is the same lack of evidence for the statement . . . that the ideas at the bottom of hysteria are always of a sexual nature . . . I know the answer made is that the proof of these statements lies in the so-called facts of psycho-analysis. But can we implicitly rely upon the dreamy imaginings of a patient undergoing this process? Is it not very probable that we may put into his mind just what we want to find there? We know that Freud gave up that portion of his theory which relates to sexual assaults, because he found his patients had misled him. And if the master of this method may be deceived, how much more his disciples? To this I cannot help adding that psycho-analysis, if it is to mean the resurrection of buried sexual ideas, might to many patients do much more harm than good. The proof of the pudding, we are reminded, is in the eating; but the dish is a little unsavoury, and I cannot help hoping that the taste for it will not become general."—*Brain*, Jan. 1911.

Whilst fully admitting the force of these criticisms, the writer must confess that his own experience leads him to support Freud's thesis as to the importance of sexual repression and conflict in relation to the development of the psycho-neuroses. It may be the duty of the physician to investigate unpleasant psychical details just as it is his duty to investigate unpleasant physical details. His sanction lies in the urgency of the symptoms and the possibility of relieving them. When there is no doubt about the former nothing should be left undone that may give lasting relief.

It has also been contended that in the published cases recovery may have been due to other means. That it is not merely due to

suggestion appears to be certain, as many of the patients had been treated by hypnotism without success before psycho-analysis was undertaken. Still, it must not be forgotten that many psychasthenic and neurotic patients improve or recover without any special treatment. They provide the majority of "cures" by faith-healing, osteopathy, and the like. Every physician can call to mind such surprising recoveries, and although the devotees of psycho-analysis speak in no uncertain voice as to its therapeutic value, the reader of the reported cases would like to have independent testimony as to the reality and permanence of the recoveries. On this question more evidence is needed.

Conclusion. It is too early to estimate the importance of Freud's work. There can be little doubt that it helps to elucidate symptoms, and that he touches a great truth in showing that long-forgotten experiences influence conduct unconsciously and that repressed desires and instincts are directly concerned in the production of the psycho-neuroses. Our ground is less sure if we assume that patients are necessarily benefited by the revival of these repressed desires, and there is reason to fear that the inquiry into these topics may sometimes be injurious. It is important to select the cases with great care and to make sure that the conditions are favourable. It is evident that in some cases of decided mental disease, such as dementia præcox, little benefit can accrue, whilst in unstable and untrustworthy persons the inquiry is altogether contra-indicated. On the other hand, in patients intelligent enough to understand the object of the investigation, whose general character and mental make-up are of sufficiently good quality, and who are not too old to learn new habits of thought, psycho-analysis is a most promising line of treatment.

On the whole Freud must be given credit for introducing a great advance in psychiatry, and, though we may not acquiesce in all his extreme views, we must acknowledge that he has thrown light upon some of the most obscure and intractable of mental disorders. He teaches the physician the importance of ascertaining the patient's mode of thought, his hidden motives, conflicts, troubles and fears; and the key to this inner life, now recognized to be all-important, is psycho-analysis. With its help the patient learns to know himself and to face and overcome difficulties instead of avoiding them; and by the removal of persistent, though probably unconscious, fears and stresses, the growth and development of character becomes possible. To use one more simile, the tangled skein of thought is patiently unravelled by means of psycho-analysis, so that the thread may be rewound in an orderly way; but whether this

is possible or not must inevitably depend upon the quality of the thread itself.

B. P.

CRIMINAL RESPONSIBILITY

Strictly speaking, the term "criminal responsibility" is tautologous, for "responsible" means, in English law, "liable to punishment," and no act is in law punishable unless it is criminal, or, if not criminal in the technical and restricted sense, unless it is an offence against the law. For every offence against the law the offender is responsible, that is to say liable to punishment, and cannot be absolved from this liability except under certain conditions. It is important that this meaning of "responsibility" should be kept steadily in mind during legal discussions on the subject, for the term has also an ethical meaning, which is not the same as its legal meaning, and medical writers and speakers on the subject are very apt to confuse the two. In ethics, "responsible" does not mean "liable to punishment by law"; it means "rightly punishable," and to say that a person is irresponsible means, not that he is not liable in law to punishment, but that in the opinion of the speaker he ought not to be punished. This is quite a different thing, and as long as these two meanings of "responsible" and "irresponsible" are confused, no discussion on the subject can be fruitful. Here I propose to discuss, not what condition ought to absolve a person from liability to punishment for his wrongful acts, but what conditions actually do absolve him in English law as it at present exists.

On paper and in general terms, the principles of legal irresponsibility are fixed and settled: in practice the greatest difficulty is experienced in estimating how these principles will be applied in any given case; but in spite of this difficulty we find that on the whole justice is done, and the requirements of the average conscience are efficiently met.

The law on the subject is contained in certain answers given by the judges to the House of Lords in 1843 (Mr. Justice Maule dissenting) and is as follows:—"Every man is presumed to be sane, and to possess a sufficient degree of reason to be responsible for his crimes until the contrary is proved to their [the jury's] satisfaction; and that to establish a defence on the ground of insanity it must be clearly proved that at the time of committing the act the accused was labouring under such a defect of reason from disease of the mind, as not to know the nature and quality of the act he was doing, or if he did know it that he did not know he was doing what was wrong." This, then, is what the defence must affirmatively establish, and in order that the medical practitioner may be

guided in his investigation into the mind of the accused, it is necessary to examine these conditions with some care.

If it can be shown that the accused did not know the nature of his act, he is relieved from responsibility for that act. But what is the nature of an act, as distinguished from its quality? I think it may be taken that to know the nature of an act means to know "what we are doing"—to know the immediate consequences of the act, or those consequences the wish to produce which constitutes the intention. Thus, to strike a man violently on the head with a bludgeon, or to push him over the brink of a dock, is likely to result in his speedy death, and the person who so strikes or pushes him, kills him. His death is the natural and immediate consequence of the act, and therefore in such a case the nature of the act is killing. If the person takes a jewel off a jeweller's counter and walks out of the shop with it, the natural and immediate consequence of the act is that the jewel is removed from the possession of the jeweller, and passes into his own. The nature of the act is taking possession. If he takes ship to America, the nature of his act is travelling.

In any of these cases, the nature of the act remaining the same, its quality may be innocent or criminal. If a man strikes another over the head and so kills him, it may be that there appeared no other way of warding off an assault that threatened to be fatal. In that case the quality of the act was innocent. But it may be that the act was done for the purpose of robbery or revenge, and in this case its quality was murderous. The jewel may have been taken after due payment, and then the quality of the act is innocent; or it may have been taken without the knowledge or consent of its owner, and in this case the quality of the act was furtive or theftuous. The voyage to America may have been undertaken for sport, for commerce, or to fulfil a promise to lecture, and then its quality is innocent; or it may have been undertaken to get rid of the burden of supporting wife and family, and then its quality is desertion.

To exonerate an accused person from punishment, it is sufficient to prove either that when he killed the man he did not know that he was killing, or that when he knowingly killed, he did not know the killing was murder. Here, however, an important qualification must be made. To determine, in any given case, whether killing is or is not murder, is a question of law, and one that is often difficult to determine. Is a man, therefore, to be excused from the penalty attaching to murder if he *bona fide* but erroneously believes at the time that the quality of the act is not murder, but manslaughter? According to the plain words of the judges'

answer, it would seem that he would be excused, and no doubt there are circumstances in which he would; but in other circumstances he would find himself balked by the "conclusive presumption" of law that every man knows the law, however uncertain or nebulous the law may be. A man might very likely find himself condemned to the gallows for a homicide that he *bona fide* believed was only manslaughter. It follows that homicide should never be lightly undertaken.

According to the answer of the judges, there is a third exonerating condition. The prisoner is relieved of responsibility if the defence can show either:—(a) that he did not know the nature of his act, (b) that he did not know its quality, or (c) that he did not know he was doing what was wrong. It would appear *prima facie*, that if a man does a criminal act, knowing its criminal quality, he must know that he is doing what is wrong. If a man commits murder, knowing that he is committing murder, or if he steals, knowing that he is stealing, it is difficult to see how he can be ignorant that he is doing wrong; for the very idea of murder or stealing contains the idea of wrong so completely and inextricably bound up with it that it is difficult to see how he can know that he is murdering or stealing and not know that he is doing wrong. It may be, however, that a man's sense of right and wrong is so distorted and perverted that he can persuade himself that a homicide that other people would call murder, and that would be wrong if they did it, would not be wrong to him; or that a converting into his own possession that would in other people be theft and wrong, would not be either if he did it himself. It would seem, therefore, that a socialist who genuinely holds the belief that property is theft, may steal with impunity; but it would be dangerous for him to put his doctrine into practice, for the exoneration applies to those only whose lack of knowledge of right and wrong is due to "defect of reason from disease of the mind."

It seems, however, that if an accused person conscientiously believes that a crime done by him is not a crime, he does not know the quality of the act, whether or no he believes that it would be a crime if done by some one else; and therefore it would appear that, strictly speaking, it is impossible that he should, in the words of the judges, know "it," that is, the nature and quality of the act, and not know that it is wrong. However, this consideration was, perhaps, thought by the judges to be a little beyond the comprehension of a petty jury, and the condition of knowing the wrongness of the act was inserted.

In practice, this is the condition that is usually relied upon. The defence does not often seek

to show that the accused did not know the nature of his act—in common terms, that he did not know what he was doing—and his knowledge of the quality of the act is left out of consideration, since it is included and swamped in the knowledge of its wrongness. In the great majority of cases in which the plea of insanity is raised, the defence seeks to show that the accused did not know that what he was doing was wrong; or at least this is the ostensible defence. In practice the defence usually amounts to showing, or attempting to show, that the state of mind of the accused, at the time of the commission of the crime, was such that he did not as fully appreciate as a sane man would, either (a) the consequences of his act, or (b) the circumstances in which it was done.

Of these two defects, the latter, though it is but little appreciated by the courts, is by far the most important; for it may very well happen, as it happened in the case of Hadfield, that the accused knew completely the nature and quality and consequences of his act, and that it was in a certain sense wrong, and yet may be so insane that no jury would convict; but if it can be shown that from defect or disorder of mind he does not rightly appreciate the circumstances in which the act is done, and if the crime is shown to have arisen out of this want of appreciation, then he will be held not responsible, as Hadfield was held not responsible.

To determine whether at the time the act was committed the actor knew that it was wrong, is on the face of it as difficult a problem as the human mind can well undertake. We must not only investigate the state of mind of a person at a time that is now past, but we must be agreed upon the meanings of the words "know" and "wrong," as to which speculation may easily lose itself in a maze of conjecture. In practice, the difficulty, though often great, is seldom found insuperable; for, in practice, the jury, and the other persons concerned in the case, have a rough-and-ready appreciation of the meaning of these terms which is sufficient to serve the purposes of justice; and in practice substantial justice is done. The touchstone which judge, jury and counsel apply to the case is the conduct, in circumstances similar to those in which the act was done, of the ordinary or average man. If they find that the act was one which, upon consideration of all the circumstances, might have been done by an ordinary or average sane man under the influence of motives that are known to operate on sane men, and to lead them to the commission of such acts, the jury will find the accused guilty, and they will be right in so finding. If they are unable to reconcile the conduct of the accused with the conduct that they would expect under similar circumstances from an

ordinary or average sane person, allowing for the exaggeration that certain passions, such as jealousy, greed, lust, and so forth, are apt to exhibit in persons that yet must be considered ordinary, the jury will find the accused insane, and they will be right in so finding. But if this is so, the testimony of the expert would appear to be superfluous and redundant, for such comparisons as are suggested can be made without expert assistance by any one who is conversant with average human character. What, then, is the function of the expert? It is described very clearly by Mr. Justice Wilde in *Smith v. Tebbett*, "While the world at large can only contrast the doubtful case with the sane, the physician has at hand the alternative contrast with the insane. . . . The question of insanity, though it falls to the lot of a legal tribunal, is properly a mixed one—partly within the range of common observation, and in so far to be considered by a jury; partly within the range of special experience, and in so far the proper subject of medical inquiry. It is the office of the court, then, to inform itself, as far as opportunity permits, of the general results of medical observation, and to approach the subject of this case on the two opposite sides thus indicated, searching for a fit conclusion by alternately presenting the parallel of sanity and insanity to the sayings and doings of the accused." It is improbable that King's Bench judges, in trying a criminal case, are guided by the dictum of Sir J. P. Wilde in the Probate court, but the natural good sense of the judges has led to the same practice.

It is not often that a witness is called upon to give his opinion as to the knowledge that the prisoner had as to the nature or quality, the rightness or wrongness, of the act with which he is charged. Few judges will allow such a question, which it is the function of the jury to determine, to be put to a witness. If, however, the witness is of opinion that the act was committed in post-epileptic automatism, it is clear that such evidence must be given, and in such cases it is allowed.

If the expert is able to show that the accused was insane at the time the offence was committed, such evidence will go far to exonerate the accused; but such evidence, even if accepted, will by no means establish his irresponsibility; and it may not be accepted. The mere *ipse dixit* of the expert will be tested by cross-examination, and unless he can produce the evidence on which his opinion is founded, and unless that evidence carries to the jury conviction that the accused was insane, the expert will waste his breath in testifying to the insanity. Even if the accused is proved to have been insane, his irresponsibility will not, in law, follow as a matter of course, though in practice, proof of

insanity does usually carry irresponsibility. In law, an insane person is responsible unless his insanity deteriorated his mind in certain ways already set forth. Proof that the accused was insane at the time of the act does not even shift the burden of proving responsibility on to the prosecution. In practice, however, no jury would find responsible a person they believed to be insane. The real difficulty of the defence is to prove insanity—that is, to adduce evidence that satisfies the jury that the accused was insane at the time of the offence. If he is able to do this, the expert need not trouble himself or the court about the prisoner's knowledge of right and wrong, or of the nature or quality of the act; and in fact not one expert in a hundred knows or needs to know the meaning of the nature or quality of an act, or the difference between them. C. A. M.

PUERPERAL INSANITY

There are many authors of the present day who give no separate place in their classification of mental diseases to puerperal insanity. Their reason for this is that the insanity associated with child-bearing exhibits no distinguishing feature from other forms, and therefore they content themselves with merely referring to it when describing the forms it commonly assumes. From a practical point of view, however, puerperal insanity warrants a more distinctive place in classification, for although it presents no symptom which clearly marks it off from all other forms of mental disturbance, it adheres more or less faithfully to one or two definite types. Moreover, it occurs from time to time in general practice with dramatic suddenness, and is the most common of all mental diseases which the general practitioner is suddenly called upon to treat. It belongs to the acute varieties of insanity, and as a rule is curable. Year by year it forms a certain percentage of the female admissions to the asylums of England and Wales, and many cases are successfully treated at home, or away from asylum care, by the medical attendant in whose practice it has occurred.

The insanity connected with child-bearing is divided into three groups, according to the time of its appearance. Thus we have the *insanity of pregnancy*, *puerperal insanity*, and the *insanity of lactation*.

Puerperal Insanity.—By puerperal insanity is meant the mental disturbance which occurs during the first six weeks following the birth of the child. It occurs much more frequently than the insanity of pregnancy or of lactation.

Cause. In a large proportion of the women who become insane at the puerperium there exists a predisposition to insanity arising from

a neurotic family inheritance. This may be a direct insane heredity or it may be an epileptic, neurotic or alcoholic heredity. The patient's mother may have had an attack of puerperal insanity, and may have passed on to her daughter a tendency to suffer in the same way. In this connection it is of interest to note that Mott, in his investigations of relatives in the London County Asylums, discovered amongst other things that mothers transmit to the offspring more frequently than fathers, and that daughters are more often affected than sons. In view of the frequency with which a neuropathic inheritance is met with in such cases, it is difficult not to regard it as an important factor in the causation of the disease. Other causes are: a previous attack of insanity; any mental stress, whether sudden or prolonged, such as grief over the death of a relative or worry over the desertion of the husband; the knowledge that the child will be illegitimate; the age of the patient, for the older the neurotic woman is the greater the danger, especially in the case of primiparæ; a lowered state of nutrition due to the presence of some bodily disease such as syphilis or tuberculosis, or to alcoholic intemperance, or imperfect hygienic surroundings; prolonged or difficult labour.

In some cases septicæmia exists, but under modern methods this is less frequent than it used to be, which may account for the decrease in the percentage of the cases of puerperal insanity during the last thirty years.

The most important exciting cause met with now, however, is toxæmia. This may not be severe enough to provoke serious symptoms such as occur in septicæmia, but it is sufficient to cause a slight amount of fever, increased rapidity of the pulse and a more or less marked leucocytosis. This is invariably found in acute confusional insanity, which most authorities regard as a toxæmia, and which is the commonest form of puerperal insanity.

If the loss of blood is considerable and produces great exhaustion, collapse delirium may ensue.

Form of Insanity. Puerperal insanity assumes, as a rule, one of three forms. Many are cases of acute confusional insanity, others are cases of dementia præcox of the katatonic variety, and some manic-depressive insanity. During labour delirium may occur which passes off when the child is born. The acute confusional form is the one which is looked upon as the most typical, and is best known as "puerperal mania."

Onset. Symptoms of Acute Confusional Insanity may follow the birth of the child very closely and may develop with startling rapidity, so that the home which was the scene of so much quiet happiness is suddenly filled with

fear and dismay. It may be that for a short time everything has gone well. The joy with which the event has been anticipated seems to be realized, and all anxiety is allayed. Then an alarming change takes place; an undreamt-of complication has arisen. After a sleepless night the gentle, newly-made mother has become a noisy, excited, and perhaps violent woman, striking terror into the hearts of her relatives and causing the gravest anxiety to those in attendance upon her.

Mental Symptoms. Sleeplessness is one of the earliest symptoms and should make those in attendance upon the woman uneasy as to what is going to follow. The patient becomes dull and quiet, and shows no interest in anything that goes on in her room. She appears to be indifferent to her friends and to her baby. This indifference may deepen into antipathy, and an attack of frenzy may occur, in which the woman may murder her child or make an attempt upon her own life. In some cases the responsibility of the patient for such an act may be called in question, a fact which should be borne in mind. Apathy and indifference may be quickly followed by talkativeness and excitement, until a state of delirium develops. In her delirium the patient chatters about past events. More recent occurrences, such as her marriage and her confinement, are not spoken of, and appear to have no place in her memory. She makes no reference to her husband or to her baby. By this time the patient may be in a state of continual unrest, tossing about in her bed and clapping her hands. She plays about with the bed-clothes and may tear them to pieces. The excitement increases and the patient is liable to expose herself, and becomes lost to all sense of decency. The patient may jump up and down in bed, or rush about the room, smashing things and displaying an amount of energy quite out of proportion to the amount of physical strength she possesses. She may resist the nurse's attention to her, and be very violent. The patient no longer recognizes her surroundings, and she mistakes the identity of the people about her. She will hardly look at food, and will struggle against it. Hallucinations of hearing are often present, but are vague and fleeting; she thinks she hears people talking in an adjoining room. Her attention wanders, and she only listens to a word or two of what is said, and that is enough to start a new train of thought for her. Ideas succeed one another so rapidly in her mind that she only has time to express fragments of them.

Bodily Symptoms. Certain bodily symptoms accompany these mental symptoms. A varying degree of fever is present, which even in the absence of septic infection may rise to

101° or 102° F. The pulse is soft and rapid. There is sordes about the lips, the tongue is furred, and constipation is marked. In septic cases the lochia may be scanty and offensive, but otherwise may be normal. Abscesses in the breast may develop, and there may be retention of urine.

Progress of the Disease. The illness may last only a few weeks, the patient making a good recovery. On the other hand, it may last much longer. With due care and attention the acute bodily symptoms will subside in a few weeks, and although the various bodily functions do not immediately become normal again, yet the patient will have gained considerably in strength. The excitement may still continue, with a certain amount of confusion of mind. She may still be very violent, and nurses frequently notice more purpose in the violence at this stage and less blind resistiveness and destructiveness. She is faulty in matters of toilet, and she may indulge in bad habits. As convalescence approaches the patient gradually comes to herself and begins to puzzle out things. Such a patient, when she first realized that none of her own people were with her, concluded that they were all dead, and that she was left to the care of strangers. Another told me that her first conscious thought was that she was in heaven—very flattering, no doubt, to those who had the care of her; but sometimes it is the other way about with these patients, and they fear they are in the lower regions. Sometimes with a view to recalling the baby's existence to the mother the child's photograph is sent to her, but it has no meaning for her. "That is not my baby, my baby is dead," she will say. She reads different meanings into the letters which she receives, and re-reads them in wonder when her mental atmosphere has cleared. Gradually convalescence ensues, and a perfectly satisfactory recovery takes place.

Prognosis. During the first few weeks of the illness there is danger of the patient dying from exhaustion, and for a much longer period there is danger of the patient dying by her own hand, otherwise she will most likely make a good recovery. As has been said, the duration of the illness is variable. It will probably be short if it starts soon after the birth of the child, but it may last longer if the mental symptoms do not appear until some weeks after the confinement. If recovery does not take place within a few weeks, then it may be delayed for three, six or nine months. As a rule the recovery is complete. There is always the possibility of the malady recurring at some future confinement, but this happens less frequently than one might expect.

Treatment. If the patient can afford the

expense, she should be treated at home or at any rate outside of an asylum, entirely from sentimental reasons. If the expense of private nursing cannot be afforded, or if the patient exhibits pronounced suicidal tendencies, then it is wiser to place her immediately under asylum care. The safety of the child has to be considered also, and therefore it should be taken from the mother at once. If this is not done, disaster may be the result.

In these cases very careful nursing is required. Rest in bed is essential, and everything possible must be done to maintain the patient's strength. If she entirely refuses food she must be fed by means of a nasal or œsophageal tube. If this is delayed too long the patient may become very much exhausted. In those cases where the exhaustion is extreme, saline injections per rectum should be given. These are most easily given by means of a rubber catheter (No. 8), to which may be attached about a foot of rubber drainage tubing, to the other end of which is fixed a glass funnel. The saline injection should consist of saline solution in the proportion of one teaspoonful of salt to a pint of water. The temperature of the solution should be the temperature of the body, which means that it must be about five or ten degrees higher in the jug. This should be given every four hours for a day or two. After the first administration the patient will not probably retain more than eight or ten ounces at a time. This is not meant to take the place of food, which must be given by means of a tube in small quantities three or four times a day. Eggs beaten up and mixed with hot milk should be given in this way, and very soon the patient will be able to have at least three pints of milk and four or six eggs daily. Later on, when she is taking her food naturally, she should still have a plentiful supply of milk foods. If the lochia is offensive a hot (115°–118° F.) antiseptic douche should be given twice daily. The breasts may have to be emptied and strapped. Constipation must be treated and it may be necessary to purge the patient freely; it should not be allowed to recur.

In the great majority of cases no sedatives need be given. Any good they do is only temporary.

When the patient is strong enough it is well to have her out of doors as much as possible, as fresh air and plenty of food, especially fattening food, are the best sedatives.

Katatonia.—The second form which insanity at the puerperium is likely to assume is the katatonic variety of dementia præcox, associated with stupor. The symptoms of this may appear during pregnancy. If at that time the woman seems indifferent to her condition,

which one would expect to be of absorbing interest to her, especially in the case of primiparæ, then those in attendance should be on guard. This indifference may increase, without any change taking place at the confinement. It may be several weeks later before the characteristic symptoms of katatonia declare themselves. Indifference may give place to depression and to stupor. This may be followed by a phase of the disease characterized by impulsive acts of violence or destructiveness. Recovery may take place eventually or dementia supervene more or less rapidly.

This variety is as a rule of longer duration than the acute confusional variety, and may last nine months or a year. The treatment is chiefly symptomatic and has been described elsewhere.

Manic-Depressive Insanity.—The third form which insanity occurring at the puerperium may assume is maniacal-depressive insanity, and is not so common as the other two. Those who are known to suffer from attacks of excitement and depression do not become insane at childbirth as frequently as one might expect. It is true, however, that sometimes at the first pregnancy or confinement the earliest manifestations of the disease appear.

Insanity of Lactation.—The insanity of lactation is that form of mental disorder which appears during the time that the woman is nursing her child, but not before six weeks or two months have elapsed since the confinement took place.

Cause. As in puerperal insanity a predisposition to insanity exists, and the exciting cause may be found in the exhausted state of the patient's health through prolonged nursing of the child. It is liable to occur in cases where the patient has borne several children in the space of a few years and has nursed them all. It is rather more common amongst poor, hard-working women than amongst the well-to-do. The imperfect hygienic surroundings of the poor will also help to produce a lowered state of health.

The *form* of insanity is usually that of melancholia of a subacute kind. The symptoms are mild when they appear early, and more severe when they appear later. The patient becomes low-spirited and unable to do her work as usual, and begins to fancy that her neighbours are talking about her, and perhaps that they are saying things against her. The depression deepens, and the patient begins to talk of "putting an end to it all," or she may make some attempt to do so. The course which the disease runs is similar to that of melancholia arising from other causes. In spite of the suicidal tendencies which may appear, however, it never assumes a very acute form.

The *prognosis* is good and the prospects

brighter when the symptoms appear early, otherwise recovery may be delayed for months.

The *treatment* is to wean the child at once, and to insist on rest in bed. The patient should have a plentiful supply of simple nourishing food and as soon as possible should be out of doors for as long as possible each day, without incurring too much fatigue. Constipation may prove troublesome and must be treated.

Insanity of Pregnancy.—This form of insanity is comparatively rare, more so than puerperal insanity or the insanity of lactation. As in these two forms, a neurotic inheritance is an important factor in the causation of the disease. Other considerations are the presence of any wasting disease which is undermining the patient's health, and the age of the patient. Sometimes the dread of the approaching suffering preys upon her mind. As a rule it takes the form of melancholia, but other varieties of insanity are met with. Symptoms of general paralysis of the insane have revealed themselves for the first time during pregnancy, and the initial symptoms of katatonia may appear then.

The *symptoms* may appear during the early months of pregnancy or not until after the fourth month. They may not attract much notice, being thought to be nothing more than the curious longings and caprices which women sometimes exhibit during pregnancy, more especially those of a neurotic disposition. Sleeplessness is an early symptom, which may be followed by loss of interest in friends and relatives. This may deepen into dislike in the case of her husband. She may become suspicious of those around her, and finally distinctly depressed, and may begin to accuse herself of various offences, and attempts at suicide may be made. There will be present the usual bodily symptoms which accompany melancholia, constipation, etc. Loss of appetite may not be so marked as a perverted appetite.

Prognosis. If the illness begins before the fourth month of pregnancy it is probable that recovery will take place before the birth of the child, otherwise it may not take place until some months after the child is born. Many of the cases which appear for the first time in the later months of pregnancy prove to be cases of dementia præcox, and in such cases the outlook is not very bright.

Treatment. It is advisable, if possible, to treat the patient at home or in private, if this can be done with safety. If not, the patient should be sent to an asylum. The treatment is the same as in other cases of melancholia, but the nurse in charge must be on the outlook for the appearance of symptoms such as retention of urine, varicose veins, œdema of the feet, etc. It must be borne in mind that labour itself may begin without the patient informing her nurses

of the fact. It is not advisable to induce labour in the hope that the mental symptoms will disappear, because such a result can never be guaranteed.

N. K.

MELANCHOLIA

Melancholia is a name that was formerly given to any morbid mental state of depression of functional origin; but in recent years the use of the term has become limited to (1) the depressive phase of maniacal-depressive insanity and (2) the morbid depression which appears in presenility. Kraepelin limits the appellation *melancholia* to the latter of these two conditions, and claims that it differs from the former in such a way that the two varieties of depression can be differentiated without reference to the age of the patient. For presenile melancholia he claims apprehensive restlessness and absence of retardation as distinguishing features, apprehensive restlessness being absent and retardation present in the depressive phase of maniacal-depressive insanity. With this distinction the present writer, for one among many, does not agree; for, on the one hand, apprehensive restlessness is common enough in maniacal-depressive insanity, and, on the other, retardation is by no means uncommon in presenile melancholia.

While, however, we are unable to recognize any symptomatological or pathological differences between the two conditions, we are prepared to admit that presenile melancholia is usually incurable, while attacks of maniacal-depressive insanity are curable; that presenile melancholia shows no tendency to alternate with mania, perhaps because with advancing age there is an increased tendency to states of mental depression, and that hereditary influence has a much smaller etiological relationship with presenile melancholia than with maniacal-depressive insanity. In this latter connection, however, we have to remember that insanity is liable to appear much earlier in the children than in the parents, and the present writer has observed several cases of maniacal-depressive insanity whose parents suffered from presenile melancholia. Moreover the prognosis of an attack of depression occurring in a maniacal-depressive patient during the presenile period is not so favourable as that of a similar attack occurring in early life. Inasmuch, therefore, as we believe these two conditions to be identical, the melancholia here described includes presenile mental depression and the depressive stage of maniacal-depressive insanity.

The physical health of the patients is poor, there is generally a history of loss of weight, the tongue is furred, there is loss of appetite, and obstinate constipation is the rule. The

secretion of sweat is deficient; the complexion is therefore inclined to be rather muddy and the hair drier than natural. There is slight chlorosis, and in women menstruation is arrested. The urine is scanty, highly coloured and loaded with urates; this is possibly due to the fact that patients do not take sufficient liquid nourishment to effect normal dilution of the urine. In puerperal cases the secretion of milk ceases.

The aspect of the patient is that of depression. There is slight flexion with adduction at all the joints, and this is associated with a certain amount of rigidity of the large proximal joints. The muscles of the back and neck are in a state of contraction, as also are those of the shoulders and hips, although to a less degree. Rigidity of the muscles controlling the movements of the elbows and knees is also present, but this is less obvious than in the case of the larger joints; while the hands and feet are fairly flaccid.

Associated with this rigidity there is weakness of the affected muscles. The disease is a sort of double hemiplegia; differing, however, from a true organic double hemiplegia in that the peripheral muscles of the hands and feet are not so markedly affected. This is best demonstrated by asking the patient to hold his arms straight above his head. In extreme cases he can scarcely raise his elbows above the level of the shoulders. The patient's gait often gives a hint as to the nature of his disease. He walks from the knees and uses the hip movements but little. Moreover, he prefers standing to sitting, the latter posture causing him discomfort on account of the rigidity. The handshake of a melancholiac is also noteworthy in that he shakes from the wrist; the normal handshake is from the elbow.

All these physical signs of melancholia are obvious enough in severe cases of the disease, but in mild cases it requires a trained observer to detect such symptoms. All movements, however, are slow, and the patient finds difficulty in doing things which were formerly easy to him. Everything is an effort and he finds himself disinclined for occupation of any kind.

In severe cases the muscular contraction affects the face, the corners of the mouth being turned down, the naso-labial folds abnormally pronounced and the eyebrows knitted so as to form deep furrows at the root of the nose.

The above series of motor symptoms is the foundation of the patient's mental attitude. He feels that his will power, his volition, has gone and that his normal instincts are in abeyance. He is unable to turn his attention to anything, at least for any length of time; attention has been demonstrated psychologically to be motor in origin.

Quite apart from the dejection consequent

upon such thoughts, the patient is depressed owing to the fact that his enforced attitude is one of depression; his general emotional tone is therefore one of intense misery. Everything looks black, to such an extent that he is incapable of believing that he can ever recover from his illness; life is not worth living, and he contemplates or makes serious attempts at suicide. On the other hand, the rigidity of the muscular system is such that it does not allow the normal play of features associated with emotional reaction and, as a result, we find that melancholiacs are deficient in emotional reaction; not merely that they do not laugh when a mirth-provoking incident is related to them, but also that they do not feel any occasion of gloom on the receipt of bad news. There is loss of feeling, but no loss of sensation, sensation is normal in melancholia.

Associated with all these symptoms the patient has a kind of subconscious introspection, leading him to arrive at certain judgments which constitute the delusions of melancholia. Inasmuch as some regard the capacity for volition, instinct, attention and emotion as the essence of mentation, they consider the absence of such faculties as evidence that the mind has gone. Others regard these faculties as symbols of a soul within, and their absence as evidence that their soul is dead. Hence such people conclude that their soul is lost, that they are eternally damned, that they have committed the unpardonable sin, and that they have led an immoral life. Others, again, regard the above-mentioned faculties as the symbols of life itself, and, these being in abeyance, they believe themselves to be dead.

Certain other patients attach more importance to the physical aspects of their disease, and to them the loss of appetite means that they are unable to swallow and that the throat is obstructed; the constipation means that the bowels are permanently obstructed; the weakness of the limbs means that they are paralysed; or the inability to concentrate attention on a train of thought means that the brain has gone.

Yet others ascribe their inability to do things not to their own incapacity, but to interference by other people, and they develop delusions of persecution.

There is no disorder of sensation. Perception is clear, and the patients know where they are, can recognize their friends and tell the time of day. Hallucinations do not occur in uncomplicated cases. Similarly there is no real defect of memory, although the patients sometimes complain that their memory is going. If they can be induced to converse, it will be found that the judgment and reasoning power are good in respect of topics unconnected with their delusions.

The insomnia of melancholia is a very constant and persistent symptom. Patients suffering from this disease usually have difficulty in getting to sleep before two or three o'clock in the morning. Commonly they are awake again by six o'clock and then have their worst time in the twenty-four hours. They are extremely depressed, and suicidal attempts are most frequently made during the few hours before breakfast time.

Varieties. It is customary to classify melancholia by reference either to the physical signs or to the delusions. When paresis, immobility and incapacity for occupation are the most pronounced signs, the patient is said to be suffering from *stuporose melancholia*; and when restlessness associated with picking or plucking movements of the fingers are in evidence, he is said to be suffering from *agitated melancholia*.

If the patient has clear insight into his condition, realizing that it is due to illness and being subject to no delusions, the disease is called *simple melancholia*; but when disorder of judgment and consequent delusions arise, the disorder is known as *delusional melancholia*. Some authors give a special name, *hypochondriacal melancholia*, to this disease when the disorder of judgment is in relation to the patient's knowledge of his physical health.

Course and Prognosis. The reader will gather from the article on *Maniacal-Depressive Insanity* that the termination of most cases of melancholia is favourable, but that there is liability to recurrence or subsequent attacks of mania. About three to six months is the usual duration.

Diagnosis. As in all cases of mental disease, the practitioner should be careful first to eliminate the possibility of *general paralysis* by looking for such physical signs of that disease as tremor, ataxic speech, loss of the pupillary reaction to light and grossly altered knee-jerks. The knee-jerks of melancholia are small but brisk.

The depression of *dementia præcox* is more insidious in its onset and accompanied by mannerisms, signs of catalepsy and catatonia. Hallucinations of hearing also are common in *dementia præcox*.

Acute confusional insanity is characterized by hallucinations, and such disorders of perception as agnosia, disorientation and illusions of recognition. Anæsthesia of the hands is common in this condition, but uncommon in melancholia.

The diagnosis from *neurasthenia* is sometimes difficult. Neurasthenics have more insight into their condition than melancholiacs and suffer much less from anorexia and constipation and much more from strange sensations in the head, back and abdomen. Moreover, there is no muscular rigidity in neurasthenia.

The morbid fears of *psychasthenia* some-

times resemble those of melancholia. The psychasthenic, however, realizes the groundlessness of his fears, whereas the melancholiac is convinced that his fears are well founded. The physical signs of melancholia are absent from the former condition.

Some *epileptics* suffer from attacks of typical melancholia, but the history of convulsions will put the practitioner on his guard in estimating the true nature of the case.

Treatment. This consists of rest in bed and overfeeding. The melancholiac usually resents being put to bed and offers all sorts of excuses why such treatment should not be adopted, but experience teaches that bed has a beneficial and curative effect upon these cases. Restlessness can be combated by giving half a drachm of liq. morph. bimec. three times a day after meals, and the habit of sleep can be restored by the administration of a couple of drachms of paraldehyde in an ounce of peppermint water every night at bedtime. A warning against travel is necessary, inasmuch as it is still recommended by the ignorant.

Similarly, melancholiacs not only dislike food, too often they actively refuse it. Nevertheless it must be insisted on that their meals be regularly taken, and that their nutrition be increased by the addition to their diet of three pints of milk daily, with cream if possible. When food is actively refused it must be given by means of a feeding-tube, not a feeding-cup. An œsophageal tube is passed into the stomach three or four times a day and a pint of nutritive fluid, consisting of milk, cream and eggs, poured down by means of a funnel. Sometimes it is desirable to peptonize each feed.

The bowels should be regulated by the administration of suitable purgatives.

It must always be recognized that every melancholiac is a potential suicide. The practitioner must therefore avoid delay in placing his patient under asylum care.

W. H. B. S.

MANIA

Mania is that phase of maniacal-depressive insanity which is characterized by motor excitement and mental exaltation. The name was formerly applied to all cases of mental disease in which motor excitement occurred; and there are even still a few physicians who use the term in this way, preferring a monosymptomatic classification of mental disease to one based upon groups of symptoms.

The patients are generally in poor health, but this is not so striking as in melancholiacs; the tongue is not so furred, constipation is not so obstinate, the complexion is less muddy, and the appetite is capricious but seldom abolished.

Menstruation, though irregular in some cases, is not usually suppressed. In puerperal patients the secretion of milk is not arrested, as in melancholia, but, on the contrary, rather in excess, to such an extent that it often becomes necessary to massage the breasts and to apply belladonna plasters in order to avert the formation of mammary abscesses.

The chief characteristic of the disease, however, is motor excitement and restlessness, mainly affecting the muscles of the large proximal joints. The patients stride rather than walk, swaying the trunk from side to side and waving the arms from the shoulders. The condition is the reverse of melancholia, in which there is weakness and rigidity of the large-joint muscles. The attitude is one of general extension and abduction, again in contrast with that of melancholia, in which there are general flexion and adduction.

The patients are noisy and garrulous, being either hilarious and jocose or angry and reviling. They shout, laugh and sing by turns.

All this motor activity finds an outlet in destructiveness. The clothing is torn, vases are hurled to the ground and smashed, and the nurses suffer undeserved blows. In milder cases the garrulity is less marked, the patients are often rather smart in repartee, and excitement finds its outlet in mischievousness rather than destructiveness. They play practical jokes and put things in their wrong places for fun.

There is general hyperæsthesia to the extent that a slight pin-prick evokes a scream; and the senses of smell, taste and hearing appear to be abnormally keen.

There are no hallucinations in uncomplicated cases.

The feeling of energy induced by the motor excitability usually gives a sense of well-being, power and mental capacity. I have known some patients carry out enormous undertakings during a mild attack of mania which was insufficient to necessitate segregation. More commonly this sense of capability gives rise to delusions of exaltation, the patient believing himself to be the Messiah, the reincarnation of one of the prophets or some other great man.

Pari passu with the motor restlessness there is restlessness of ideation, with an abnormally rapid "flight of ideas." Thoughts chase each other through the patient's mind too quickly to find expression in words, and there results a form of incoherence due to elision of connecting links. A patient, before dashing a plate to the ground, uttered the words "Plate, knife, cut, avoid, my sisters." This is an example of what is not incoherence. If she had said "Plate, cut, my sisters," she would have been incoherent to her hearers, although there would have been no incoherence of thought.

These patients are not incoherent to themselves and there is no confusion of ideas. They know where they are, recognize the nature of their surroundings, know the nurses and doctors by name, and can tell the date and time of day. Their memory is excellent for recent as well as for remote events, and their perception of common objects and pictures shown to them is keen. As a rule they are fairly clean in their habits, but liable to be untidy in their dress. They may decorate themselves with leaves or tawdry pieces of coloured ribbon, and if they tear up their clothes, it is often for the purpose of fantastically arraying themselves with the same garments fashioned anew.

When the storm is over and before convalescence becomes established the patients are liable to sink into a temporary condition of stupor in which they take no interest in things going on around them and do not speak, except perhaps in monosyllables, or occupy themselves in any way. During this stage a few hallucinations of hearing may occur, and there is usually some analgesia of the hands and forearms. These are to be regarded as symptoms of nervous exhaustion.

Varieties. These are degrees of intensity rather than true varieties of the disease.

Simple Mania is a state of exaltation in which there is a well-marked feeling of *bien être*, a sense of capability and power, excessive emotional reaction and lack of moral control. The patients are commonly youths on the brink of manhood who swagger and bluster, believing themselves to have fully arrived at man's estate. They take undue interest in dress and wear nosegays and ties and socks of brilliant hue. They become disobedient to their parents and adopt extreme measures to assert their independence of authority. Eroticism shows itself in numerous engagements with members of the opposite sex. Such patients are seldom understood until they do something too bizarre to come within the layman's conception of normal conduct.

Acute Mania is characterized by the more intense and reckless excitement above described. The patients are boisterous, destructive and noisy; yet, in spite of their violent behaviour, they have clear insight into their own mental condition, unless the disease has invaded the reasoning faculty and they suffer from delusions.

Acute Delirious Mania is the most severe variety of the disease. In addition to still greater motor disturbance there are distinct signs of general illness. The temperature is raised to 101° F. or even more, the pulse is soft and frequent, the tongue coated with a thick fur and the stomach often incapable of retaining food. Obstinate constipation is the rule and there is absolute insomnia. Many of these

patients, fifty per cent. according to some observers, die from sheer physical exhaustion.

Chronic Mania is, as its name implies, a state of motor excitement which falls into line with the other varieties in all respects, except that it persists indefinitely. The symptoms are not so severe as in acute mania, and perhaps the most striking feature of the condition is remarkable exaltation of memory (*hyperamnesia*). The patients can remember the dates on which trifling incidents occurred years ago and, so long as there is no dementia, they never forget a person's name.

Diagnosis. *General paralysis* should always be eliminated by a careful search for the physical signs of that disease, viz.:—absence of the pupillary reaction to light, tremors, difficulty of articulation, and alteration in the knee-jerk. The knee-jerk is never absent in cases of mania, nor, on the other hand, so exaggerated as in *general paralysis*.

Cases of the *infection and exhaustion psychoses*, in which motor excitement is a prominent feature, differ from mania in that the patients are confused in their ideas, disorientated and afflicted with hallucinations and loss of memory, whereas mentation is generally clear in maniacal cases.

The excitement of *dementia præcox* is sometimes difficult to differentiate, but diagnosis is important from a prognostic point of view; mania nearly always terminates in recovery, *dementia præcox* in mental wreckage. The latter disease may be suspected when an excited patient with good perception and memory suffers from hallucinations, and diagnosed when there are also present such cataleptic and catatonic signs as echopraxia and echolalia, stereotypy and verbigeration, seclusiveness and negativism.

Epileptic insanity is to be suspected when the onset and termination of the excitement are very abrupt, when there is no remembrance of the attack, and when the patient suffers from epileptic fits.

Course and Prognosis. Nearly all cases of mania recover or give place to an attack of melancholia, as described, under maniacal-depressive insanity. A few cases become chronic and a considerable number of patients suffering from acute delirious mania succumb to exhaustion. The usual duration of an attack of mania is four or five months. In individual cases the practitioner may be guided in his prognosis as to duration by the history of previous attacks.

Treatment. This must be directed towards improving the patient's general nutrition by means of a liberal diet and inducing as much rest as possible.

A good plain liberal diet, well cooked and

varied so that the patient does not tire of food, is all-important in the treatment, and, if he be obviously ill-nourished, it is well to supplement his ordinary meals with extra milk and eggs, bread and milk, cream, cocoa, etc. Extract of malt and cod-liver oil are also useful adjuncts for increasing the body weight.

The patient should have continuous rest in bed. It is often difficult in the first instance to induce the patient to submit to this form of treatment, but a tactful nurse can usually do much towards persuading him. A series of prolonged warm baths (99° F.) sometimes breeds a desire for rest. The duration of the bath is one hour the first day, two hours the second, three hours the third, and so on up to eight hours, then it is gradually reduced until it reaches one hour again, the whole course lasting a fortnight. After the bath the patient returns to bed and is induced to rest as much as possible. The bath treatment should not be pressed if it exhausts the patient.

Maniacal patients seldom sleep without the aid of hypnotics, of which the best for them is sulphonal, this drug being a motor sedative as well as an hypnotic. Thirty grains may be given nightly, and the practitioner must not be disappointed if it does not act well for the first night or two. It is well, however, to vary the drug occasionally, say with paraldehyde, so as to avoid the occurrence of hæmatoporphyria.

The bowels should be regulated by the use of suitable aperients. W. H. B. S.

DEMENTIA, AND STATES OF ACQUIRED MENTAL ENFEEBLEMENT

General Definition. The term dementia is popularly and legally used as synonymous with insanity, but technically this is not correct. Dementia connotes those states of mental weakness which occur in persons who have previously been in full and complete possession of normal or average intellectual faculties. The term thus excludes cases of idiocy, imbecility and feeble-mindedness which commence at birth or from an early age—such being cases of amentia, high or low grade according to the amount of mental defect present. The term “moria” is often used, especially in American medical literature, to describe the slighter forms of congenital weak-mindedness, which do not amount to idiocy or imbecility. There may be no difference between amentia and certain stages of dementia, either in quality or quantity of mental reduction, but the former applies exclusively to congenital cases, the latter to those whose mental weakness is acquired in later life. It is the difference between the bankrupt and the indigent or very poor—both

"have not," but one "has had." A further difficulty in regard to dementia is to fix the line of demarcation between the amount of mental weakness consistent with responsibility and that which may technically be described as the dementia of insanity, the difficulty, for example, to distinguish between physiological dotage (or mental weakness consequent upon old age) and that amount of dementia which is pathological, such as may be seen to follow upon repeated attacks of mania, melancholia or, indeed, from old age and infirmity. The actual commencement of dementia, moreover, is difficult to determine, hence the importance of the subject from the medico-legal aspect.

Cause. Although periodic insanity recurring at more or less regular intervals is not associated with much dementia, it may nevertheless be stated that dementia (not infrequently accompanied by epilepsy) is the natural termination of all the varieties of insanity. It is especially the sequel of long-continued epilepsy, and it follows states of mania and of melancholia, but not of chronic delusional insanity or paranoia—often called monomania. It is the invariable accompaniment of general paralysis, some forms of tabes, chorea (especially the senile form, Huntington's chorea), and it may also be the direct result of certain toxins, such as alcohol, lead and syphilis. It occurs as the consequence of organic destruction of the brain by cysts, hydatids, pachymeningitis or tumours—when frequently there is marked hebetude or stupidity and dullness. It is known to follow some injuries to the head, and it may result from hæmorrhage, embolism or thrombosis with cerebral softening. It is the ordinary sequel of severe arteritis, and this is the most frequent pathological condition associated with cases of dementia from senile decay.

Symptoms. Those who are suffering from dementia may be described as mental cripples needing the minds of others to buttress or prop them up. Their mental defect varies from a slight impairment to gross degeneration. The chief symptom is mental apathy and indifference, which is evidenced in the expression and attitude. They are heedless and careless of personal appearance, neglectful and dirty in their habits, they move about passively without energy, they take little interest in their surroundings, and in extreme cases they will sit about or crouch on the floor in flexed attitudes. They bolt their food, forget to wash, to fasten their garments or to button their clothing, they forget to use their handkerchiefs, and the ordinary functions of the individual come to be performed in a manner regardless of the proprieties and amenities due to others; thus their ways are so objectionable and their conduct in society so unendurable that it becomes necessary to care for them elsewhere

than in the domestic circle. In the early stages there is merely a loss of feeling and affection, a blunting of the senses and a weakening of the emotions and a general loss of energy, often preceded by insomnia. There is a disinclination for the ordinary duties of life. The young lose their situations from mere slackness, inattention, or neglect, and not at first from any loss of memory, which is usually good for past events, and they themselves mind these losses less than their parents or friends. They become selfish, they want and demand the best, and are ungrateful even when this is given to them. They show no emotion, merely a negative attitude of indifference, and "unemotionalism" is the key-note of their automatic conduct. They become dull and stolid, although they may repeat things and words in a senseless, meaningless way. Egoism gradually replaces all the former altruism, and in accordance with the "law of dissolution" that the latest faculty is the first to go, "courtesy, ceremony and convention" give way to all the self regarding attributes of their former conduct. Dementia in the old exhibits a general diminution of mental power as shown in thought and action. This comes on gradually and they wander about aimlessly, although capable of doing ordinary routine work under the supervision and control of others. In adult or senile dementia, and in that following previous attacks of insanity, there is marked loss of memory, more especially for recent events, and memory as a rule may be taken as an indication of intellectual capacity and judgment, at any rate in so far as the ability exists to take a broad view of any subject, or the power to keep in mind the various factors of any complex problem. Owing to this failure many senile demented have an inability to undertake testamentary responsibilities. They not infrequently consort with undesirable friends and will act upon their suggestions, and so may commit criminal or civil actions which they themselves had neither the initiative to originate nor the grasp to appreciate the consequence, and as to which they feel totally indifferent. It is owing to this loss of, or impairment of, the higher control that there is the prominence of lower or animal characteristics, bodily excitement and impulsive actions being often associated with mental indifference and a heedless regard for consequences.

This condition of dementia is a gradual deterioration ending in complete mental degradation, without, as a rule, any hallucinations or delusions. The more marked the dementia the less prominent are hallucinations and delusions.

Forms. Dementia may commence in an acute form (1) as a primary condition occurring from the first as a gradual and progressive mental weakening; or, as is more common, it is

(2) secondary, and the result of other conditions, and (3) there may also be "partial dementia." The secondary varieties may be (a) those consequent upon separate attacks of insanity in an acute form, or upon one prolonged single attack which ends in confirmed mental weakness; (b) those that may be described under the term dementia adventitia or dementia accidentalis occurring in previously healthy persons as the result of cerebral hæmorrhage or thrombosis, *e.g.* post-hemiplegic cases, or those due to head injury (under this variety may also be included those cases of dementia due to other organic lesions as have already been named, such as tumours); (c) those due to alcohol, Indian hemp, opium, the use of bromides or other drugs, the use of lead or the poison of syphilis; (d) those due to repeated epileptic seizures; (e) those associated with old age—arterio-sclerosis.

1. **Primary Dementia** is known under the name of dementia præcox (for which see special article). This form commences as a rule in young persons whose parents or collateral relatives show a record of mental or nervous disease. It affects those who, under undue stimulation or pressure have taken high places at school, or even those who have become exhibitioners of their college, or those who under a severe strain have obtained, in spite of their youth and short experience, commanding positions in commerce or trade. A gradual mental enfeeblement takes place, and four varieties of primary dementia are usually described: (i) simple weak-mindedness, (ii) hebephrenia, (iii) katatonia, and (iv) the paranoid form. The illness begins usually with insomnia and anxiety; there is some anæmia; often dilated pupils reacting to light, and frequently also constipation. The urine is scanty and there is excess of urates and phosphates. The knee-jerks are normal, but the skin reflex is diminished. Mentally there is an absence of desire and curiosity, a lack of interest in their occupation, and a dull satisfaction with their condition. They answer questions correctly when interrogated, but there is a retardation in the reply, and the general mental activity is impaired; there is a want of proper adjustment between the receiving or afferent processes and the discharging or efferent ones, hence the term dementia sejunctiva which has been suggested for this form. Finally there is a lack of judgment, passing on to a progressive mental enfeeblement until a state of childishness ensues as its termination. In the course of their illness persons suffering from this form exhibit certain peculiar symptoms, among which quite opposite states may be noticed, viz. they are at one time resistive and negative, standing or sitting in the same fixed attitude until their extremities are blue and cold, or they are impressionable and suggestible, easily taking up any fresh position in which they are

placed at the moment (*flexibilitas cerea*), retaining these poses until they drop from sheer fatigue. They may repeat actions (*echopraxia*), or sentences (*verbigeration*), or sounds and words (*echolalia*) uttered by others, or they may perform over and over again eccentric, automatic or rhythmic movements.

2. **Secondary**—(a) consequent upon repeated attacks of insanity. The large asylums of this country contain a great number of cases of secondary dementia among their inmates. The larger part of their population consists of the class described as primary dementia, and the next larger part consists of secondary cases. These are they whose relations and friends seek to place in doctor's houses when well-to-do, for care and protection. Their dementia as a rule does not compromise their lives, and whether rich or poor they continue to live quietly in the healthy surroundings provided to-day in our public and private asylums. They do much of the work of such institutions, and they are usefully occupied in the gardens and grounds. They also, by "accumulating," *i.e.* living on under favourable conditions, account in a great measure for the so-called increase of lunacy, which in the opinion of some is an apparent rather than a real increase.

(b) Dementia adventitia or accidentalis is the result of hæmorrhage, *e.g.* post-hemiplegic dementia. There are a not inconsiderable number of these in asylums and under private care. They are easily known and treated. Cases of organic disease of the brain causing right hemiplegia with aphasia, which become irritable and noisy, and in whom moral changes also occur, which become defective in their habits, destructive and unable to look after themselves, are frequently met with in asylums for the insane. Cases of cerebral tumour with hebetude and dullness have often been brought into asylums for conduct intolerable in hospital or in the home. Cases of serious head injuries with violent outbursts or noisy restlessness are also known as secondary dementia. Infectious and other diseases may also be the commencing link in a chain the end of which is dementia. For instance a young nurse had acute rheumatism with cardiac disease, a vegetative growth from a valve escapes into the cerebral circulation and causes aphasia with paralysis and subsequently dementia; she is brought to the asylum and lives on for nearly thirty years in this state. It is well to bear in mind the legal aspect of cases of aphasia with mental deterioration.

(c) Those the result of alcohol. Twenty per cent. of all the insanity (mania, melancholia and dementia) in men, and ten per cent. in women, have been attributed to excessive drinking, and this is probably true, but the cases in which insanity occurs had a tendency already to

break down, which the excessive drinking actually determined. The typical cases of alcoholic dementia are few. These are cases of Korsakoff's disease or polyneuritic psychosis, and they are mostly incurable. In them there is gross dementia with muscular weakness of the legs and arms due to the neuritis. Lead is also known to cause dementia, but with improvement in the conditions of work and the use of leadless glaze such cases are now rare. Indian hemp and opium are rarely causes of dementia in this country.

Syphilis is a powerful nerve poison and is closely related to dementia in two ways: (i) by gummatous infiltration or meningeal inflammation associated with proliferative endarteritis, coming on with bodily symptoms together with dementia, and this from three to five years after infection. The bodily symptoms are manifested in headache and paralysis of one or more of the cranial nerves—the third the most frequent. The parts bathed by the poisoned cerebro-spinal fluid are those most commonly affected, viz. the base of the brain and the interpeduncular space. The mental symptoms are those of progressive enfeeblement. (ii) Dementia paralytica, coming on within twelve to fifteen years after infection, associated with the mental symptoms so commonly seen in general paralysis. An analysis of over three hundred of such cases at Claybury gave the average duration of this dementia as one year and four months from the time of admission into the asylum till death. It is described as para- or meta-syphilitic dementia, because it is not relieved by any known anti-syphilitic treatment.

(d) Those due to epilepsy or to senile chorea. Repeated small fits—petit mal—rather than severe and infrequent ones, in adults, tend to destroy the mind, but tend to prevent its development in the young. These persons are liable to outbursts of great impulsive violence upon slight or no provocation, and they always need careful supervision. Associated with senile chorea there is a form of dementia which tends to run in families.

(e) Those associated with arterio-sclerosis. This form is the most common one associated with old age, and the mental symptoms may come on at any time after the age of fifty years, especially if there be renal disease present. It is important to avoid undesirable outside influence in the case of those who have property to dispose of, and to ascertain whether the testator knows not only the number but the claims of his various beneficiaries and the extent of his property, also if these can be repeated correctly. Their careless and heedless habits, their manner of dressing and appearing in public, have often led some of this class to be charged with indecent exposure or with making improper overtures when they were really

irresponsible. The effect of alcohol upon this class is still further to reduce the power of self-control. The recognition of senile dementia as a form of insanity needing care and control is recognized by the Lunacy Act, 1890, sec. 116.

3. Partial Dementia.—It has been stated that every attack of insanity, however slight, leaves some "scar" upon the brain. If this be the equivalent to stating that some slight mental weakness occurs after such an attack, then the statement is true. The amount of dementia is very difficult to determine in persons suffering from slight periodic anomalous mental conditions at stated intervals, and they may suffer from very slight dementia, so the term is justifiable in these cases and "partial dementia" expresses it better than any other. Those cases, on the other hand, in which attacks of insanity have occurred several times, or those young persons suffering from stuporose melancholia (anergic stupor) or from other forms caused by undue stress, anxiety, ill-health, or some serious illness do suffer from mental enfeeblement, which varies from an appreciable to moderate and even severe mental failure. Many of the large asylums can testify to the number of victims of complete dementia from these latter forms.

Diagnosis. It is desirable to separate cases which are of syphilitic origin from others, and to do this we have to seek the assistance of chemical methods of diagnosis. Pupillary reaction, lymphocytosis, the Noguchi test and the Wassermann reaction will indicate those who might be relieved by antisymphilitic remedies, although mental states with tabes or general paralysis are beyond relief. The appearance of the patient, if young—his glance, his expressionless face, his languorous look and manner, his "unemotionalism," the condition of the pupils and the history of insomnia will help to form the diagnosis of primary dementia. Cases with symptoms of early excitement and hallucinations, in whom there was a family record of mental and nervous diseases, would also probably come under this division. The history of the case as to previous attacks of insanity, as to injury, fits or the presence of paralysis or of old age would point to the variety of dementia. The blood pressure may be helpful in diagnosis.

Prognosis. Favourable in cerebral syphilis, less so in alcoholic cases, unfavourable in all others. As a rule dementia is a condition which implies progressive psychic enfeeblement until the most profound deterioration is reached, and this enfeeblement proceeds without compromising life. The patient leads a vegetative life until some intercurrent disorder ends it, most commonly œdema with congested blue extremities, a feeble circulation and cardiac failure, broncho-pneumonia, pulmonary and intestinal tuberculosis or dysenteric diarrhoea.

Pathology. The mental sanity of an individual will continue so long as the inherent durability of his neurone endures. Some persons' neurones will never, under ordinary circumstances, decay: others commence to decay and perish under the mildest stress; and the inherent stability or otherwise of the nervous mechanism is the key to dementia, which is caused by neuronie deterioration. The morbid appearances of the brain in such a case are the physiological results of the loss through decay of the essential elements in the cerebral substance. Wasting of the convolutions is caused by the degeneration of these cell substances. The physical expression of dementia is evident in the wasting of the cerebral convolutions, their place in the closed cavity of the skull being taken by an increase in the cerebro-spinal fluid. In dementia paralytica this fluid contains cholin and nucleo-proteid—waste products from the decay of the neurones, and due to the breaking up of the lecithin. These waste substances cause the cerebro-spinal fluid to exercise an irritative effect upon the lining membrane of the ventricles, which provokes the ependyma to proliferate, as may be seen especially in the fourth ventricle in most cases of long-continued insanity, and particularly in cases of dementia paralytica.

The pathology of dementia præcox or primary dementia implies a disturbance of the organic metabolism within the brain. Microscopically there is a deficiency of the pyramidal cells in all regions of the cortex. The Betz cells show a deficiency of the chromophilous substance and there is an increase of neuroglia cells in the deeper layers of the cortex. Chemically there is a disordered sulphur metabolism, due to an inherent deficiency in the oxidation processes. The blood is hydræmic, with a tendency to eosinophilia. A neuro-psychopathic history occurs in seventy per cent. of all cases, which implies at the outset an imperfect formation of the central nervous system, and the neurones of such persons begin to decay with the first effect of stress or responsibility—a good place in the school suffices for some, starting the struggle for life for others; puberty or early adolescence being the favourite periods, yet some may resist stress until a later age, but when decay commences it proceeds in the great majority of cases until recovery is hopeless.

Treatment. Cases of primary dementia require isolation and rest, to which treatment some of them will react favourably; possibly twelve per cent. of cases of primary dementia will recover, *i. e.* if they receive early treatment. The continuous bath at the body temperature for many hours at a time may assist recovery, also the electric bath with the continuous current twice a week for twenty minutes at a time. The improving cases increase in weight

under this treatment. Muscular exercise by Swedish drill is desirable. Strangers are preferable in carrying out the treatment rather than their own friends, but a trained mental nurse is indispensable in order to keep them clean and to encourage orderly habits and regular methods of life. They need a nourishing diet, with eggs and milk to replenish the drain in nucleo-proteid and fat. Drugs may be necessary to procure sleep or to control impulsive excitement, bromide and chloral being the least harmful, but hyoscine subcutaneously injected may be necessary. Sulphonal should not be given until the case is quite hopeless. Testicular or epididymic extract may be found useful. Constipation is to be controlled by the administration of daily doses of a laxative, and frequent small doses are preferable to occasional large ones. Antisyphilitic treatment by Ehrlich's Salvarsan, alternating with mercurial treatment, is very successful in the early stages of dementia in which the Wassermann reaction is positive, and where cerebral syphilis rather than dementia paralytica is evident. Good nursing is the only treatment for confirmed cases of secondary dementia.

R. J.

STUPOR

Stupor is a disordered mental state in which the patient, though conscious, fails to react to his environment and remains silent and immobile, often for weeks or even months together. It is not to be regarded as a clinical entity, since it may constitute a phase of several mental diseases.

The name is not applied, however, to those forms of extreme terminal dementia in which mentation is permanently abolished to such an extent as to render the patient incapable of reacting to his surroundings on account of a lack of apprehension; nor is it customary to consider under this heading those stuporose states which arise as a preliminary to coma from intracranial pressure in such conditions as meningitis and cerebral tumour.

Stupor may occur in various forms of chronic intoxication, of which septicæmia, certain post-febrile conditions, uræmia and alcoholism are perhaps the commonest; it is frequently encountered in exhaustion psychosis (acute confusional insanity); it appears in maniacal-depressive insanity as melancholic stupor, post-maniacal stupor and anergic stupor; it is common in dementia præcox, especially in the katatonic variety, and one meets with it occasionally in general paralysis, epilepsy and perhaps hysteria.

In any case of stupor, therefore, it becomes the duty of the physician to ascertain which of the above diseases is the underlying cause of

the morbid manifestation, and the reader must refer to these under their several headings in order to learn the symptoms on which he must rely to make an accurate diagnosis. Accuracy in the differential diagnosis of these various conditions is of the utmost importance, because the prognosis of any given case is directly dependent thereon, quite apart from considerations of treatment.

Speech and movement being practically in abeyance in all cases of stupor, the physician is deprived of the help rendered by a large number of symptoms usually to be observed in other (non-stuporose) varieties of the disease from which the patient is suffering, and he must depend upon certain physical signs in forming a diagnosis. The history of the case is often helpful; but when the history and physical signs are not mutually corroborative the history must be neglected.

The most reliable symptom of the toxic and exhaustion psychoses is analgesia of the characteristic distribution described elsewhere and determined by the patient's response to the prick of a pin. It must not be forgotten that post-maniacal stupor is in reality a mild form of the exhaustion psychosis, and the fact that a stuporose patient has recently passed from an attack of acute mania into a stuporose condition will in itself suffice to indicate the true nature of such a case.

There is no analgesia in melancholiac stupor. This form is to be recognized by the presence of proximal rigidity.

Anergic stupor is characterized by extreme hypotonia of the muscles. Patients suffering from anergic stupor are completely flaccid and the limbs possess no tone, so that a patient lying in bed in this condition can be, so to speak, folded up with his knees touching his chest and his heels resting on his buttocks. If he be sitting in bed, he can be bent forward so that his face comes into contact with the bedding between the calves of his legs without the knees being flexed.

Katatonic stupor is to be recognized by the presence of cataleptic phenomena, especially *flexibilitas cerea*, negativism and echopraxia; but it must not be forgotten that such symptoms may also be present in acute confusional insanity. Inasmuch as the differentiation between these two disorders largely depends on the state of the patient's receptive faculties, which cannot be ascertained when he is stuporose, the diagnosis in such cases is often difficult. A definite cause for the disease, an acute onset and the presence of analgesia argue for the exhaustion psychosis; while the absence of a definite cause, a slow insidious onset and normal sensation suggest dementia præcox.

If stupor occurs in association with con-

vulsions, the practitioner has to consider whether the cause is epilepsy or general paralysis, and he should test the pupillary reaction to light and examine for other signs of the latter disease.

W. H. B. S.

HYPOCHONDRIASIS

The conditions described under this name cover a wide range of mental and bodily states which come under the observation of practitioners and specialists in almost every department of medicine.

As its derivation implies, the region of the hypochondrium was supposed by the older authorities to be the primary seat of disorder. So also in melancholia, with which it is closely associated, the disordered secretion of the liver was held as a sufficient explanation of the mental state of the patient. This view has, however, been superseded in later times. Hypochondriasis is now rightly regarded as essentially a brain disorder. Some patients evince little or no abnormality of the bodily functions, but are always complaining of ill-health, whilst others who suffer from some slight common ailment magnify their symptoms out of all proportion.

Hypochondriasis exists in all degrees, from the mildest form, differing but slightly from the normal standard, to an aberration of mind that renders certification necessary.

In the normal healthy individual there should be no consciousness of the activities of the abdominal or thoracic organs. The nerve currents to the cortex from these parts should pass unheeded. The hypochondriac, on the other hand, is so constituted that he is more or less sensitive to the impressions from these visceral currents. He develops a habit of exaggerating their import, and becomes morbidly conscious of his bodily mechanism. His attention becomes monopolized by these sensations and associated ideas, at the expense of special sense impressions from without. Defective or disordered metabolism of the cerebral neurones, with the production of toxins, is a probable hypothesis in the etiology of hypochondriasis.

The sanity or insanity of any particular case must be regarded as largely dependent on the interpretation the patient gives to his sensations, and the extent to which his conduct is affected thereby. Some patients perform their life's work unimpaired, although they may never cease to discuss their imaginary ailments. They frequently state that their vital energies are being sapped, yet they may grow fat and live for years. Others give up their occupations and become chronic invalids, whilst not a few give way to suicidal impulses.

When the misinterpretation of the bodily

sensations develops so far that definite delusions are the outcome, the patient is usually classed as suffering either from **Hypochondriacal Melancholia** or **Hypochondriacal Paranoia**. The former affection may be acute, with active resistance to treatment, the patient perhaps refusing to take food and imagining he is blocked-up or unfit to live. In the latter, ideas of ill-health are attributed by the patient to persecutors. In neither is there much tendency to dementia, but the prognosis in the former is better than in the latter, which is essentially a chronic malady. Closely allied, and sometimes classed with hypochondriacs, are certain psychasthenic individuals who are beset with hypochondriacal ideas. One person has an obsession that he is incubating for hydrophobia, another is always washing and is fearful of the effects of micro-organisms, another is perpetually frightened of catching cold and insists on all windows being closed. Little can be done to improve these individuals.

There is usually a neurotic history in hypochondriasis. From early youth a patient may have brooded over his health; in the majority of cases, however, the condition first manifests itself in mid-life. Although more frequently seen in men, it affects both sexes, and is more common in those who are unmarried.

Hypochondriasis may be conveniently classified according to whether the symptoms are (1) general, or (2) correlated to particular organs of the body, the more usual coming under notice being, (a) the alimentary tract, (b) the sexual organs, (c) the brain itself.

1. **General Hypochondriasis** occurs at all ages, particularly in adolescence. The subjects generally lead sedentary and solitary lives and imagine their health ruined. Their morbidity is often accentuated by reading quack literature. They look at their tongues, count their pulse, and are always studying their health and refer to medical works. Some complain of breathlessness and pains, and imagine they are about to die. These latter are not so improvable as the former, who with change and moral encouragement recover, with the help of tonics, nutritious diet and sea air. The prognosis in cases past mid-life is always doubtful, although the climacteric in women is answerable for some cases that recover when menstruation ceases.

2. (a) **Hypochondriasis of the Throat and Alimentary Tract.**—This forms a large class of cases, the majority being under the influence of insane delusions, requiring certification for their proper treatment. The patient is dominated by the idea that there is obstruction to the passage of food. He says he is blocked-up, and locates the mischief for the most part at the beginning or at the end of the digestive tract, or at both, and sometimes in other regions of the stomach

or bowels. The patient says he cannot swallow, and, when persuaded, makes futile attempts to do so. Likewise when he goes to stool he makes no voluntary effort. Some patients say they can swallow liquids but not solids, and vice versa. Some form of paralysis or cancerous growth is frequently suspected by them, and a suitable specialist consulted. The ordinary symptoms of dyspepsia are often completely misinterpreted. Thus a climacteric patient with flatulence imagines herself pregnant, the borborygmi in a male patient induce him to believe that he has a living animal within his stomach. Others with a sense of sinking and weight at the epigastrium say that the stomach and bowels are contracted or have disappeared; that they are hollow and can contain no food at all, or that any ingested food immediately decomposes within them; that the products enter the circulation and leave no residue at all. The prognosis in these cases as a whole is not favourable, but when a gouty diathesis is present some recover after a duration of months or even years. In the treatment of the slighter throat cases the passage of an oesophageal tube at intervals sometimes satisfies and benefits the patient for a time. The severer cases that show definite symptoms of exhaustion insanity need forcible tube-feeding. Many are suicidal and require close supervision. Attempts are genuinely made at self-mutilation or destruction in these patients, whilst in the milder cases suicidal acts are committed and threats uttered to call attention to their state of health. Rectal enemata occasionally assist some patients who imagine that nothing ever passes from the lower bowel. Partly allied with these cases are those who think they have lost control over their sphincters. One patient examines the tail of his shirt and wants to change repeatedly, whilst others have a morbid fear of vesical incontinence. Little can be done for these cases.

(b) **Sexual Hypochondriasis.**—This occurs in both sexes, but is more frequent in males. There is commonly a history of masturbation and sometimes of excessive venery. The onset is gradual, the patient feels he is losing virility, becomes morbidly self-conscious and dwells constantly on sexual matters. He develops exaggerated fears of emissions and of the results of past habits of masturbation. He imagines himself impotent or works himself up into an actual state of impotence. The condition is associated with decided suicidal ideas, and the patient requires the utmost care and attention. Impotence or the dread of impotence is a not infrequent cause of unhappiness and mental depression shortly before and after marriage, sometimes leading to suicide or a worse tragedy. Sexual perversion is

occasionally at the root of the trouble, or the patient may be obsessed with the idea that he has had syphilis (syphilophobia), and repents his engagement or marriage.

The *prognosis* in the milder cases of sexual hypochondriasis in young persons is fairly favourable. Change of surroundings, with cold baths, good food and tonics, is productive of wonderful improvement, the citrate of iron and quinine with small doses of strychnine suiting them well, whilst occupation should be provided; travelling may be recommended if the suicidal element be not pronounced. The question of marriage must be decided on the merits of the particular case, but on the whole it should be discouraged.

In women fear of the marital act is the most common cause of sexual hypochondriasis. There may be physical disorder requiring treatment, but most cases are purely mental and cure is rarely possible. Some women of a prominently sexual type develop delusions of persecution and imagine they have been outraged in their sleep or under an anæsthetic. They make serious accusations against innocent parties which sometimes require legal action. Certification is generally necessary.

(c) The symptoms of **Brain Hypochondriasis** are manifold. Patients speak of a feeling of weight in the head or that the brain feels dead, or is swollen, shrunk or liquefied. They say they cannot think and are in agony for fear of losing their mind. Others complain that people read their thoughts and influence them, so that persecutory delusions follow. In most the progress of the disorder is gradual, but sometimes patients state that they felt something give way in their brains on a specific occasion, that something "snapped," and they have never been the same since. It occurs mostly in the latter half of life; patients become chronically depressed and say life is not worth living, but rarely become actively suicidal. They seek fresh advice, but little can be done for them. The prognosis is unfavourable, they continue in much the same state for the rest of life. The majority are unable to follow any occupation and find their way into institutions. Earlier in life the outlook is better, and some recover after a few months' change with suitable companionship. It must be noted that some types of progressive insanity commence with symptoms of brain hypochondriasis. Thus general paralysis, dementia præcox, and senile dementia must be specially distinguished.

In every case of hypochondriasis, whether the symptoms be general or confined to a particular organ of the body, the physician should make a careful physical examination. As regards treatment he should not neglect to listen to the reiteration of symptoms, however wearisome

this may be. He will thereby gain the confidence of the patient. Suggestion and hypnotism have in experienced hands proved of some use in certain cases. A firm but kindly attitude should be assumed towards the patient, and with general therapeutic measures much improvement, and indeed in some cases complete recovery, can be effected. R. H. C.

THYROGENIC INSANITIES

When certain lesions interrupt the functional activity of thyroid and parathyroid glands there may be induced a series of psychopathic states in association with the characteristic physical symptoms of cretinism, myxœdema and Grave's disease. Cretinism, resulting from a functional incapacity of the thyroid in infancy and early youth, whether endemic or sporadic, symptomatizes itself on the psychic side in an arrest of mental development; myxœdema, following on disease or ablation of the thyroid in later life, shows itself by a trophic and interceptive alteration in the cutaneous structures, with a coincident psychic torpidity and occasional active psychic symptoms; while exophthalmic goitre, in which there apparently is a primary insufficiency of parathyroidal function, and a secondary compensatory or accessory thyroidal hypertrophy, displays certain oculo-cardiac symptoms with mental involvements of varying intensity.

In **Cretinism** (and we are here considering the sporadic form only) there is a more or less general impairment of every mental faculty, the degree of idiocy exhibited depending in a large measure on the date of onset of the physical malady, so that the earlier the suspension of thyroidal function the wider and more extended will be the intellectual implication. Between, on the one hand, the speechless, irresponsive automata, whose psychic functions are merely rudimentary and often not even reflex, who are conscious only of their nethermost animal calls, and frequently fail to respond even to these, and who drag out a vegetative and helpless existence, and, on the other, those of the highest grade who have a fair degree of intellectual acquisition with a certain educational aptitude for automatic and mechanical occupations, and a certain power of acquiring manual dexterity, there are all varieties of degree of defect. In the majority of cases, as in myxœdema, mental and physical torpor is a prominent symptom—ranging from a drowsy motionless inactivity of a fatuous stolidiform character to a dull slow-moving defect of keenness. Those of the middle class exhibit, prior to specific treatment, some nebulous appreciation of environmental influence, but their attention cannot be engaged,

they are void of memory and their mental dullness is accentuated by their auditory, gustatory and olfactory physical defects. In all but the lowest grades the cretin may at times exhibit fulminations of irritability, but as a rule he is a placid, drowsy, fatuously amiable midget, unimpressible and of slow chameleon-like movements; on the whole he is far easier of management than the ordinary idiot. Whatever the degree of his mental defect may be, however, it will be wise to observe a very strict caution in venturing on a decided prognosis upon the psychic side of his affection, under specific treatment. This will undoubtedly cause a speedy disappearance of the torpidity, but the measure of his intellectual improvement will be in inverse ratio to the range of his mental defect, the greater the psychic deficiencies, the less chance of amelioration will there be. The high-grade idiot who can already speak and who is educable along certain lines will assuredly improve in speech, range of vocabulary and manual dexterity, and sometimes even the alacry, owing to the improvement in hearing, articulation, etc., be found to become thus teachable; but the relatives must be impressed with the experience we have acquired that under thyroid treatment the psychic improvement will always be less extensive than the physical amelioration, and that an amplification alone can be brought about of psychic functions already established but existing in elemental or partially developed form—there can be no acquisition of new psychic processes or functions—the undeveloped will remain undeveloped. The subject of sporadic cretinism, in fact, when he makes the best possible recovery under thyroid medication will always have to be a dependent on others for advanced intellectual effort.

Certain mental concomitants, unmistakably due to the pathological condition, are recognized as constants of **Myxœdema**; but it is clearly wrong to include all forms of mental abnormality that may occur in the myxœdematous as instances of myxœdematous insanity. It will be only by careful observation and record, following on the investigation of a large number of these subjects, who by specific treatment have been cured of their physical malady, that we shall be in a position to eliminate the false accidental psychoses from the true insanities of the basic disease. There appear to be three groups of mental conditions affiliated with the myxœdematous state:—(1) Those undoubtedly the direct result of the pathological condition—psychoses due to impaired nerve conductivity, trophic defect, or a toxæmia. (2) Those that are the indirect results of the malady—mental symptoms auto-induced psychically in the neurotic; and (3) those of inconstant form,

instances probably of accidental insanity affecting the subject while he is myxœdematous. Those in the first class alone can fairly be termed psychoses of the condition, while the second class may perhaps be included as insanities of the disease indirectly induced.

There are but few of the myxœdematous who do not to a greater or less degree exhibit the effects of imperfect nerve conductivity and imperfect nerve nourishment in their psychic as well as in their sensory and motor fields. A psychic pseudo-paresis appears to envelop them, they show a sluggishness in every mental operation, a profound disability to rouse themselves to any attentive effort, so that they cannot with any briskness or alertness wake up to environmental appreciation, cannot follow any line of discussion, cannot efficiently record any impressions from without, or produce with facility such registered impressions as they may be in possession of, not because of intellectual defect, but because the lines of connection between clogged receptive and semi-nourished emissive stations are operating imperfectly; and they betray defects of memory, which, be it noted, is not a true pathological amnesia, but an apparent memory inefficiency due entirely to their torporous inability to sustain attentive effort. Their psychic disability, in short, is merely a functional interruption and not an organic lesion, and this is proved by the fact that as the physical cachexia disappears under thyroid treatment so do these mental symptoms vanish. As she stolidly sits in her place with a facial expression of heavy hebetude or sulky porcine indifference, vacantly lethargic in all her conduct processes and deficient in her volitional impulses, save a snappy irritability and peevishness when roused to effort, she appears to the superficial observer to be a dement; but dementia is absolutely out of court in her condition even though her memory is defective; to be a dement postulates an incurable brain state which hers is not—it is only in the last stages of her disease, when appropriate treatment for her basic affection has not been adopted, that one finds a true dementia, a mental weakness due then to prolonged interruption and disuse of psychic associative centres and their lines of connection. Examine her carefully, and by visual rather than auditive paths, and you will discover her intelligence and her judgment to be fairly accurate and unaffected. Her mental operations are merely mud-bound, they are not deranged.

This apathetic inertia is the usual psychic picture with which we are confronted, but in a goodly proportion evidences of larger mental implication can be seen. A fairly constant aggregation of symptoms, bearing a toxæmic stamp, may be observed in the excitement with

confusion, the incoherence in ideal sequence, and the transient shifting delusions and hallucinations that with untidiness, dirtiness and general incapacity in self-preservative conduct mark some cases. Others are deeply depressed, have suspicious and persecutory delusions or self-condemnatory beliefs, visual hallucinations of a terrifying type, or auditory, gustatory or olfactory subjective disturbances; while states allied to the forms of late dementia præcox, paranoid conditions, phenomena symptomatic of maniacal depressive insanity, or simple non-delusional feelings of anxiety and apprehensiveness, or simple hypochondriacal ideas—all these are here and there to be encountered. The separation of these into true myxœdematous insanities and accidental insanities occurring during the myxœdematous state is difficult; but one form, that of delusional insanity of suspicion and persecution, may be explained by psychic influence; the painful, distressful consciousness in a hypersensitive neurotic of the facial and bodily deformity of which she is the subject, and the knowledge that she is an object of comment and derision, are influences which may react so strongly upon her as to drive her into an insane condition. Of this, a good many years ago, I had an excellent example. Appropriate specific treatment sometimes wipes out the abnormal mental associates, at others leaves them untouched, and no rules can yet be laid down as to the curability of the active insanities found with myxœdema. The prognosis of all but the primary and undoubtedly myxœdematous forms must be made with caution.

It is accepted by a good many investigators that **Exophthalmic Goitre** is primarily a parathyroid malady; whether this be correct or not its mental symptoms are certainly more of a toxic type than merely phenomena antithetic to those exhibited by cretinism and myxœdema, as one would expect them to be from the hypertrophied state of the thyroid. There can be but little doubt that the parathyroids subserve an important antitoxic function—the results of experiments amply demonstrate this—and it is probably in proportion to the degree of implication of these glands that physical and mental symptoms evolve in intensity and severity. Even in those in whom the psychic evidences are of minor grade, irritability, capriciousness, disturbances of attention, indecision with an incapacity for mental concentration, some confused nervous apprehensiveness, emotional weakness and fits of depression, indicate the presence, to some small degree, of a toxic factor; and the symptoms in the more intense and severe grades of psychic involvement, in the true insanities of this disease, more fully corroborate the view as to the nature of the

disturbing influence. Various forms of morbid mental upheaval are to be observed in Graves' disease, and it is quite as important as in myxœdema, though much more difficult, to differentiate the true from the accidental insanities of the malady. The psychic associates of the disease are simple melancholia, delusional melancholia with terrifying visual and auditory hallucinations and concepts of persecution with obstinate refusal of food; maniacal-depressive insanity of alternating form; alternations of tranquillity and maniacal excitement with ideal incoherence and insomnia, much motor restlessness, voluble loquacity and violent destructiveness; and finally instances of true acute confusional insanity of severe form. These last, though not of very frequent occurrence, are always of extremely grave type, and it is exceptional for them to recover; of five such cases that I have seen but one has ended in complete recovery, and that with a remarkable diminution in all her physical symptoms and the preservation of good mental and physical health for fourteen years. As in myxœdema there may be auto-induced psychoses of persecutory delusional form.

All the mental associates of Graves' disease are of bad or very doubtful prognosis, being either of persistent or periodic form, or, if extremely acute, generally fatal in termination.

J. F. G. P.

OLD AGE AND INSANITY

Old age has a different meaning in different individuals. It has been well said that "a man is as old as his arteries," and arterial degeneration is so constant a feature in senile dementia that it has also been called arteriopathic dementia.

No fixed age limit can be definitely drawn above which the patient can be spoken of as senile. There are many cases of insanity occurring in the sixth decade of life, or even earlier, which must be looked upon as due to premature senility. The cases occurring in the earlier periods, however, are not marked by such profound decay of mind as in those occurring from the age of sixty-five upwards. Occasionally it happens that an individual has maintained sound mental health till well over eighty years of age and then has the misfortune to break down in mind concurrently with sudden cortical decay.

In those who break down mentally in old age there is very commonly found to be a family history of insanity; this occurred in thirty-five per cent. of cases under my care. In many of these one or other parent or grandparent has also had senile insanity. In a considerable number a child of the patient has broken down mentally or has shown other evidence of mental

instability long before the psychosis has appeared in the parent. Insanity in old age, therefore, does not depend only on arterial degeneration, but may also be the expression of an inherited neurosis. Physical and mental stress, alcoholism and syphilis predispose to early senility.

It is not every case of insanity seen in old age which is an example of true senile insanity. A patient may have suffered from recurrent insanity of the maniacal depressive type from early life and may still continue to suffer thus in old age.

Chronic delusional insanity or dementia coming on in adolescence, or after an acute attack of insanity in middle life, may be compatible with prolongation of life till over eighty years of age.

Again, many senile cases are examples of organic brain disease due to arterial degeneration, resulting in cerebral hæmorrhage or cerebral softening and associated with hemiplegia, aphasia or other paralyses. Many of these cases recover mental balance as the destructive lesion becomes quiescent, unless there is at the same time generalized cortical atrophy or malnutrition from arterial degeneration.

1. Senile Dementia.—This may supervene gradually or may be marked at its onset by an acute psychosis passing into dementia.

In typical cases the patient is noticed to gradually lose memory and business capacity. He fails to keep appointments, forgets where he has put things, and cannot remember recent events although old organized memories remain. He forgets to pay his rent, rates or bills when due, or sometimes may wish to pay twice over. He may consider that he is still conducting a large business when it is being done for him by others or has disappeared by his incapacity. As the disease progresses he fails to recognize his immediate relatives or may mistake them for dead relations or other people, does not recognize his own house and will lose his way if out alone; eventually disorientation of time and place becomes complete. He then lives "in the past," speaking of his father or mother or other deceased relatives as still alive and of himself as thirty or forty years younger. Marriage, children, business and means may be all forgotten or remain as fragmentary memories.

Perception fails, ideation becomes very restricted, voluntary attention disappears, thought becomes slow and incoherent or is hardly expressed at all. Hallucinations are rare in simple senile dementia. Emotional instability is marked, the patient being sentimental and easily moved to tears or to anger. Later the emotions are blunted. Control of sexual desire is often lost early, so that the patient may

be accused of some sexual crime or may be found to be squandering his money on sexual gratification, or may desire to marry a young woman. In women the talk may be of engagement, trousseau and marriage.

Volition becomes profoundly affected; in the early stages the patient is obstinate and stubborn, but later becomes childish and devoid of will power and may be easily induced to sign documents or give away money at the dictation of unscrupulous persons.

Concurrently with the mental failure there is physical decay varying in different cases, so that some are difficult to manage in consequence of considerable motor activity although with very defective memory, while in others muscular weakness with restricted energy are present from the first. Apraxia is often very marked, and may vary from simple inability to carry on an occupation to total failure to recognize the uses of or to make use of common objects such as a pen, knife and fork or clothes. Gradually the patient becomes inert, loses the power of walking, loses control over bladder and rectum and becomes bedridden. The disturbance of conduct varies greatly in different cases.

Insomnia and nocturnal restlessness are common, often associated with drowsiness by day. Death may occur from convulsions and coma, from cerebral hæmorrhage and softening, or from pulmonary hypostasis, cystitis or renal disease, or cardiac failure.

2. In many cases an attack of maniacal excitement with confusion ushers in the decay of mind. The patient becomes restless, talkative, extravagant, increasingly excited, noisy and shouting, and sleepless. Incoherence of speech follows, the identities of those about him are mistaken, there are delusions commonly of the exalted type and hallucinations of sight and hearing. At times food is refused and there is much resistance to all attention. Eroticism, self-exposure, and loss of control in cleanliness are early features.

The strength rapidly fails, the patient is tremulous and tottering yet constantly struggling and further exhausting himself. Seizures may occur with more or less paralysis of limbs or aphasia.

In cases with excitement of the confusional or delirious type death may occur early from exhaustion or the excitement may pass off leaving dementia.

In some cases the attack of excitement may be of the type of simple mania marked by talkativeness, exaltation and moral perversion but without marked loss of memory, at any rate in the early stages. Such attacks may be recovered from, but the prognosis, where there is excitement of any type in old age, is always grave, and if bodily failure does not take place

there is likely to be damage to capacity or to memory, and in many cases dementia gradually supervenes.

3. **Melancholia** may occur in old age and be recovered from, or may be the precursor of dementia. The case begins with lassitude, inability to concentrate the attention, fatigue in following the ordinary occupation, depression and sleeplessness. The bowels become constipated, appetite fails and there is loss of flesh. The case may remain one of simple depression without definite delusions, but perhaps with suicidal tendency, or delusions of one of the usual groupings may develop. Hypochondriacal depression with delusions as to the state of the viscera is common, and perhaps especially so are delusions of bowel obstruction or of sexual loss. Such patients are extremely suicidal and generally incurable, general enfeeblement of mind and loss of memory gradually developing.

Another well-marked group is that in which there are delusions of financial ruin, the patient expressing himself as having "no money and no clothes," and believing that he has dragged his family into ruin and that he will be treated as a criminal.

In other cases the delusions are of the religious or self-accusing type, the patient believing himself to be wicked, eternally lost, and condemned by God, and accusing himself of crimes or raking up sins of early life which he believes are unpardonable.

In all these cases there may be either torpor and silence or agitation and resistance, and tendency to suicide and refusal of food. In senile melancholia there may be no loss of memory, and if this symptom is absent a guarded prognosis may be given, as many such cases recover even in advanced age.

In another group fixed delusions of persecution may develop (senile paranoia), the patient believing that he is persecuted by enemies who plot and conspire against his character, prospects, health or financial position. Delusions of unfaithfulness by husband or wife are often associated with failure of sexual power. Delusions of sexual persecution, of attempt at rape, or of drugging or physical persecution with threats of violence against the imaginary persecutors exist in some cases, especially in women, associated with hallucinations. Delusions of exaltation sometimes coexist with delusions of persecution or may occur without. In these cases failure of memory gradually supervenes and the prognosis is bad.

Treatment. In simple uncomplicated senile dementia the patient can generally be managed at home with the help of efficient nurses, attention to the physical condition, and guarding against accidents. As the patient is unable to manage his affairs, very often for the protection

of his property a receiver has to be appointed under sec. 116 of the Lunacy Act. The question of testamentary capacity has always to be borne in mind.

Where, however, the mental disorder assumes the form of definite acute insanity asylum care is needed unless the means allow of efficient care at home or in a special house taken for the purpose. Senile insanity is generally very difficult to treat at home as the patient cannot understand and resents control in the house where he has been master. This can, however, often be managed where the physical failure is very marked.

R. P. S.

CLIMACTERIC INSANITY IN WOMEN

As in the case of *puerperal insanity*, some authors do not describe *climacteric insanity* as a separate form. It occurs, however, more frequently than puerperal insanity, and is of considerable practical importance. Further, Kraepelin, the greatest authority on mental diseases of the present day, restricts the term *melancholia* to a group of cases occurring during the period of involution, the leading features of which are apprehensiveness, a feeling of impending danger, with marked depression and accompanied by delusions of self-accusation, of persecution, or of hypochondria. According to the statistics of the commissioners in lunacy a greater number of certified patients suffering from climacteric insanity are to be found amongst private patients than amongst paupers, and there must be many more cases met with in private practice who are treated and recover without being certified.

Cause. There frequently exists, in these cases, a predisposition to insanity. The functional changes taking place at middle life appear to be too severe a tax upon those who have inherited an unstable brain. Writers on this subject refer to the connection of the suprarenal glands with the reproductive organs at the involutive period of life. There is reason to suppose that the former increase in activity at the time when the latter becomes less active. If this leads to arterial hypertension, it may result in arterio-sclerosis. There may also be an *auto-intoxication* resulting from the various glandular changes occurring at this time. Alcoholic intemperance is frequently met with in women at the climacteric, who have not in any way been addicted to alcohol previously. This has sometimes given rise to the error of attributing the cause of the disease to the intemperance which has, in such cases, only been an early symptom. Climacteric insanity occurs more frequently in married than in single women. A previous attack of insanity may be a sufficient cause; and any

form of mental stress occurring at this time in a woman of neurotic disposition may cause the illness.

Form of Insanity. It has already been mentioned that climacteric insanity very frequently takes the form of *melancholia* with feelings of apprehension that some great calamity is approaching, and with delusions. It may take the form of *chronic delusional insanity* which may be systematized and progressive; less frequently cases of *mania* are met with.

Melancholia.—*Symptoms.* Sleeplessness is an early symptom, and also lack of energy to do things and inability to make plans even for the ordinary routine of work or pleasure. The daily duties gradually become more and more of a burden to her, and the patient becomes low-spirited and then very much depressed. She reviews her past life and can see no good thing in it. She accuses herself of sins of omission and of sins of commission. Formerly she believed she was doing what was right, but now she knows how wrong it all was. She has been selfish, she has been dishonest, etc. She has a dreadful fear that something is going to happen to her. She is going to be thrown to the dogs, or there is a terrible persecution against her. She has sinned beyond all forgiveness, she knows she has, because the feeling that God has withdrawn Himself from her is so strong. The reasoning of others assails this conviction in vain. Then comes the thought that it would be better for her friends if she was out of the way, and so she makes some suicidal attempt. Sometimes the depression is not so profound, but the fears and apprehensions are intense. The patient fears some great calamity coming upon her—she is to be burned, she is to be given to the dogs to be worried. A lady was obsessed with the idea that she was to be the victim of some French “necromancers”; hers was a marked life. This feeling was not always present with her, but when it was, it absorbed her, and though clear on every other point, her reason failed to help her to throw off this dominant idea. “Mark my words,” she said to me, “in three days I shall be dead.” In three weeks she was so much improved that she was able to leave the hospital in order to complete her convalescence under the care of some friends.

Constipation may be present, with a furred tongue. The pulse, rather than being slow, may be increased in rapidity.

Prognosis. In the milder forms this is good, and the patient will probably recover within a few months. In the more severe forms recovery will be delayed much longer and may never take place very completely. Where the delusion exists of having sinned beyond all

forgiveness, and where the remorse is somewhat noisy, the outlook is not so hopeful.

Treatment. As a rule such cases do well with institution life. The brightness and little social excitements do them good. They take an interest in the other patients, which takes their attention off themselves. In any case these patients should not be treated at home, but sent away from home and away from their friends. They do best with a complete change, and should have rest, fresh air and plenty of good food.

Climacteric insanity may take the form of chronic delusional insanity which may be systematized and progressive, and does not differ from the ordinary form of this disease. The delusions may refer to the generative organs. Hallucinations of hearing are present and the patient may complain of curious cutaneous sensations. A lady who suffered in this way used to talk to me about the “burning sensations” which she experienced in various parts of her body, but she preferred her own explanation to mine. They were caused, she told me, by electricity which was worked upon her by some one a hundred miles away, and as what she considered conclusive proof of her statement she showed me from time to time minute discolorations of the skin.

The outlook is not bright from the point of view of recovery, but as a rule such patients benefit very considerably by institution treatment.

If mania occurs at the climacteric it will probably be acute and may last from six to nine months.

N. K.

ADOLESCENCE AND INSANITY

The era of development, not only in man but in all the higher animals, is one of great importance in regard to the functions of the whole nervous system. In the lower animals, whose maturity comes earlier in life than in man, any retardation or morbid change in the process of development is sooner observed. In man, as might be expected, from the enormous complication and high integration of his brain, and the dominance of its mental function, the most important risks of the developmental period are met with during the period of adolescence, that is, between the ages of fourteen and twenty-five, and are those whose seat is in the brain. A careful clinical study of the defects and the diseases to which human beings are subject during development shows that the different ages are liable to different forms of disease. During the formative and embryonic stage, *in utero*, acephaly, deformed palate, genotous idiocy, etc., occur. From birth up to seven years, which is the period of

most rapid brain growth, rickets, epilepsy, Friedreich's disease, hydrocephalus, etc., occur, while from fourteen to twenty-five a large number of other defects are met with, the most marked of which are hysteria and adolescent insanity. As a matter of statistical fact, the ages between eighteen and twenty-five, which are those when the completion of mind, volition, self-control, moral sense and character take place, are those during which attacks of a characteristic kind of mania are frequent. There is no age, in fact, at which maniacal attacks occur so commonly. The key to the occurrence of all the neuroses during the developmental period is to be found in nervous heredity. As the result of a careful inquiry into the heredity of adolescent insanity, I have found that there are hardly any exceptions to the rule of an unfavourable nervous predisposition of some sort. If it is not mental disease, it is epilepsy or some form of motor or sensory neurosis. In a few cases it is tuberculosis, acute rheumatism, or some sort of degeneration.

The following may be taken as the typical characteristics of adolescent insanity. The patients, coming as I have said from a neurotic stock, are frequently found on careful examination to have exhibited mental peculiarities such as precocity, egotism, super-sensitiveness, impulsiveness, want of social development, oddities of manner, premature sex feelings or undue resentment at the discipline of parents and teachers—all those existing before the actual attacks of mental disease. There are also commonly found some of the numerous bodily "stigmata of degeneration." I found that fifty-five per cent. of my patients showed an abnormal condition of the upper palate, while defects in the cranium, ears, eyes, muscular movements and chest, were also not uncommon.

The first mental symptoms of the attacks observed are usually a slight melancholic depression, and in about one-fourth of the cases the symptoms remain melancholic during the attack. In the other three-fourths the patients begin very shortly to show elevation which passes quickly into mania. They are restless, boastful, sleepless, self-assertive, erotic, not amenable to discipline and unmanageable in most cases, this frequently going on to a delirious state. All the normal mental characteristics of adolescence are exaggerated and distorted. This condition will last for two or three months and then gradually abate. Naturally the relations of the patients think that recovery has taken place, but unfortunately relapses come on in another month or so, such recurrences taking place four or five times, with intervals of comparative sanity, but with a slight tinge of lethargy and stupor in it. It

will be observed that many of the symptoms are morbid exaggerations of some of the normal characteristics of the period of life, particularly the periodicity and remissions; those representing the periodicity of menstruation and of the sexual nîsus. In the patients who recover, and they amount to about sixty per cent., the symptoms die out, as it were, there is no further recurrence, while certain bodily changes are then observed, full development of the form, growth of beard and mammæ; and, in fact, physiological manhood and womanhood have arrived. The attack of mania seems to have been a "critical" one, coming on at the time full mental maturity was being reached, when, in fact, the brain cortex, that cope-stone of biological evolution, was attaining its highest faculties of self-control and character.

Unfortunately the cases which do not recover are apt to pass into that mental death of "secondary dementia," remaining during the rest of their lives incurable, and to a large extent mindless. The permanent populations of our asylums are recruited from this source to a larger extent than from any other form of mental disease, and it may be said that *adolescent insanity precedes four-fifths of all the cases of secondary dementia.*

Adolescent insanity is apt to be complicated by periods of stupor, by delusional symptoms of the elevated kind, by hebephrenic, katatonic and paranoiac symptoms, during which, as Dr. Bruce points out, we are apt to have a fall in the leucocytes in the quiescent intervals, with a tendency to leucocytosis before each maniacal relapse. There are apt to be sexual features and the habit of masturbation in many cases.

Treatment.—For a long time I have been in the habit of adopting the following modes of treatment in those cases, namely—a discontinuance of the stronger animal foods such as beef, an abstinence from alcohol in every shape, abundant feeding with farinaceous and fatty foods such as bread, butter, milk, fruits, etc.; life in the fresh air with vigorous exercise, garden or farm work in most of the cases. For a few patients who are exhausted, thin, and tend to be delirious, short periods in bed are useful. The maniacal excitement and sleeplessness may be controlled by moderate doses of the bromides combined with tincture of Cannabis Indica. In some few cases those medicines, with sulphonal in moderate doses, will arrest the tendency to relapse, but they should not be continued for long at a time.

There are many mental and moral peculiarities falling far short of technical insanity to which the period of adolescence is subject; those also being due to hereditary nervous weakness. They chiefly consist, in different cases, of a change in the social instincts, stupidity,

intolerance of control, incompatibilities of temper, causeless aversions to relations, absurd sentimentalism, sudden immoralities, frothy religionism, unconventionalities, dipsomania and even crime. Such conditions are the cause of the most intense worry to parents and guardians, and their real nature is commonly misunderstood by relations and teachers.

Kraepelin's *Dementia Præcox* covers part of the field of my "Adolescent Insanity," and what I have said about the frequency of neurotic heredity, liability to relapses and the danger of secondary dementia, applies to both. In fact, Kraepelin's and mine are two ways of looking at what is virtually the same condition. T. S. C.

TOXÆMIA AS A CAUSE OF INSANITY

In all cases of insanity due to toxæmia one of the main factors in the incidence of the disease is hereditary predisposition. A toxæmia which in one man may produce only malaise may in another, predisposed to mental instability, produce insanity.

For purposes of description the toxins which are known to produce mental symptoms may be divided into—

1. The secretions of certain glands.
2. Toxins arising through errors of metabolism.
3. Bacterial toxins.
4. Certain drugs.

Ovarian and testicular extracts given in large doses to persons already insane have in a few cases produced symptoms of mental excitement resembling mania. Thyroid extract, administered in doses of sixty grains per diem to chronic cases of insanity, has, in my own experience and that of other observers, produced mania, often of a very acute type. I have seen a typical maniacal attack occur in a case of myxoedema in which the dose of thyroid extract had been gradually increased to over a hundred grains in the twenty-four hours; while in all cases of insanity complicated by exophthalmos the most typical symptoms are mental irritability and mania.

The nature of the metabolic toxins which cause mental disorders is unknown, for although it is a matter of common knowledge that alimentary disturbances may produce mental symptoms, and that cases of melancholia are always complicated by alimentary disturbances, no observer has as yet been able definitely to state the specific toxin or toxins which produce these symptoms. Clinically, however, there is a certain type of melancholia, with symptoms of mental confusion and vivid hallucinations, which is closely associated with, if not actually caused by, a failure of the nitrogenous excretion. In these cases the pulse is fast, the arterial tension

abnormally high, the urine scanty, the excretion of urea much below the average daily ingestion of nitrogen, and albumen is generally present. Such patients after being flushed with normal saline infusions and enemata and put upon an exclusively fluid diet make very rapid recoveries, and simultaneously there is a marked and unusual increase in the nitrogenous excretion. Such cases occur more frequently in women than in men and almost invariably in persons over middle age.

With regard to bacterial toxins we have a more certain clinical basis, because the knowledge of bacteriology has advanced more rapidly than our knowledge of metabolic toxins or the effect of increased or diminished glandular secretions. All the pyogenic organisms may produce mental symptoms. I have seen acute mental excitement with confusion and hallucinations accompany an infective cellulitis of the forearm. The mental symptoms rapidly passed off as the result of treatment by free incisions. The delirium which sometimes complicates acute lobar pneumonia cannot be distinguished by the mental symptoms alone from acute mania. One finds in such conditions all the symptoms of acute mania; the vivid hallucinations, the mental confusion, the motor restlessness and the mental excitement. Not infrequently such patients are sent to asylums, certified as insane. They are in fact insane, but the cause of the insanity has escaped observation. Leucocytosis is common to both conditions, but there is this great clinical difference, that whereas in acute mania the temperature of the body is rarely above 100° F., except in puerperal cases, in the mania of pneumonia the temperature is generally much higher. A temperature of 101° F. or higher in a case of acute mania should always suggest some physical exciting cause, which should be carefully searched for. The bacteriology of some at least of these cases of pneumonia complicated with mania differs from that of ordinary pneumonia. In three cases which have come under my notice and which died, bacterial cultures, taken from the pneumonic patch, gave in every case cultures of a streptococcus which were non-pyogenic and comparatively innocuous when injected into rabbits intravenously, intraperitoneally or into the lungs. In every characteristic these streptococci resembled streptococci isolated by myself and my assistants from the blood, faeces and urine of cases of acute mania.

With regard to ordinary acute mania there is ample evidence—in the polymorphonuclear leucocytosis, the presence of specific agglutinins in the serum, the altered opsonic index, the deviation of complement which occurs when the serum of one patient is mixed in certain proportions with the urine of another

but similar case, and in the excess of nitrogenous excretion over the nitrogenous intake of the body—that we have to deal with a bacterial toxæmia. I believe these toxins to be streptococcal in origin. The site of the lesion may be a phthisical cavity secondarily infected, or a chronic fissure of the cervix, or carious teeth, or the intestinal tract due to altered intestinal flora. It must be clearly stated that these toxæmias are not true infections in the sense that the organism is introduced from without. The streptococci which cause these conditions are normal inhabitants of the human body and of the alimentary tract. The explanation of their toxic action must be sought for in a hypersensibility of the particular individual to the specific toxins of these organisms and in a disorder of the normal protective powers of the body against these toxins. These constitutional defects are certainly a part of the hereditary predisposition to insanity.

Not only do these streptococcal toxins produce acute and apparently sudden attacks of mania, but they are also capable of producing an insidious and chronic form of disease without any antecedent acute stage. An analogy can be drawn from the action of alcohol. A large dose produces drunkenness, smaller but repeated overdoses produce chronic mental deterioration. In the same way a large dose of these bacterial toxins will produce an attack of mania, while a long but gradual absorption of such toxins will produce a slow change in the mental personality. Probably the best example of this chronic streptococcal toxæmia is to be seen in those cases which occur in women after childbirth. The history of such a case commonly is that after the birth of a child the mother recovers slowly; there is usually some record of local symptoms, such as vaginal discharge. Gradually the character of the patient changes, delusions develop, and months and often years after the patient is certified insane. A persistently recurring leucocytosis, with some uterine or vaginal disorder, may be the only physical symptoms. On the mental side there is a complete change of character, irritability, loss of self-control and delusions, often sexual and centering round the husband. Some of these cases upon examination have a chronic fissure of the cervix, while others have an endometritis, but they all agree in this, that the uterine or cervical discharge swarms with streptococci. They are cases of unsuspected chronic toxæmia and if diagnosed early are amenable to local treatment.

Drugs which produce mental symptoms hardly fall to be considered here, but it is well to remember that the use of belladonna liniments in susceptible persons may produce violent delirium.

L. C. B.

DRUGS AND POISONS IN RELATION TO INSANITY

Insanity is generally stated to be the product of two factors, "stress and heredity"; and its causes must be looked at from at least two standpoints. Firstly, there is the actual exciting cause, and, secondly, the predisposing, contributory or favouring factor. These two components are inversely related in their influence, the greater the inherited instability of the nervous system, the less need be the exciting or determining factor. The old scheme of etiology divided causes into moral and physical, and this served a useful purpose, for it called attention to the special dangers to be avoided, although it offered no explanation of how these acted injuriously. All of us know worry and anxiety to be fertile causes of disorganization of the metabolic processes of the whole body—bad news stops the salivary and gastric secretion, impairs digestion, inhibits and weakens the heart's action, and serves as a mental shock—and it does this by lowering the defences of the body against the effect of toxins within the organism.

The forces of our civilization demand the highest and utmost mental output from competing units, and unless the basic material conditions are effective and adequate there is exhaustion and failure. To prevent exhaustion there must be a satisfactory balance of reserve force whereupon to draw, and this proper balance implies a condition of stable equilibrium between anabolism and katabolism. Often the first indication of a deficit is the loss of sleep—for anabolism or the building up of neuronic granules takes place during sleep, and when natural sleep becomes insufficient then katabolism proceeds unduly; and to ensure fresh activity recourse is had to sedatives and hypnotics in order to meet the fresh duties imposed by the constant and continuous strain of social surroundings. It is not possible to prove directly that the stress of civilization is measurable by the harmful action of special toxins upon the cortical neurones and other cells, but the effect of the removal of toxins from the liver through the alimentary canal by timely remedies, of toxins from the kidneys through the urinary tract, and from the skin and lungs by activity and exercise, lends presumption to the view that morbid mental states can be relieved by the removal of toxins which have accumulated within the system. Experiments in regard to fatigue also indicate that there are intra- and extra-neuronic toxins which impair the normal physiological action of the cells, for after electrical stimulation of muscles, when the products of their activity are washed out with fluids isotonic with ordinary blood serum, such as solutions of normal saline, the formerly

exhausted and inactive muscles will begin again to contract upon stimulation.

The effect of drugs and certain poisons upon cells in different parts of the nervous system is probably similar; strychnine, for example, has an attraction for the motor ganglion cells in the cord and stimulates them; bromides lower their reflex excitability; conium acts upon the sensory nerves, and curare has a similar selective effect, depending upon the special predisposition of individuals, on each of whom the effects may vary. Stimulants have always exercised a fascination for mankind, the feeling of being well is in itself a stimulus and is concomitant with an increase of vital activity. The easy access to relief from vexation and worry by the use of drugs advertised as "headache powders," cordials, refreshers, "nerve" sedatives, soothing tablets and cardiac stimulants has in a great many instances created in men and women a permanent habit compared with which the previous restlessness was only a trifling and a passing inconvenience. Of the various drugs which men and women indulge in to soothe pain or to gladden the heart, possibly the most widespread is alcohol in one of its various forms; for some, even methylated and wood-spirit relieves mental anxiety and yields a temporary feeling of *bien être*; in some parts of Ireland ether is taken, but brandy, rum, gin and whisky are the forms of spirit most frequently used for this purpose. Stimulation is transient, and being followed by exhaustion, more is taken and the drinking habit thus contracted. It is not necessarily the alcohol itself that causes neuronie decay and—in the end—mental destruction, but the toxæmia induced by interference with the metabolism of the liver and other cells, which allows the defences of the body to become impaired, so that the toxins of intestinal bacteria enter the blood stream and produce the mental symptoms. Like other poisons and drugs, they also produce morbid mental symptoms by a lowering of the bodily defences, so that attacks are made upon the cortical and other cells of the corporate structure by the toxins of organisms habitually present in different parts of the body rather than by the poison ingested.

Alcohol. The chief physical symptoms which follow the excessive use of this drug—and a very small amount of alcohol is sufficient in those with a history of head injuries or those with a neurotic family history—are tremors, redness of the conjunctiva, flushed cheeks and morning sickness. The chief mental symptoms are hallucinations of sight and of sensation; suspicions, mainly of marital infidelity; sex delusions, and loss of memory. The varieties of insanity are:—(1) *Delirium tremens*, an acute phase of habitual chronic drinking, or the result of injury or of acute physical illness or an

abrupt stopping of the drink. There is always acute gastric disturbance and the hallucinations of sight are worse at night. (2) *Confusional insanity*, a mild irritable incoherence. (3) *Mania a potu*, characterized by impulsive motor violence and loud shouting and raving with hallucinations of sight—one glass of whisky may cause this in the neuropathic. There is no subsequent memory of the event, which is often denied in consequence. (4) *Subacute mania*, not unlike paranoia, or may be general paralysis—which the Wassermann reaction or a leucocyte count of the cerebro-spinal fluid will decide. (5) *Korsakoff's psychosis*, weak-mindedness, forgetfulness and peripheral neuritis. (6) *Alcoholic dementia*, moral, mental and physical degradation. The treatment is to stop all drink; atropine injections have been found useful, also the treatment by hypnotic "suggestion." If a person is drunk three times within the year in a public place he or she can be treated as a "black lister" and sent to an inebriate reformatory for three years, but patients can go voluntarily on certificates into special homes.

Morphia, Opium and Chlorodyne. The mental symptoms from morphine which amount to certifiable insanity occur mostly in neurotic persons—often medical men—and in those met with were mostly the result of prescriptions for sleeplessness or for the relief of pain. The drug was taken by the mouth or injected subcutaneously in about equal numbers. All had anxious, emaciated, thin and restless looks, with an evasive, uneasy manner, and were characteristically untruthful; most of the cases suffered from depression. The treatment adopted deprived the patient of its further use. In one case there was almost fatal collapse, bromides having to be substituted. Paraldehyde is also useful. The discomfort and restlessness of the sudden stoppage is not unattended with danger, and the "tapering" method, viz. the gradual withdrawal, may be preferable in some cases. Uræmic symptoms may follow the use of morphia. Cardiac tonics are necessary and remedies for the accompanying gastric catarrh and vomiting. Ungovernable impulse to get the drug has resulted in assaults being committed upon druggists who refused to sell it.

Paraldehyde. Confusion, tremor, physical weakness, delirium like that caused by alcohol, with gastritis, chronic delusions, impulsive violence and suspicions. In the writer's opinion the use of this drug is not an infrequent cause of melancholia. The habit is contracted in trying to avoid the use of chloral.

Cocaine. Hallucinations, often of a terrifying nature, and inability to work, restlessness, depression, sleeplessness and rambling chattering occur from its use, also marked untruthfulness. It produces early mental symptoms,

alcohol perhaps may never do so, morphia only after years of use, but cocaine quite quickly. The few admitted under the writer's care recovered. It is rarely the cause of actual insanity. It has been used to control the morphia habit, but only resulted in establishing another. It was extensively taken by chemists in a certain manufacturing firm. It is mostly taken by the mouth, and it is stated to stop craving for food or drink and to supply a feeling of temporary "satisfaction." The effect has been described as "midway between alcohol and tobacco," and to be stimulant and narcotic. When taken by the father it is stated to have been the cause of idiot children. One peculiarity of taking it is the loss of the "time" sense.

Chloral. Often taken by medical men and journalists of both sexes. One medical man of the writer's acquaintance took it regularly, and swathed his legs and feet in cotton-wool afterwards. He died demented.

Cannabis Indica. Belladonna.—Atropine in the eye may give rise to delirium. It is drunk as *chang*, rare in India, common in Egypt; it is smoked as *ganga* and eaten as *magune*. It gives rise to acute hallucinatory insanity, with impulsive violence, simulating mania, and is the cause of "latah," volitional insanity.

Chloroform and Ether. One case of a midwife under the writer's care had chronic persecutory delusions, and a man, an artist, developed chronic paranoia. "Delayed" poisoning is not uncommon after chloroform. It is often used to obtain short temporary rest. It is rarely the cause of insanity—possibly more often, like cocaine, the sign of a neuropathic diathesis.

Tobacco. Insanity has been induced indirectly in growing boys by causing gastric disturbance and anæmia. The signs are tremor of voluntary muscles, noted in the writing and the difficulty of alignment.

Antipyrin, Antifebrin, Antikamnia, Exalgin and Phenacetin. Not the cause but often the accompaniment of disturbed "nerves" and headaches in women who were admitted under care about the "climacteric." The symptoms are associated with intoxication, collapse, cyanosis, sweating, mental apathy and depression.

Sulphonal, Trional, Veronal and Tetronal. These are all neuronc poisons and are associated with mental symptoms. There is peripheral neuritis, morbilliform eruption and hæmatoporphyrinuria.

Bisulphide of Carbon. Insanity noticed in a few rubber workers. The persons are anæmic and suffer from exhaustion psychoses.

Lead and Mercury. Both exercise markedly injurious influences upon the nervous system. Several lead workers have come under the writer's care from factories in East London, some with marked symptoms of "plumbism,"

which are allied to general paralysis, but with wrist-drop and palsy in addition. The mental form is melancholia rather than mania—some have "fits" and many complained of headaches. Most of them improved, some ended in dementia. Mercury workers also have tremors, depression and marked ill-health.

Arsenic occasionally produces neuritis and mental symptoms.

Syphilitic Poison. General paralysis and tabes are the most classical forms showing mental symptoms and are para- or meta-syphilitic, but there may be local paralysis, especially of the third nerve, with tremor. The Argyll-Robertson pupils, inco-ordination and sensori-motor disturbances are the chief signs. This poison is the chief cause of endarteritis, arterio-sclerosis, and atheroma. Its great tendency is to form fibrous changes, which crowd out and destroy the essential cells.

Pellagra: from eating diseased maize; the symptoms resemble general paralysis.

Defective Gland Secretion. Cretinism, myxœdema, Addison's disease, Graves' disease, acromegaly and osteo-arthritis. All these are known in asylums, and, not infrequently, the mental symptoms are of an incurable character.

Poisonous bites of Mosquitoes, Adders, and Dogs. Not often the cause, but may be associated with insanity or mental symptoms. R. J.

KORSAKOFF'S PSYCHOSIS

This term is applied to a group of symptoms described by Korsakoff of Moscow, and to which many other names have also been applied.

In the largest number of cases the disease is associated with a history of alcohol and with alcoholic polyneuritis. The same condition is, however, described as occurring in association with other intoxications and infections, such as tuberculosis, influenza, diphtheria, typhoid or other infectious fevers, puerperal septicæmia or other septic intoxications, poisoning by bisulphide of carbon, carbonic oxide, lead, arsenic or mercury, and by diabetic or other auto-intoxication.

I have myself seen it following typhoid fever, both where alcohol could certainly be excluded as a precedent cause and also where there had been previous alcoholism, also following syphilis and malaria complicated with alcoholism. It appears to be more frequently associated with a history of excess in spirit or beer drinking than excess in wine.

The average age of cases I have seen has been forty-four years, but cases have been recorded as occurring in childhood or youth. It is more common in female than in male patients.

I have usually failed to discover inheritance of insanity; but often obtained a history of

alcoholism in the parents, or brothers and sisters.

There is commonly a history of previous attacks of delirium tremens or other acute forms of mental disorder from alcoholic excess.

Mode of Onset. Generally Korsakoff's syndrome does not immediately supervene upon any other acute psychosis, but when due to alcohol develops in those who have been "soaking" for years and have shown signs of progressive mental and moral degradation. Very commonly there has been loss of business or professional capacity, neglect of household duties, loss of memory and loss of moral sense, inability to recognize the damage which is being done to physical health, to reputation and to welfare of self or dependents by alcoholic excess, and total inability to abandon the noxious habit. The patient becomes increasingly selfish and solitary. Corresponding to the varying effect of alcohol in different individuals, there may be at times previous depression with threats of suicide, irritability and excitement with hostility, suspicion of and impulsive violence to wife or husband, or simply increasing stupidity.

Symptoms. The patient may then gradually or rapidly pass into the state of confusion of mind with complete disorientation of time and place characteristic of Korsakoff's psychosis, or more commonly an acute or subacute delirium develops concurrently with the neuritis. In this there is tremulousness and general physical weakness, complete confusion of mind, chattering incoherence, inability to recognize individuals well known to the patient or perhaps mistaking them for others, resistance to feeding or other necessary attentions, loss of control over bladder or rectum, insomnia, slight rise in temperature, rapid feeble pulse, dry tongue and lips, hallucinations or illusions, especially of sight, hearing and common sensation, and perhaps a fatal termination from exhaustion, hypostatic pneumonia or cardiac failure.

On physical examination it will be found that the patient has weakness of the arms and legs; tenderness of muscles, associated in some cases with superficial hyperæsthesia and in others with anæsthesia or defective localisation of sensation; feeble inco-ordinate gait, passing in extreme cases to definite paralysis of legs with wasting of muscles and dropped foot, with simultaneous paralysis and wasting of arm muscles and dropped wrist. The knee-jerks may be brisk at first but are speedily lost. The facial expression becomes vacant, the eyelids droop, speech often becomes slow and defective, as if there were loss of power in tongue or lips, but without necessarily very marked tremor. The papillary light reflex is retained, although often sluggish, unless there be a previous history of syphilis. Hallucinations in these cases are

commonly very vivid; the patient sees snakes, beetles, lights, faces or figures of the dead or of devils, and he constantly mistakes shadows or other objects. He hears imaginary bells, noises, shots fired or voices, and easily misinterprets any real sound. He may taste poison and smell imaginary gases. Very characteristic are the illusions and hallucinations of common sensation connected with perverted sensations due to the peripheral neuritis. The patient complains that strings or wire are tied tightly round his limbs or head, or that they are electrified; he feels that his legs are bitten by rats, snakes, leeches or "mad fish," or that animals of different kinds are in or under the bed. Women not uncommonly imagine that they have just given birth to a child or twins or that a child is in the bed. The patient will throw off the bed-clothes to look for the imaginary pests or will try to get out to look under the bed and fall in the attempt.

When the more acute delirious phase has passed off, so that the patient is able to talk coherently and answer questions and no longer seems to be in danger of a fatal termination, the profound disorientation of time and place continues, associated with great loss of recent memory. This also is the case where the disease has come on without delirious onset.

The patient who has been under care some weeks will say that he has only arrived that morning, he will not be able to name the place he is in or he may give different versions of it every few minutes, he may consider himself to be in India when he has been some weeks out of that country, or he will say that he is living in a place he has left some years before. His time sense will be absolutely faulty, so that he may not even know the season of the year, and much less the day, month or year. He will forget that he has seen persons well known to him immediately after they have left the room, and will immediately forget the name of a person who is interviewing him, even although he has been told several times. He will mistake the identity of individuals or call them by names of people he has formerly known. He may absolutely forget such facts as marriage, the number and sex of his children and his own age.

It is very characteristic that such patients "romance" as to recent events, and often these statements are made so coherently and so plausibly that at first sight they appear to be statements of fact until they become either manifestly absurd or are found on investigation to be absolutely fallacious. Such patients will describe walks or expeditions or participation in wars or other important events which are found to be quite imaginary. In this condition the facial expression and speech may have become normal, but the patient remains

paralysed in the lower extremities, with absent knee-jerks and wasting, with perhaps also paralysis of hands. Not uncommonly the hallucinations of hearing and common sensation which have been present in the acute delirious stage persist, but in a less marked degree, whereas the hallucinations of sight have disappeared.

In this stage sleep has become normal, and food is taken without resistance and the general bodily condition improves. In many cases the paralysis gradually disappears and the wasting is recovered from, though the knee-jerks may long remain absent. Concurrently with this the patient's mental condition may improve, in which case he gradually begins to realize his surroundings and to be aware of the flight of time and to grasp that he has been mentally ill, but there will be a considerable gap in his memory for the greater part of his illness. In other cases the memory may be permanently damaged and the patient may have permanent loss of power and contraction of the legs. In others again more or less organized delusions of persecution may remain, the patient attributing his condition to poison or electrical appliances used by imaginary enemies.

It is important to remember that the characteristic mental disorder may be present without definite signs of peripheral neuritis. Recovery may take place after several months with complete abstinence from alcohol, but such persons are weak in volition, and therefore a recurrence of the habit of alcoholic excess is likely, with consequent further damage to mental power.

Death may occur in the acute stage from exhaustion, from diaphragmatic paralysis, or from some local complication such as pneumonia.

Treatment. In patients of the poorer class the necessary nursing and general supervision can only be obtained in the wards of a hospital, infirmary or asylum, and the question as to which kind of institution is suitable depends largely upon the prominence or otherwise of the mental disorder. The more severe cases usually need asylum care.

In patients whose means allow of it the requisite nursing and guarding against alcohol can often be carried out at home, but again the nature of the mental symptoms may necessitate asylum treatment, while if craving for alcohol remains after the more acute stage has passed off and when the patient is beginning to get about, it may be difficult to ensure abstinence in the patient's own home. During the acute delirious stage the patient must be kept in bed under constant supervision and skilled nursing, and strength may be maintained by fluid nourishment administered artificially if necessary. Alcohol must be entirely forbidden. Sleep must be obtained by drugs, as in other cases of delirium, but hyoscine and morphia should not be used. Massage and electricity should not be resorted to for the paralysed muscles until all acute symptoms have subsided. In cases due to other causes than alcohol the source of the original infection should be ascertained and appropriate treatment adopted.

R. P. S.

PART II.—SURGERY

I.—ANÆSTHETICS

GENERAL CONSIDERATIONS IN ANÆSTHETICS

A FEW matters of no small importance, but not finding a suitable place in any other division of the subject, are considered under the above heading. Firstly, there is the question of what are and what are not suitable cases for the employment of general anæsthesia. It falls to the anæsthetist not infrequently to give an opinion which should be of the highest value, if not decisive, as to whether it is right to submit a particular patient to the action of a general anæsthetic. Obviously no comprehensive general rule can be laid down, for in every case the pros and cons must be weighed and considered in the light of the particular circumstances of the particular case. In a general way, however, it may be stated that when the surgical operation is regarded as not merely expedient but necessary, when the surgeon believes that the patient can withstand the effect of the operation, then it is very rarely that the anæsthetist is obliged to say that in his opinion the patient will not survive the anæsthetic. Very often, however, in the case of persons desperately ill but requiring a life-saving operation, the anæsthetist finds himself obliged by his experience to qualify the assent which he gives to the administration of an anæsthetic. Thus it happens not uncommonly that he says, for example, "I think it right to give this patient an anæsthetic, provided that the operation can be finished within half an hour." Although, then, it is very rare for an anæsthetist to have to refuse to give an anæsthetic when a surgeon wishes to operate, it is in just such cases that his experience and skill are taxed to the utmost in choosing exactly the most suitable anæsthetic and method of administering it. It is in such cases of desperate conditions that the difference between recovery and subsequent collapse may lie almost entirely in the difference between the proper anæsthetic given to the proper extent and in the proper way, and an unsuitable drug administered to an unsuitable extent. The principles which guide the choice of anæsthetic in various cases are laid down in the subdivision dealing with that matter and cannot be entered into in detail here. It may, however, be pointed out that what is the best course when special skill is available

is not necessarily the best course when that is not the case. In short, the practitioner who only occasionally administers anæsthetics will most wisely use the drug and method with which he is most familiar, and, therefore, most skilful, although that may often not be the drug and the method best suited to the particular case, nor those which the specialist would choose whose action is not limited by lack of familiarity with all but one method.

This consideration leads naturally to the remark that not only is it sometimes a question who should be anæsthetized, but also who should anæsthetize. There is no doubt that very often the best results are not obtained because from difficulties of time or finance the administration of an anæsthetic in a difficult case is undertaken by one whose experience in the matter is of the slightest. When such an action is unavoidable there is no more to be said, but in many instances special skill could easily be obtained, and this is not done merely because the important bearing of the administration upon the success of the operation and its after-results are not fully grasped by those responsible for arranging matters. It is particularly in operations upon the nose and throat, and in those upon the abdomen, that the necessary skill and experience on the administrator's part are most urgently required, and their absence most likely to lead to inconvenience, danger and even fatality.

In the case of operations in private houses, the question sometimes arises as to whether the patient may not be anæsthetized in his own bed in his own room rather than upon the operating table, in the room where the operation is to take place. If this can be done he is spared all sight of what may be to an apprehensive subject an alarming array of preparations. In the case of children it may be said at once that not only is it admissible, but generally very much preferable, that they should be anæsthetized in bed and remain in complete ignorance of all else concerning the operation. The ordeal is in this way invested with a minimum amount of terror or disturbance of any kind. If by good luck the child or infant is asleep when the hour for operation arrives, the anæsthetist should employ all his skill and resource to induce anæsthesia without awakening the patient. In such a case the child will afterwards have no unpleasant memories whatever associated with the surgical

proceeding, and will, indeed, be in a merely puzzled wonderment as to how he is still in bed and how the stitches got there. In nervous and timid children it is no small gain, as parents will readily acknowledge, to obliterate in this way all the circumstantial accompaniments of an operation. With adults, who are not so easily transferred from bed to operating-table, the matter stands rather differently. Here unless the patient is a highly nervous one, or likely to be really upset by what she sees and hears in the operating-room, there is every advantage in giving the anæsthetic when she is upon the table rather than when she is in bed. The time for which she is under is considerably protracted if the latter course is followed, for a very deep anæsthesia must be achieved before the removal from bed to table can be safely undertaken. Otherwise there is almost certain to be some recovery, with retching or vomiting or other inconvenient symptoms, before the patient is on the table or as soon as she gets there. Moreover it may well be that the surgeon and his assistant are needed to help in carrying the patient, and a further delay is entailed while hands thus soiled are being made surgically clean. Again, from the anæsthetist's point of view it may be very difficult with the patient in bed for any position to be taken up which gives the administrator the necessary facility if there is any marked movement or stage of excitement during induction. The best plan, as a rule, is to have the patient lying well down in the bed, so that the anæsthetist, sitting on the bed at her side, has room to pass an arm round behind the patient's head if he wishes. The bedclothes, too, should be so arranged, with the arms within them, that though movement of the limbs is not uncomfortably restrained, it is at least restricted to some extent.

Another point on which a few words may be said here relate to the period of recovery. The stage during which a patient, although perfectly still and apparently still completely under the influence of the anæsthetic, is yet quite able to hear and to remember what is said begins at an earlier moment than those who are present often suspect. Thus it has often happened, to the writer's knowledge, that conversation has been carried on in the presence of a recovering patient who was thought to be incapable of hearing, such conversation being by no means intended for her ears. Nurses may often be advantageously warned of this early return of the power of hearing on the part of the anæsthetized, which depends of course upon the fact that the sense of hearing is the earliest of the special senses to return after anæsthesia. Similarly it is the last to go, and care must be taken during the induction of

anæsthesia that conversation or the noise of instruments being moved are not allowed to produce a disturbing effect upon the still-hearing though apparently unconscious patient.

J. B.

LOCAL ANÆSTHESIA

The use of Local Anæsthesia for minor surgical procedures is now thoroughly established, and the help afforded by this means, both to the patient and surgeon, is so general, that it is difficult to realize the condition of affairs before the discovery of the anodynes used for this purpose.

The discovery by Corning of the properties of cocaine was the first step which led to the elaboration of our present knowledge. Schleich in utilizing this discovery did much in evolving a technique now familiarized under his name.

As long as cocaine was the drug chiefly employed the methods of infiltration analgesia were strictly limited. The toxic effects of cocaine injected hypodermically were such as to restrict its use to small quantities in circumscribed areas, while its analgesic effect was of short duration and insufficient for any but the simplest surgical procedures.

The discovery of eucaine by Merling at once removed one of these objections, since eucaine is far less dangerous than cocaine and of almost equal analgesic value.

Other substances have also been used, such as stovaine, eucaine lactate, tropacocaine, novocaine and alypin. These possess good analgesic properties when injected under the skin, and have less toxic effects than cocaine.

The other objection to the use of cocaine alone, namely, the rapidity with which its local effect passed off, was next met by the addition of the active principle of the suprarenal gland, which has the property of constricting the smaller vessels of the part into which it is injected, so that an analgesic solution with suprarenal extract can now be injected with safety under the skin, and complete loss of pain be produced in the part for even such a long period as three hours.

When eucaine and adrenalin are injected hypodermically the skin becomes blanched and anæmic, the blood supply in the part is reduced, and the eucaine thus remains at the site of the injection.

By this localisation of the eucaine its effects on the nerves of the part are intensified and prolonged, so that when combined with adrenalin less eucaine is required to produce a complete analgesia.

Also, as the eucaine is localised for an hour or longer, it reaches the higher nerve centres very slowly and then probably as a more in-

nocuous compound, having undergone changes during its local absorption in the tissue cells.

Braun found experimentally that a lethal dose of cocaine, if combined with adrenalin and injected into a rabbit, produced little or no toxic effect.

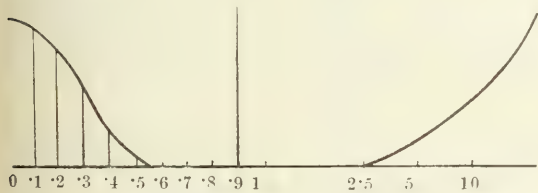
A knowledge of these facts enables us, on the one hand, to employ less of the drug when combined with adrenalin, as its action is concentrated locally; and on the other hand, it justifies us in increasing, if necessary, the amount of eucaïne to be injected into a larger area, since its toxic effects on the higher nerve centres are restrained, if not entirely abolished.

I have myself on more than one occasion injected six grains of B. Eucaïne with adrenalin into the tissues, where an extensive area required operation in an adult, with no immediate or subsequent ill effects.

Another factor essential to the success of any hypodermic injection has to be considered, namely, the osmotic tension of the injected fluid.

The hypodermic injection of saline solutions of varying strengths will produce painless swellings if they closely approximate to the normal physiological strength, 0.9 per cent. NaCl, which has the same osmotic tension as the blood, but if they differ from this they will produce irritation or even local necrosis.

The importance of these considerations becomes evident when we realize that the injection of an isotonic fluid into the tissues is harmless, while the injection of a non-isotonic fluid will cause irritation, delay healing, and may cause local necrosis.



Figures give percentages of NaCl.

Diagram to illustrate the irritation produced in the tissues by injections of NaCl solutions in varying strengths. (After Braun.)

We now come to the selection of the most suitable analgesic substance. After an extended trial of several, I find that none gives more satisfactory results than the Hydrochloride of B. Eucaïne, a synthetic product, chemically known as benzoylvinylidiacetonalkamine. This substance occurs as a white powder, soluble in water to the extent of $3\frac{1}{2}$ per cent. and it can be sterilized in solution by boiling without undergoing change.

The most suitable strength of a eucaïne and adrenalin solution for general use has only been determined after much experience. I

have found for routine surgical work that the quantities formulated by Braun and adopted by Barker cannot be improved upon. The amounts are as follows—

B. Eucaïne . . .	0.2 gram	= 3 grains
Sodium Chloride . .	0.8 gram	= 12 grains
Distilled Water . .	100 c.c.	= $3\frac{1}{2}$ ozs.
Adrenalin Chloride (1 in 1,000)		10 minims.

The strength of the B. Eucaïne in this solution is 1 in 500 and that of the Adrenalin Chloride 1 in 200,000. This solution produces no pain on injection, and does not cause loss of vitality in the tissues: it has the same freezing temperature as blood and is isotonic. I have injected 200 c.c. of this solution without causing any ill effect.

The solution is quite easily made; a glass beaker is obtained of 200 or 300 c.c. capacity, 100 c.c. of distilled water are poured in and 0.2 gramme B. Eucaïne and 0.8 gramme pure NaCl are added and the contents boiled.

When the sterility of the contents is assured, the beaker is cooled to blood heat and 9 or 10 drops of a 1 in 1,000 solution of Adrenalin Chloride are added and the analgesic solution is ready for use.

A syringe of about ten c.c. capacity, with a fine needle and able to withstand boiling, completes the outfit.

In using this solution a few practical points may be noted—

1. The solution should be freshly made and boiled to ensure its sterility. Compressed powders containing B. Eucaïne and sodium chloride in the above proportions are easily procurable.
2. The liquid preparations of suprarenal extract are often unstable and lose their specific action when boiled and on exposure to light and air. Hence the bottle of adrenalin solution must be carefully stoppered and guarded from contamination.
3. In the presence of an alkali, suprarenal extract becomes inert. Hence all sterilization of the syringe must be done in pure water.

The recent synthesis of adrenalin, however, gives us a substance of equal value as a vaso-constrictor and of greater stability than the extracts, as it is unaffected by light and does not deteriorate when boiled in dilution.

Local Analgesia may be obtained in a given area by two different methods—

1. By the injection of eucaïne solution directly into the tissues to be operated upon, termed Infiltration Analgesia.

2. By the injection of eucaine into or around the nerves supplying a given part. This produces a break of nerve conductivity at the site of the injection with motor and sensory paralysis below this level. This is termed Regional Analgesia.

No rigid distinction, however, need be drawn between these two methods, as, in practice, excellent results are often obtained by a combination of both.

To demonstrate the technique of this method let us suppose a patient with varicose veins requires their excision.

The skin of the leg having been carefully prepared and the position of the vein marked, the eucaine solution and the syringe are sterilized and cooled.

The syringe is now filled, taking care that all air bubbles are excluded and the needle thrust into the skin over the vein and the solution slowly injected.

A wheal is formed and the skin is raised by the injected fluid.

The needle is withdrawn and, the syringe being refilled, it is again inserted at the extremity of the wheal, where sensibility is diminished and more solution is injected. Similarly the tissues on each side of the vein are injected until the infiltrated area is of sufficient extent to cover the requirements of the operation. Twenty cubic centimetres of the solution are usually ample for the removal of each vein.

Half-an-hour is allowed to elapse before the operation is begun, by which time the œdema has disappeared and the infiltrated area appears white in contrast to the surrounding skin, this blanching being an excellent guide to the extent of the analgesia.

An incision may now be made and the vein removed by an almost bloodless operation.

For the removal of a finger or a toe Regional Analgesia is more suitable.

Suppose that amputation of the terminal phalanx of a digit is necessary.

Here the needle is inserted at the base of the finger and eucaine solution is injected superficially and deeply on all sides, until a ring of distension is formed around the base of the finger. The object in view is to infiltrate all the nerves leading to the area of operation; both the deeper nerve trunks and the finer superficial nerve twigs, and thus to produce a break of nerve conductivity at the level of the injection.

After thirty minutes the surgeon may proceed to amputate with perfect confidence that the patient will feel no pain.

Local Analgesia is admirably adapted for most small surgical procedures, such as the removal of cysts and bursæ, the excision of

pieces of rib or operations on the male genitals, or the removal of non-malignant growths in the breast. It is especially indicated for the operative treatment of strangulated herniæ in old people or for other measures in cases of pulmonary or cardiac disease where the administration of a general anæsthetic is attended by grave risks.

Local Analgesia, however, should not be attempted in cases where the surgeon has doubts as to the extent of the manipulation which may be necessary to complete the operation.

It must never be forgotten that the analgesia is only local; so dragging of the tissues must be carefully avoided, lest structures be pulled on which lie outside the anæsthetic area.

This is especially to be noted in abdominal operations, where the extreme sensitiveness of the parietal peritoneum is not easy to abolish, while the intestines, though insensitive, should be lightly handled, or a drag will be felt on the mesentery, which has the reflexions of the parietal peritoneum at its root.

As a rule, Local Analgesia is not to be recommended for operations on children or on adults lacking in self-control, as the operator must have the entire confidence and co-operation of the patient.

When the vaso-constrictor action of the Adrenalin wears off reactionary hæmorrhage need not be feared unless some larger vessel has been left unsecured, or too much adrenalin has been added to the solution. I have not experienced such an occurrence. Doubts also may be entertained as to the rapidity of wound healing after large injections. These are groundless, as experience shows that when the injected solution is sterile and isotonic, primary union is invariable.

The term "analgesia" has been used in preference to anæsthesia in describing this method. It is more accurate, as in many cases tactile sensation is not completely lost, while pain in the same area of injection is entirely abolished.

J. W. H. H.

MORPHINE AND ATROPINE INJECTION

THE subcutaneous injection of morphine and atropine before operation has been practised by a great many, and the opinions as to its beneficial results are very much divided.

By those who recommend its use it is claimed that the atropine stimulates the heart's action and thereby minimizes the likelihood of cardiac failure under chloroform, and in the cases where ether is used the action of atropine would lessen, if not entirely prevent, the unwelcome secretion in the mouth and trachea which is often such a great hindrance to a smooth

and even anæsthesia, and may become a source of considerable trouble to the anæsthetist and surgeon. Now the stimulating action of atropine on the heart is such a small factor, if indeed it really exists, that the advantages gained are very questionable, but with reference to the prevention of secretion, the advantage gained may be very considerable, although one cannot be certain as to the amount of action produced in each particular patient; sometimes the action is very good, at others it does not seem to have the slightest effect. Patients vary so much in the way they respond to the actions of various drugs that, to make any certainty, it would be necessary to make a trial injection or injections some days before operation, in order to arrive at the most beneficial dose for the effect required.

Now this is not always possible, nor is it advisable, for, apart from the discomfort produced from the action of the drug, the mere fact of the injection is apt to cause worry and anxiety to the patient, so one is compelled to give a medium dose, trusting to get a medium action.

Taking atropine first, its actions can best be seen if put down in tabular form.

<i>Central Nervous System</i>	First stimulates, then depresses.
<i>Eye</i>	Dilatation of pupil.
<i>Heart</i>	? Any change. Sometimes increased rapidity, sometimes the rapidity is diminished.
<i>Blood Pressure</i> . . .	There is probably a slight increase. The arterioles in the abdomen are contracted; the skin, dilated.
<i>Respiratory Centre</i> .	Slightly stimulated, the respirations becoming deeper and more rapid.
<i>Temperature</i>	Slightly raised.
<i>Glandular Secretion</i> .	Lessened.

With the central nervous system there is no advantage, as that which is first gained is afterwards lost.

With the eye change, there are two slight disadvantages. The first is that the anæsthetist loses a very important guide to the depth of anæsthesia; the second, and especially if the action of the drug is well marked, patients will occasionally complain of a dimness of vision, which has, in one or two cases, very much increased the already existing nervousness.

With the heart changes, the advantages are, as already stated, very questionable.

The increase of blood pressure should be a decided advantage, but here the action is again slight and also somewhat uncertain. The contraction of the abdominal arterioles while the action of the drug lasts is a temporary advantage to the surgeon during operation, but after the effect has gone off, the arterioles dilating may produce slight abdominal hæmorrhage. This may occasionally retard recovery but has, as a rule, no bad after-effects.

The stimulation of the respiratory centre is an advantage especially when chloroform, which depresses the respiratory centre, is used, as it is often very difficult during induction to get patients to breathe in an even and rhythmical manner. Sometimes, also, during the operation, it may become necessary to stimulate respiration owing to the depressing effect of the chloroform vapour, so that any change in this direction should be welcomed by all. Great care must, however, be taken, for with these increased respirations it must be borne in mind that more chloroform is being inhaled, and with the knowledge that the pupil is already dilated, owing to the action of atropine, the commencing dilating pupil, due to overdose of chloroform, might be overlooked.

The slight raising of the temperature may be also considered as a slight advantage.

The glandular secretion has already been discussed, but should the action not be as marked, and it sometimes appears to have no action at all, the careful use of mouth swabs should remove any undue difficulty in this respect. It must, however, not be forgotten that thirst and dryness of the mouth—a common factor after all operations—is generally very much increased after the use of atropine.

With the use of morphine, idiosyncrasy here has also to be taken into account, and it must be admitted that considerably less anæsthetic is necessary to keep the patient in the required state for the operator. The induction is as a rule much quieter and the struggling stage often entirely abolished, but the exact amount of action to be obtained from the drug varies, of course, considerably in different individuals.

The use of morphine in giving laxity to the muscles, which in the case of abdominal operations is a very important point, also relieves the necessity of pressing the anæsthetic to the same extent, for in some abdominal operations the anæsthetic has to be pressed very considerably in order to obtain the required amount of muscular relaxation. In other operations the same applies, although the complete relaxation of muscles may not be necessary to the same extent. Some claim that the morphia produces a soothing effect upon the patient before operation and thereby lessens the state of nervousness; well, this should be the effect, but I am afraid

it is far from the general rule, possibly owing to the great nervous strain from which the patients are suffering.

From the anæsthetist's point of view the use of morphine with chloroform brings the patient sooner, and with less tendency to struggling, into the anæsthetic state and makes his part of the work, for the moment, much easier; although producing as it does a contracted and sometimes pin-point pupil which may rob him of a very valuable guide to the depth of anæsthesia. But, in conjunction with atropine, this action may sometimes be neutralized, in fact, the opposite may be the result, but, being aware of the fact that the patient is under the influence of these drugs, the conditions should not in any way hamper the administration.

Open ether has, of late, come very much to the fore and is an easy, simple and excellent way of administering this anæsthetic, to say nothing of its safeness as compared with chloroform, and since we have the action of the atropine to prevent the unwelcome secretion in the mouth and trachea, there seems no reason why this method should not be employed in all ordinary cases.

I have, however, met one or two cases where ether in conjunction with morphine and atropine has produced very considerable cyanosis, and where the absence of saliva has not been quite so marked as one might have wished. Also, sometimes, a condition of short and irregular breathing, occasionally a well-marked Cheyne-Stokes' respiration, all of which conditions generally disappear when chloroform is substituted for ether. These conditions are probably due to some peculiar actions of the drugs in certain cases.

I might here give in tabular form the general actions of morphine.

<i>Drowsiness</i> . . .	Is a general condition.
<i>Respiration</i> . . .	Slowed, slightly increased in depth, but sometimes shallower and irregular, sometimes also of Cheyne-Stokes character.
<i>Circulation</i> . . .	Very slightly, if at all, affected.
<i>Pupil of Eye</i> . . .	Contracted.
<i>Glandular Secretion</i>	Lessened.
<i>Alimentary Canal</i> .	Nausea and vomiting.
<i>Temperature</i> . . .	Slight fall.

When cyanosis occurs this is due to the lessened excretion of CO_2 , and may have a great deal to do with the cyanosis produced during the ether administration.

Urine . . . Sugar may be formed in the urine afterwards, and this has been noticed especially in cases where the respiration has been markedly interfered with. It is said to be due to an increase of lactic acid in the blood and urine and to be accompanied by a disappearance of glycogen from the liver.

The drowsiness, as I have said before, should be present, but is unfortunately often absent.

The respirations being slowed rather indicates the use of a respiratory stimulant and, as a rule, open ether can be used with great advantage.

The contraction of the pupil may here, as with the dilated pupil of atropine, cause the anæsthetist some embarrassment; but as there are many other signs to go upon it is not necessary to take these too much into account. One is apt to think that the actions of the two drugs would neutralize one another, but my experience in this respect is that the action of either one or the other drug nearly always predominates.

The lessening of the glandular secretion is here again an advantage during operation, but, like atropine, it tends to produce thirst and dryness of mouth afterwards. As regards nausea and vomiting I am of the opinion that it tends to increase rather than diminish this condition.

As regards the after-effects as a whole it is very difficult to come to any definite conclusion as opinions are so much divided. Those who use it habitually claim that it quiets the patient both before and after operation, assists in the anæsthetic, prevents or reduces sickness, and, in fact, is of great assistance in many ways.

Others, again, say that they cannot notice any advantages at all, but give as disadvantages, especially after abdominal operations, such conditions as increased flatulence, abdominal distension, a condition of restlessness (the patient wanting to sleep but unable to do so), increased thirst, eye symptoms and increased sickness.

The amount of injection varies from morphine $\frac{1}{8}$ to $\frac{1}{4}$, atropine $\frac{1}{100}$ to $\frac{1}{50}$ gr., and is generally injected at times varying from twenty minutes to one hour before operation.

The one great advantage where atropine is used, and where the drug acts properly, is the lessening of secretion in the mouth, which undoubtedly enables many to use ether, which although the safer anæsthetic is, as a rule, much more difficult to administer. H. C.

SPINAL ANALGESIA

By spinal analgesia is understood a method of rendering parts of the body insensible by the injection of local analgesics into the subarachnoid space of the spinal canal. In this method the physiological block to afferent and efferent nerve impulses is effected nearer the great nerve centres than in local anæsthesia.

In general anæsthesia the higher nerve centres are first affected by drugs, and after them the cord and nerves right down to the site of operation. Thus the whole organism is saturated with a powerful drug in order to produce unconsciousness to pain during manipulation in some limited area.

In local analgesia, *per contra*, the object in view is to produce a painless area, without loss of consciousness, of sufficient extent to permit the same manipulations to be undertaken, and to accomplish this without the general flooding of the tissues with a toxic agent.

Some thirteen years ago Bier first produced spinal analgesia with cocaine: this drug he found unsatisfactory and later with the discovery of stovaine by Fourneau he made further researches into this method, which in the hands of careful pioneers has developed to its present recognized position. In comparing the use of spinal analgesia and a general anæsthetic, such as chloroform, the following points become prominent—

In spinal analgesia a small quantity of a narcotic agent is localised in the spinal sac, the higher nerve centres remaining as a rule unaffected. The heart and lungs are scarcely affected, so that in morbid conditions of these organs life-saving operations are rendered possible which would have been almost certainly fatal under general anæsthesia.

There are also many individuals whose dread of a general anæsthetic will cause them to refuse an operation of even grave necessity rather than submit themselves to the effects of chloroform or ether.

To these, spinal analgesia is an inestimable gain.

The method is not without its dangers, and the possibility of infecting the spinal meninges with septic organisms must ever be borne in mind. No person should attempt this procedure whose aseptic technique is not unquestionable; and although the simplicity of the apparatus reduces this danger to a minimum, the most extreme care in every detail should be taken.

The amounts of the drugs suitable for injection are now well determined, so that an over-dose should be equally impossible.

So far, spinal analgesia has only been generally employed for operations on the lower half

of the body and legs, yet some have used it for operations on the head and neck. Nevertheless, if it be only found safe and of value below the xiphisternum, and general or regional analgesia must continue to be employed for the upper parts of the body, much will be gained to surgery.

As to the age limits of applicability, infants twelve hours old have been successfully injected and undergone operation. In fact Mr. Rood tells me that at University College Hospital he uses spinal analgesia for practically all operations on children and finds that for them it is the best anæsthetic, especially in abdominal cases, as it reduces the shock of an operation to a minimum and gives most complete relaxation of the abdominal muscles.

At the other extreme of life spinal analgesia is also useful, and operations have been undertaken on individuals of eighty years of age.

In old people, however, with damaged lungs, liver, kidneys or heart, all operations, whatever be the nature of the anæsthetic, are more or less dangerous, and in such cases it is difficult to apportion the risk between the anæsthetic, the shock of apprehension and the operation itself, even though the latter be slight.

Syncope is very liable to follow even slight violence without operation in old and decrepit people.

Sex offers no bar to the procedure, it is as suitable for women as for men.

The duration of the analgesia varies according to the amount of the drug injected, but the average time is about one hour, while the time from injection to complete analgesia is from two to ten minutes.

The usual sequence of events after injection is, first, formication in the toes; then loss of the knee and cremasteric reflexes, followed by loss of painful sensations in the perineum and later in the feet, groins and abdomen.

The position of the patient, however, during and immediately after the injection, is a determining influence in this course of events.

The results obtained at first, by earlier workers, were irregular, both as to the height and duration of the analgesia. This lack of uniformity is not surprising when we realize that in the adoption of a new method, new principles were involved and different drugs were employed in varying strengths.

The method to be described here is that elaborated by Prof. Barker and used by him at University College Hospital.

There are only three ways by which an analgesic solution injected through the second lumbar interspace can make its direct effects felt in the mid-dorsal region, or higher, as is sometimes the case in this procedure, these are—

1. By slow diffusion;
2. By a shifting upwards of the whole column of cerebro-spinal fluid in which it is suspended;
3. By gravitation, if the injected compound be heavier than the liquor spinalis.

1. Diffusion alone of one fluid in another is a slow process and is unlikely to be the mode by which the injected fluid is spread in this procedure.

2. That the cerebro-spinal fluid does recede towards the head on elevation of the pelvis is undoubted, but it is difficult to imagine its receding to such an extent as to carry with it a mass of fluid lighter than itself the distance from the second lumbar to the fifth dorsal vertebra, some eight or ten inches.

3. There remains, then, the action of gravity. This force may affect an injected fluid of greater density than the liquor spinalis, and carry it through the latter to the most dependent part of the canal. Thus a heavier solution behaves quite differently from one of lesser density when injected into the spinal sac. It is easy to observe the behaviour of one fluid injected slowly into another, if the first be coloured with an aniline dye. If both have the same temperature and specific gravity, the injected fluid forms at first a distinct coloured cloud, which slowly diffuses through the mass into which it enters, if the latter be in a state of rest. On the other hand, if the injected fluid has the same temperature but a greater specific gravity, it sinks rapidly in a definite stream to the bottom of the second fluid, and remains there without diffusion for a period proportionate to its density and viscosity.

A consideration of these facts shows that if we aim at localising a spinal injection to any particular region of the cord we can utilize the force of gravity acting upon an injected compound of greater density than the liquor spinalis.

Thus the heavier injection sinks to the lowest part of the canal, independently of any displacement of the cerebro-spinal fluid. Here it remains, more or less undiluted, in contact with the surrounding structures.

There are several drugs which have been used to produce spinal analgesia, such as alypin, novocaine, tropacocaine and stovaine. They differ widely in their physical properties, and their specific gravities and freezing-points in five per cent. solutions show a distinct difference one from another and from the specific gravity of the cerebro-spinal fluid.

They differ also in their specific action and toxicity when injected within the spinal dura.

A failure to appreciate these points may largely account for the irregularities which

have been reported by some to follow their use.

Without entering into a detailed comparison of these various drugs and their respective actions, it is only necessary to state that I have obtained the most uniform and reliable results from the use of tropacocaine and stovaine.

A five per cent. solution of tropacocaine in distilled water has a specific gravity of 1.0106 and a freezing-point of 0.0545° C.

A five per cent. solution of stovaine in distilled water has a specific gravity of 1.0064 and a freezing-point of 0.0585° C. The specific gravity of the cerebro-spinal fluid is 1.007.

Thus a five per cent. solution of tropacocaine is heavier than the cerebro-spinal fluid, and if injected into the dural sac will gravitate to the most dependent portion of the canal.

A five per cent. stovaine solution, however,

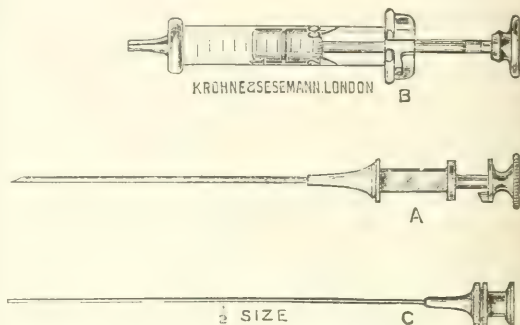


FIG. 1.—"Record" Syringe with Inner Cannula.

being lighter than the liquor spinalis, will not gravitate, but slowly diffuse at the place of injection.

To obviate this objection to the use of stovaine, Barker has added five per cent. glucose to the injected fluid, so that a solution of five per cent. stovaine plus five per cent. glucose and ninety per cent. distilled water has a specific gravity of 1.0230.

This solution, being heavier than cerebro-spinal fluid, will on injection gravitate to the lowest portion of the spinal canal; while beyond rendering the solution slightly viscid, and thus helping its localisation, the addition of glucose has little or no action on the contents of the canal.

With such a solution, owing to its comparatively high density and viscid character, diffusion and consequently dilution of the stovaine is limited.

Thus a smaller dose can produce a full effect, and the solution, by means of gravity, be so localised as to exert its specific action at the desired level of the cord.

Technique. For use in spinal analgesia the

"Record" syringe of 2 c.c. capacity is certainly the best.

The needle has a close fitting stylet, and the point is oblique and hollow so as to secure sharpness without too much lengthening of the terminal opening. As the operator is dealing with very small amounts of injection fluid, and the loss of two or three drops would make a considerable difference to the extent of the analgesia, a means has been devised by Barker for the delivery of all the injection compound through the point of the needle. This consists of a second cannula, slender enough to fit the first hollow needle loosely and long enough to project beyond its point about 1 mm. when the conical base is pushed home.

This cannula is attached to the syringe, which is filled with the solution through it.

Our next consideration is how to pierce the lumbar dural sac with the point of a needle, and through it to inject our solution below the termination of the spinal cord.

The human cord terminates at its lowest extremity opposite the second lumbar vertebra, and below this is out of reach of harm. The dural sac extends to about the level of the third sacral vertebra. The configuration of the bones below the fourth lumbar spine, however, makes a needle puncture below this level a matter of great difficulty, if not a practical impossibility, so that our choice of a puncture spot is restricted to the second or third interspaces of the lumbar vertebrae.

Here the sac can be reached between the laminae, or the needle can be thrust exactly in the middle line between the second and third, or third and fourth spines.

It is now generally acknowledged that puncture in the middle line is the easiest and safest method. Here the puncture is least painful, and there is less risk of wounding any nerve structure or vessel if the needle is kept true to the middle line and only just penetrates the dural sac completely.

At either side there is a possibility of touching the strands of the cauda equina.

Besides this, any small quantity of fluid injected in the middle line can spread freely through the liquor spinalis, whereas, if delivered among the nerves of the cauda equina on either side it may be entangled there, and tend to pass upwards or downwards in their interstices on that side alone, and so fail to reach the general cavity of the dural sac. The consequences of this may be an effect too low for the contemplated operation, or a one-sided analgesia.

The middle line, therefore, is the preferable site for the entrance of the hollow needle. Here the analgesic solution passes freely into the spinal fluid and can move unhindered upwards or downwards from the point of entry; it can

now be influenced in various ways and for varying objects, according to its density in relation to that of the spinal fluid.

A convenient guide to the site of injection is the fourth lumbar spine, which is on a level with the highest point of the iliac crests; a line joining these two points across the back will indicate this spine.

The hollow needle is thrust through the skin just above this or the third spine and its point aimed straight forward and a little upward. If this is accurately done, no difficulty as a rule is experienced in reaching the middle of the dural sac.



FIG. 2.—Position of Patient for Injection in Operation for Appendicectomy. The head and pelvis are raised, so that the sixth dorsal vertebra is the most dependent part of the spinal column.

In some very stout people the spine may be difficult to feel with the finger, and the point of the needle may strike bone; its upward slant is then changed, and the needle point thrust in a lower direction.

This usually suffices to pass the spine without the necessity of a fresh skin puncture if the back has been well rounded in order to obtain the greatest amount of separation between the lumbar spines.

In a few cases it may happen that the spines are clubbed or twisted at their ends, or even overlap. In such, we may fail to reach the canal, but these failures are rare. With a little practice lumbar puncture becomes quite easy, though in early attempts some difficulties may be encountered.

Whether the patient during the puncture should sit on the edge of the table, with the back rounded to its maximum, or lie on his side with the knees well drawn up, depends on the site of the operation and the height of the analgesia required.

Spinal puncture is certainly easier in the first position. To illustrate the procedure employed, let us take the case of an operation for right inguinal hernia, with possibly some omentum in the sac. Here we must aim at obtaining analgesia to the level of the ensiform cartilage, which means that the stovaine-glucose solution must be brought into contact with the nerve roots as high as the sixth dorsal vertebra.

The needle, cannula and syringe are boiled for ten minutes in plain water (without alkali) to ensure their sterility. When cool, the cannula is fitted to the nozzle of the syringe.

One of Billon's ampoules containing the sterile stovaine-glucose is now taken and the end is broken off.

The cannula is introduced through the broken end and the fluid is drawn up into the syringe. The latter is then pointed upwards with the cannula still attached and all bubbles are dislodged by gentle tapping. In this position all fluid except the required dose is expelled, and the syringe is laid aside on a sterilized towel.

The patient has meanwhile been placed on the operating table and his confidence established by a few words.

The skin over his lumbar region is always cleansed beforehand as carefully as the area for operation, preferably by painting it over with a five per cent. solution of iodine in rectified spirit twelve hours beforehand and repeating it im-



FIG. 3.—The Needle and Syringe in Position after the Solution has been injected in a case of Right Inguinal Hernia.

mediately before the puncture (*cf.* Preparation of Skin).

The position of the patient must now have careful attention. For an operation on the right side he is placed lying on the right side, so that the nerves to that region may become most deeply affected.

His head and neck are raised on pillows and, to ensure that the analgesic solution reaches the sixth dorsal vertebra, the buttocks are raised by a padded one-inch board placed under his right trochanter. This will raise his pelvis about one inch, or sufficiently high to cause the sixth dorsal vertebra to be the most dependent part of his spinal column.

Great care must be taken that the head and neck are sufficiently raised to prevent the injected fluid from running higher.

His knees are now flexed on his abdomen, and his back rounded as much as possible in the lumbar region.

The skin is now finally cleansed and a sterile towel laid across the pelvis, through which the

iliac crests are felt and the fourth lumbar spine determined.

The skin on either side of the selected interspace, second or third lumbar, is then steadied by two fingers, and the needle, with stylet in position, is sharply thrust through the integument in the middle line to a depth of one inch. The stylet may now be withdrawn. The needle is then pushed firmly through the interspinous ligaments until the dural sac is punctured, when the spinal fluid flows out in rapid drops, or more rarely in a continuous stream.

This flow of cerebro-spinal fluid is most important, as it is our only guarantee that the sac has been reached by the needle. If the drops come slowly, the needle point may not be completely within the sac; it should then be rotated on its long axis, when a faster flow usually issues from the stem. In no case should the analgesic solution be injected until the flow of spinal fluid is satisfactory.

When two or three c.c. of liquor spinalis have escaped into a measure glass, the slender cannula attached to the loaded syringe is inserted through the hollow needle and pushed gently home; then the measured solution is injected into the sac by a slow thrust of the piston. When this is completed, the needle, cannula and syringe are rapidly withdrawn together and the puncture is covered with collodion, or chloroform rubber solution.

Throughout the procedure the patient is lying on his side, and this position is still maintained for two or three minutes. By this time the solution has gravitated to the most dependent part of the canal and produced its analgesic effect on the side on which he is lying.

The height of the analgesia is noted, and, if satisfactory, the patient is now gently rolled on to his back, when the other side of his body becomes quickly analgesic. The board under his pelvis may now be removed.

As a rule, two minutes elapse after the injection before the patient feels a numbness in his feet, then the perineum becomes analgesic, and later the trunk as high as the nerve-supply from the most dependent segment of the cord.

A screen should now be placed in front of the patient, as it is seldom desirable that he should see the manipulations of the operator, and, if possible, an assistant or nurse should converse with him and so distract his attention from the matter in hand.

At the conclusion of the operation the patient should be gently lifted into bed with his head and shoulders raised.

For an operation on the perineum a simpler procedure is available. Here the analgesia is not required at a high level, so no elevation of the pelvis is necessary.

The usual preparations being complete, the

patient is placed in a sitting posture across the end of the operating table. His feet rest on a chair, and he is directed to place his elbows on his knees and his head on his hands and so to round his back that the greatest separation is obtained between the lumbar spines.

The fourth lumbar spine is defined, and the needle thrust into the skin immediately above it. When the sac is reached the injection is carried out as described, and the patient is then gently moved into the lithotomy position, with head and shoulders raised.

In two or three minutes the anus becomes insensitive and its sphincters completely relaxed, when the operator can proceed to work.



FIG. 4.—Patient with Syringe in position after an Injection for Operation on Hæmorrhoids. The lower towel half covers the fourth lumbar spine.

A notable point in this procedure is the complete muscular relaxation which is obtained by spinal analgesia.

This is especially remarkable during anal and abdominal operations; the muscles are found flaccid and toneless, and there is an entire absence of that straining and intestinal protrusion which so frequently hampers the surgeon when a general anæsthetic is employed.

In only a very few cases have I seen a trace of blood appearing through the puncturing needle, either before, during, or after the escape of spinal fluid.

This was probably due to the fact that the puncture was carefully made in the middle line, and the extra-dural veins, which are more developed laterally, were not pierced by the needle.

To secure perfect asepsis throughout the procedure is beyond everything absolutely necessary, and in the nature of things is compara-

tively easy, as the skin in the lumbar region is no more difficult to cleanse than the integument in other parts of the body.

The needle and syringe require simple boiling, and should never be utilized for any other purpose.

The water in which they are boiled should be free from any alkali, a trace of which destroys stovaine. The injection fluid must be carefully prepared, not only in regard to its sterility, but also in regard to the strength of its solution.

It is better when made fresh.

The glucose-stovaine solution which I have now used for five years is made by Billon, 92 Rue Vieille du Temple, Paris, and issued in glass ampoules, containing 2 c.c. of a five per cent. solution of stovaine and glucose in each ampoule. The filled ampoules are carefully sterilized by boiling at 110° C. before being finally sealed.

The amount of this solution necessary for injection in any one case should not exceed 1·2 c.c.; or 6 centigrams of stovaine.

One c.c. of this solution, containing five centigrams of stovaine, usually produces an analgesia lasting from fifty to sixty-five minutes at the level of the umbilicus.

We may now briefly consider the dangers of this method and its range of applicability.

The amount of danger during the actual narcosis appears to be in direct ratio to the height of the analgesia. So long as the diaphragm is able to perform its function, danger to life is trifling. This is now well recognized, yet the production of analgesia above the nipple line is often attended by a feeling of faintness and air-hunger in the patient due to paralysis of the intercostal muscles. Though not dangerous, this is unpleasant and can be avoided.

Headache on the evening following the operation is fairly frequent. It usually disappears after a dose of phenacetin or bromide.

Cases of paralysis of the ocular muscles have been reported on the Continent, but in those cases where Barker's technique as above described has been employed, it has only once been noticed, and then was of a temporary character.

The range of applicability may now be considered, and although successful operations on the head have been reported by Jonnesco with a stovaine-strychnine injection, these were not unattended by risk.

Operations, however, such as the radical cure of hernia, appendicectomy and operations on the uterus, the bladder and rectum are particularly suitable for spinal analgesia.

In fact I use spinal analgesia as a routine method for all operations below the level of the umbilicus.

This means that the injection fluid must reach the sixth dorsal segment.

I have used this method also for gastro-enterostomy and operations on the kidneys and for the removal of pieces of rib, but I do not attempt to procure analgesia in any region supplied by nerves above the fourth dorsal segment.

J. W. H. H.

NITROUS OXIDE

Apparatus. The apparatus necessary for the administration of nitrous oxide consists of one or two cylinders, foot-key, stand, union, india-rubber tube, india-rubber bag, valved stop-cock and face-piece. It is always advisable to use two cylinders connected together by a double union, in case one should fail. The india-rubber bag should have a capacity of about two gallons and is connected to the face-piece by the valved stop-cock. There are various patterns of stop-cock.

Administration.—The methods of administering nitrous oxide vary somewhat with the nature of the operation to be performed.

The method to be employed for the extraction of teeth will be described first.

Dental Extractions. The patient should be seated in the dental chair with the head resting comfortably against the head-piece—that is to say, the head should be neither flexed nor extended unduly.

The patient's feet should not rest on the foot-piece of the chair, but should hang loosely on either side of it. The reason for this precaution is, that should opisthotonos occur with the feet on the foot-rest, there will be difficulty in preventing the patient from falling on to the floor; this accident will not occur if the feet are hanging loosely, one on each side of the foot-piece. The clothing about the neck and waist having been loosened, the patient should be told to grasp the arm-rests.

The anæsthetist stands behind and to the left of the patient. Having first filled the bag about three-fourths full of gas, he inserts a dental prop, and then adjusts the face-piece, holding it in his left hand so that his little finger comes under the patient's chin.

Having once placed the face-piece in position, it must be kept there and not taken off or moved to see if it fits; any such movement is most uncomfortable for the patient. When the face-piece is applied, the lever is in position A, and the patient is allowed to take one or two breaths of pure air through the aperture; the lever is then gently turned over into position B so that the patient is breathing in gas from the bag, and expiring through the valve. At the same time that the lever is moved, a gentle stream of gas is turned on from

the cylinder, and care must be taken not to do this too suddenly, as a sudden rush of gas into the bag makes a noise which is very alarming

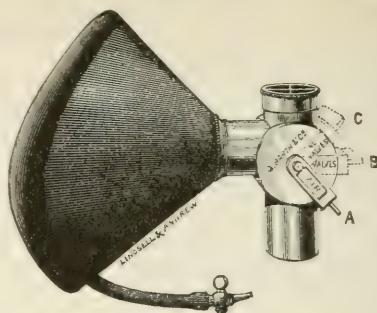


FIG. 1.—Stop-cock and Face-piece of Nitrous Oxide Apparatus, showing the three positions of the lever.

to the patient. The patient is now inspiring gas and expiring into the air, and the anæsthetist must watch for and observe the various signs by which he knows that the state of anæsthesia has been attained.

The respirations are at first jerky and irregular, but soon become deep and regular, and after continuing so for some seconds become again of a jerky character. The first indication of this latter change is that instead of a regular, long expiration, there comes a short sharp one followed by a similar inspiration. At almost the same time there is slight stertor. As soon as this has been observed the gas should be turned off from the cylinder, the patient allowed to take two or three more breaths of gas, and the face-piece then removed, the lever being at the same time turned back to position A.

The patient is now ready, and the anæsthetist must steady the head for the operator; the manner in which he does so will depend upon the tooth to be extracted, whether from the upper or the lower jaw. He must also be prepared to insert a gag should the surgeon wish to extract a second tooth from the side on which the prop is placed.

As soon as the operation is over, or better when consciousness is returning, the patient's head should be held slightly forward so that the blood can run out of the mouth. The prop should not be pulled away: it is a better plan to allow the patient to do this for himself, since frequently the sudden removal of the prop gives to the half-conscious patient the idea of a tooth being extracted, and causes him to cry out and to accuse the operator of having given him pain.

It may be necessary, as mentioned above, to insert a gag during the operation, especially if the prop slips or if the operator wishes to move it in order to complete his work. In such a case a Mason's gag should be inserted quickly on the side opposite to that on which

the operation is to be performed; in so doing care must be taken neither to break teeth nor to include a portion of the lip, both of which accidents have been known to occur and to lead to unpleasant consequences.

Nitrous Oxide and Air.—The method of administering nitrous oxide gas for operations in which more time is required than for the extraction of teeth, is slightly different from that given above.

The patient is settled comfortably, either sitting in a chair or lying on the operating table according to the wish of the surgeon.

The bag is first filled three-fourths full, the face-piece then accurately placed on the face, and the patient allowed to inspire gas and expire into the air as before.

As soon as the change from regular deep respiration and the slight stertor are noticed, the operation can be commenced. After two or three more inspirations of gas the lever should be turned back to position A for a few seconds so that the patient gets two breaths of pure air: the lever is then turned over again to position B for three or four more inspirations of gas, and subsequently back again to position A to allow the breathing of more air. The exact proportions of air to gas will vary considerably with every case, and no absolute rule can be stated. This the anæsthetist must determine for himself, and practice alone will teach him to gauge it correctly. If too much gas is given, the patient becomes stertorous and cyanosed, and jactitates; if too little, anæsthesia is lost. The points to be aimed at are to keep the patient motionless and of a good colour; accordingly the instant that muscular twitchings begin, air must be given.

It is not really sufficient, however, to wait for the occurrence of cyanosis or jactitation before increasing the amount of air; the experienced anæsthetist will anticipate these events and maintain a quiet anæsthesia while keeping the patient's colour good throughout. The art of so doing can only be learnt by practice, and until he has had a considerable experience of short cases the administrator will be well advised not to attempt to give a prolonged gas: he can hardly hope to do so successfully until he is absolutely conversant with all the phenomena which occur during a short administration.

The anæsthetist should never be guided by rules of time or of number of inspirations given. No two patients are quite alike, and what may be sufficient for one may be far too much or too little for another. The various phenomena must be observed as they arise, and as soon as the patient presents the condition of anæsthesia described above, the operation should be commenced.

With regard to other signs it may be noted

that the conjunctival reflex is usually lost or at least much diminished. The corneal reflex, however, commonly remains. The eyeballs are usually fixed, but occasionally there is nystagmus; the pupils are, as a rule, dilated. These eye conditions, although interesting, need not be relied upon to furnish information as to the patient's condition, for provided that the respiratory changes have occurred anæsthesia has been induced.

"To-and-Fro Breathing." There is yet a third method of administering nitrous oxide gas to which allusion must be made, although it will not be found so generally useful as the preceding.

The administration is begun as before, but when the second stage is reached, that is to say when the patient's breathing has become deep and regular, the lever is turned over into position C. The effect of this will be to cause the patient to expire into the bag as well as to inspire from it, so that the supply of gas from the cylinder must be turned off at the same time that the lever is altered, otherwise the bag will become over distended. It is clear that by adopting this method of procedure, the patient is made to inspire not only nitrous oxide but also carbonic acid, and that the proportion of this latter gas will progressively increase with the length of the administration.

This to-and-fro breathing, as it is called, may be used in long as well as in short cases, that is to say it may be employed as a variation of the gas and air administration already described.

It is not, however, to be recommended, for it adds partial asphyxia to nitrous oxide anæsthesia. The chief if not the only advantage of the method seems to be that it economizes gas.

Summary of the Signs of Nitrous Oxide Anæsthesia. From what has been said above it follows that the stages of anæsthesia induced by gas may be divided into three—

In the *first* the breathing is irregular and still under voluntary control; after a duration of about half a minute it passes into the second.

In the *second* the breathing is regular and deep, the pupils become gradually dilated and the third stage is reached about one minute after the beginning of the administration.

In the *third* stage, there is slight stertor, the respirations again become jerky and irregular and the condition of anæsthesia has been reached.

Nasal Administration. It is sometimes necessary, especially in dental work, to be able to give a prolonged administration of nitrous oxide. There are several methods by which this may be done, but perhaps the best apparatus is one designed by Mr. Trewby, which is a modification and an improvement on some of the earlier forms.

Trewby's apparatus is shown in the accompanying illustration. It will be seen that the nose-piece and mouth-cover are connected together by the rubber tube D, and that both are fitted with expiratory valves, A and E.

At the upper part of the nose-piece is a projection (on which is situated the expiratory

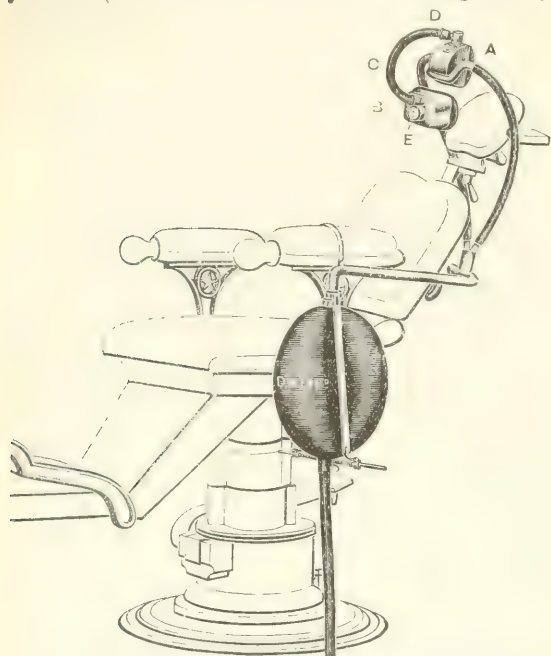


FIG. 2.—Trewby's Apparatus for Nasal Administration of Nitrous Oxide.

valve A); this can be pushed forwards to B, and by so doing the entry of gas is cut off and an air slot is opened.

The administration is conducted as follows—

The mouth-piece and nose-piece are placed in position and the patient inhales gas from the bag and exhales it through the two expiratory valves at A and E.

As soon as the patient is anæsthetized, the tube D with the attached mouth-cover is swung to the left: this cuts off the gas to the mouth-cover at A, but does not interfere with the admission of gas to the nose-piece. Gas must now be forced into the nose-piece at a slightly greater pressure than is necessary in the ordinary administration, this is accomplished by the spring, which exerts a pressure about equal to four pounds.

A small metal tube can be attached to the nose-piece through which oxygen can be given if necessary.

Trewby lays stress on the importance of having expiratory valves in both nose- and mouth-pieces in order to prevent to-and-fro breathing during the administration. His apparatus has the additional advantages of

enabling the administrator to shut off gas and give air or oxygen at a moment's notice, and of supplying the gas at a gentle pressure.

Indications for Nitrous Oxide. Nitrous oxide anæsthesia is suitable for the following cases—

1. Dental extractions.
2. Minor operations such as opening of abscesses.
3. Any operations of short duration in which it is not essential that the patient should be absolutely still and his muscles relaxed.

Contra-indications.

1. Those cases (*i. e.* angina Ludovici) in which there may be swelling or engorgement of the upper air-passages.

2. Cases of advanced morbus cordis, especially mitral disease.

3. Rectal cases.

4. Cases in which complete muscular relaxation is required.

Difficulties and Dangers of Nitrous Oxide Administration. The safety of nitrous oxide as an anæsthetic is vouched for by the fact that many thousands of administrations are conducted daily, while fatal cases are extremely rare. Indeed it has been stated by an eminent authority on the subject that "death ought never to occur as a result of gas."

At the same time there are a few details worthy of consideration, the neglect of which may lead not only to difficulties, but even to death.

1. *Obstruction to Respiration.* Any impediment to free breathing, such as enlarged tonsils and adenoid growths, laryngeal stenosis, etc., introduces the risk of asphyxia. The entry of foreign matter (such as vomit, blood, pus, extracted teeth, etc.) into the larynx, causes the same danger.

When respiratory obstruction from some such cause as one of these has occurred, a condition of apnoea ensues. This usually passes off as soon as the obstruction has been removed, but the treatment should be preventive, *i. e.* due attention to any restrictions to breathing (such as tight clothing) and the avoidance of nitrous oxide in unsuitable cases.

Cessation of respiration will also occur if gas be administered for too long a time without the admixture of air, that is to say if the patient be unduly deprived of oxygen.

2. *Cardiac Failure.* Cases have been reported in which cardiac failure has occurred under gas. The correct treatment is said to be artificial respiration, venesection and inversion of the patient. Such a fatality must be extremely rare, and will probably never occur unless some cardiac trouble pre-exists.

Nitrous oxide is not a good anæsthetic for patients suffering from mitral disease. It may be given if the lesion is fully compensated, but

the recumbent position should always be insisted upon. If the disease is advanced so that the cardiac reserve force is small, or is uncompensated so that the right side of the heart is already embarrassed, then the deprivation of oxygen which necessarily accompanies a nitrous oxide administration may be sufficient to produce a fatal result.

Gas and Oxygen.—Oxygen may be given with nitrous oxide gas by means of a special apparatus devised by Sir F. Hewitt.

Apparatus. The apparatus consists of a double gas bag, and a special stop-cock, so arranged that, to the pure nitrous oxide inhaled by the patient a variable quantity of oxygen can be added by the anæsthetist as he requires it.

The amount of oxygen given is shown by an indicator and scale, marked from 1 to 10.

In skilled hands this anæsthetic is perhaps, within certain limits, the best at our disposal.

The patient can be kept quiet for several minutes, the operation performed under complete anæsthesia without any need for haste on the part of the surgeon, and the patient recovers consciousness almost immediately with, except in the rarest instances, no unpleasant after-effects.

Furthermore, it is a safe anæsthetic and not unpleasant to the patient.

Administration. The administration of nitrous oxide gas and oxygen is somewhat similar to that of nitrous oxide and air; it is conducted as follows—

The two bags are filled three parts full, the one with nitrous oxide, the other with oxygen: the face-piece is adjusted to the face and the patient allowed to breathe air gently through the aperture at the top. After one or two inspirations of air, to accustom the patient to the feel of the face-piece, the lever is turned over so that inspiration is taking place from the gas bag and expiration into the air.

After the patient has taken three or four breaths of gas the lever is turned over slowly still further, until the indicator points first to 1, then 2, and then 3. Oxygen is thus mixed with the nitrous oxide inhaled, while expiration continues to take place through the valve into the air. The exact proportion of oxygen given varies very widely in different cases; it is determined by the patient's colour. The anæsthetist aims at keeping the patient from becoming cyanosed from the beginning to the end, but he must not err on the side of giving too much oxygen. Anæsthesia is usually induced in two or three minutes, and by that time the oxygen indicator will probably point to 4. It is best to keep the patient a little short of oxygen until anæsthesia has been well established, and gradually to increase the proportion

as the administration proceeds. If well administered to a suitable patient it should never be necessary to increase suddenly the proportion of oxygen: in other words, the anæsthetist must anticipate events, and increase or decrease the oxygen before marked cyanosis or over-oxygenation of the blood, if it may so be termed, have occurred. To accomplish this successfully requires considerable practice—experience alone can teach it. After the operation has been in progress for three or four minutes the indicator may point to 6 or 7, in fact as a general rule the longer the administration, the greater the proportion of oxygen that should be given. Rarely, however, will it be necessary to increase the oxygen beyond 7, even during operations lasting fifteen or twenty minutes, but in such long cases it may occasionally be beneficial to give a breath or two of pure air. It is also worthy of note that more oxygen will be required for children and weakly subjects than for healthy and robust individuals.

Signs of Anæsthesia. The signs of anæsthesia are quiet, regular breathing—there should be no stertor—loss of conjunctival reflex, and slightly dilated pupils.

The corneal reflex, as in nitrous oxide anæsthesia, usually persists.

As soon as these signs are present the operation may be begun, and the administrator must then observe his patient very closely, in order to maintain the condition unchanged. The slightest approach to cyanosis, stertor or jactitation calls for more oxygen, but as already stated, the experienced administrator will seldom be compelled suddenly to alter his mixture. In most cases, indeed, as soon as the condition of anæsthesia has been reached, it will be found that with a little care the proper amount of oxygen can be determined which will suffice for the greater part of the operation.

The most common error made by the beginner is to give an excess of oxygen, with the result that the patient recovers consciousness and becomes excited. To recapitulate what has been said above, the administrator's success depends upon his power to foresee what the effect of his administration at one moment will be some moments later.

Indications for Gas and Oxygen.

1. Dental extractions.
2. Minor operations in which relaxation of all the muscles is not essential, surgical dressings, etc.
3. Patients who have a marked antipathy to ether and chloroform.
4. Certain cases in which ether and chloroform are contra-indicated.
5. It is particularly suitable for such short operations as the removal of fibro-adenomata of the breast.

Contra-indications. Gas and oxygen is not suitable to—

1. Alcoholic subjects.
2. Strong muscular men.
3. Rectal and vaginal operations or examinations.
4. Abdominal surgery.
5. Any operation in which there will be much subsequent pain.

6. Examinations under an anæsthetic in which complete muscular relaxation is required.

After-Effects. The absence of unpleasant effects following the administration of this anæsthetic is one of the strongest arguments in favour of its use. Consciousness is not restored quite so quickly as after nitrous oxide alone, but this is probably attributable to the fact that the administration is usually more prolonged. Vomiting does occasionally occur, and rarely momentary hysterical excitement; these events are both more likely to supervene when an excess of oxygen has been given at the close of the operation to restore the patient to consciousness.

Difficulties and Dangers. Gas and oxygen is probably the safest anæsthetic known; no fatalities caused by it have been reported up to the present time, although many thousands of administrations have been carried out. It is true that this anæsthetic has not been indiscriminately used by the inexperienced man, but has remained almost entirely in the hands of the expert: nevertheless, danger may be said to be practically non-existent, though the successful administration presents some difficulty. The careful selection of suitable cases is almost as important as the possession of the requisite skill. For instance, an attempt to give gas and oxygen to an alcoholic subject for a rectal or vesical operation would almost certainly end in failure. It is evident that the addition of oxygen removes the dangers, slight though they may be, which accompany nitrous oxide anæsthesia. Thus gas and oxygen may be safely given in many of those cases in which nitrous oxide alone is contra-indicated owing to the risks consequent upon deprivation of oxygen.

H. E. G. B.

ETHER, CLOSED

This method consists in inducing anæsthesia by means of ether, together with a limited and known proportion of air-supply. There are several methods of administering ether in this manner—

1. Ether only.
2. Ethyl-chloride-ether sequence.
3. Nitrous-oxide-ether sequence.

1. Is not recommended because of the unpleasant sensations to the patient while narcosis

is being induced, and the great tendency to cough caused by the irritation set up by the ether in the early stage of induction, which can only be avoided by prolonged practice and experience on the part of the anæsthetist.

2. Has only one advantage over the nitrous-oxide-ether sequence, viz. that the apparatus is more portable; but its disadvantages are very great, *e.g.* extreme unpleasantness of taste and smell in the induction stage; oppressive sense of suffocation; additional risk to the patient (as there have been a considerable number of fatalities due to the use of ethyl-chloride); and the unpleasant after-effects, which are very much more than after the nitrous-oxide-ether sequence.

3. For general safety, ease in administration, and actual comfort to the patient, the nitrous-oxide-ether sequence is most strongly recommended for general purposes. On that account it is the method to be described in this section.

Closed Ether by the Nitrous-Oxide-Ether Sequence

Advantages. For prolonged anæsthesia, that is for the anæsthesia of longer duration than that procured by nitrous oxide alone, or nitrous oxide and oxygen combined, the nitrous-oxide-ether sequence is undoubtedly the *safest*. All statistics prove the death incidence of this system to be far smaller than that of chloroform, the proportion varying according to different authorities from one to five up to one to six. In other words, it is quite five times as safe as chloroform.

For the *comfort* of the patient the induction of anæsthesia by this method is less objectionable than by any other. The rapid onset of unconsciousness brought about by the nitrous oxide is of great advantage, as the patient does not have to endure the smell of the ether which he will not inhale until he is unconscious, thus avoiding voluntary "holding the breath" and decreasing the liability to cough.

It is the most *rapid* method of obtaining a complete anæsthesia, which can be prolonged for any reasonable length of time.

It is the *easiest* system for the medical man to learn the administration of; the ease to the anæsthetist being greater and the risk to the patient less than in any other system.

Alcoholic subjects can be anæsthetized by this means when they are too impregnated with the poison to take any other anæsthetic; and in cases of *aortic valvular disease* and *myocarditis* it is the only one that can be administered with any safety. Furthermore, the sequence can be continued, if desired, by the use of chloroform on an open lint mask if the operation takes a longer time than is desirable for the prolonged use of the closed ether method.

Contra-indications may be considered as due to—

- (a) Condition of the patient.
- (b) Variety of operative procedure.
- (c) General conditions.

(a) The nitrous oxide bag and the necessity of applying the face-piece close to the face is inclined to alarm *children* and make them struggle more than they would when an anæsthetic is administered by an open method. Ether is likely to cause bronchial irritation in young children with consequent evil after-effects, while the hypersecretion from the mucous membrane of the pharynx and respiratory tract caused by the ether tends to an obstruction in the narrow air-passages. This last phenomenon makes this system quite unsuited for anæsthetizing *infants*, and the younger the children the more unsuited are they for the nitrous-oxide-ether sequence. No child under eight years of age should be anæsthetized by this method. In all cases where there is any *pulmonary disease*, e.g. bronchitis, emphysema, phthisis, this system is to be avoided, as the tendency to hypersecretion in the air-passages will aggravate the pathological condition. *Asthmatics* frequently take it badly. *Aged* patients also have a tendency to bronchitis after this anæsthetic has been administered. Owing to the increase of arterial tension patients with *arterial degeneration* or a *tendency to hæmorrhage* should not have ether, and as it is said to induce suppression of urine the presence of *renal disease* is a contra-indication. When the *mitral valve* is diseased so that the pulmonary circulation is affected ether must be avoided as it may aggravate the condition. When the patient has *ankylosis of the jaw* the difficulty of keeping the tongue forward and the air-passages clear is so great that this method is inadvisable. When the mouth is not relatively clean there is a greater risk of inhaling septic matter, owing to the increased secretion of saliva, than when chloroform is used, with the consequent onset of a septic condition of the bronchi or lungs, so that the presence of *carious teeth*, *pyorrhæa alveolaris*, etc., should completely contra-indicate the use of this method.

(b) Ether vapour is extremely inflammable and when mixed with air detonates violently near a flame, hence its employment is inadvisable in operations which require the use of the *actual cautery* or any *naked lights*. For operations about the *face*, *nose*, *mouth* and *pharynx* which require prolonged anæsthesia with the mouth

uncovered this method cannot be used. For *ophthalmic* operations the anæsthetist's apparatus takes up so much space as to incommode the operator, and similarly in most operations on the *neck*; while in operations on the brain the dilatation of the blood-vessels is so undesirable that most surgeons object to the use of ether.

(c) This method can only be employed when the anæsthetist has the complete apparatus, and it must frequently happen in the country, or at other emergency operations, that this is not at hand or that its lack of portability renders its use impossible. In extremes of temperature, too, it may be contra-indicated. Ether boils

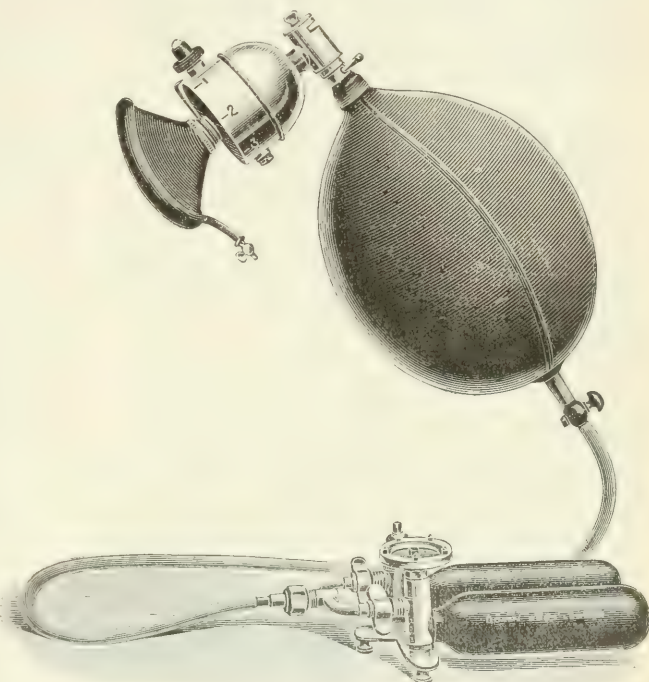


FIG. 3.—Closed Ether Apparatus.

at 95° to 96° F., and so it cannot be used when the temperature is high, and when there is extreme cold it is difficult to vaporize, so that warming the metal portion of the apparatus is always advisable at such times.

Apparatus. (Fig. 3.) This consists of two nitrous oxide cylinders, worked by means of a footscrew; rubber tubing connecting the cylinders to a large rubber bag, to act as a receptacle for the nitrous oxide gas, which in turn is connected by means of a metal tube arranged with suitable valves, to the Clover's portable regulating inhaler. This consists of a metal dome-shaped hollow receptacle through which passes a hollow cylinder open at both ends. This cylinder has in one side

two apertures which communicate with the ether chamber, and through the cylinder runs a tube, to the upper end of which the nitrous oxide bag is attached, and to the other end the face-piece. This tube has also two apertures and to it is connected a pointer, which indicates its position on the scale outside the receptacle. When the indicator is at 0 there is a direct communication between the two ends of the tube, the apertures being so adjusted that the ether chamber is cut off; when the indicator is at F. the air from the bag must go completely through the ether chamber to reach the face-piece, owing to the position of the respective apertures; while between these points only such proportion of air passes through the ether chamber as is indicated by the pointer. The ether reservoir is filled through a properly arranged opening, where the indicator shows 0, and the lower part is surrounded by a water-jacket in order to moderate the extremes of temperature that the ether evaporation might otherwise cause. It is necessary to have another rubber bag open at one end to fit into the Clover's inhaler when the nitrous oxide bag is removed. This should be so arranged with a stopcock that when necessary an oxygen cylinder can be connected thereto by means of a rubber tube.

Preparation and Administration. The previous preparation will not differ from that followed for the other systems of anæsthesia, but it is important that the apparatus be in complete readiness before the administration begins. The ether receptacle should be warmed by passing hot water through the Clover's inhaler and then filled with pure ether from a one and three-quarter ounce measure. It is now connected with the face-piece, which has been cleansed previously with eau-de-Cologne or other perfume, and the nitrous oxide bag is connected with the upper part. The other bag should be in a convenient place such as hanging on to the anæsthetist's overall. The patient is lying in the dorsal position on the operating table, the face looking upwards at first, the shoulders lying on the pillow on which the head rests and the fingers of the hands intertwined over the abdomen. The nitrous oxide bag being partly filled and cut off from the ether receptacle, the indicator pointing to 0, the face-piece, the edges of which have been smeared with vaseline, is carefully adjusted to the face so that no air can get under the edges, and the patient allowed to take a few breaths of air through the apparatus. The nitrous oxide valve (5) is then opened so that the patient inhales the gas and exhales through the valve (4), while air can be added by raising the face-piece slightly at the end of inspiration, which precaution should be taken during the

first half-dozen breaths. When the breathing indicates unconsciousness, the ether reservoir is slowly rotated towards 1, and on to midway between 1 and 2, when the nitrous oxide can be turned off, the bag removed, and the ether bag connected. The rotation must be continued slowly and some twenty breaths be taken between 0 and 1, and the same number between 1 and $1\frac{1}{2}$, and so on up to $2\frac{1}{2}$, or even 3, and in alcoholic subjects up to F., full. Thereafter the indicator at $1\frac{1}{2}$ or 2 will usually be sufficient to keep the patient completely anæsthetized. As soon as there is sufficient muscular relaxation to allow of it the head should be turned to one side so that the saliva will drain from the mouth instead of resting at the back of the pharynx, being swallowed, or inspired. One end of a gauze plug should be inserted between the molar teeth and cheek at the side on which the head is reclining and the other end rest on a towel on the pillow so that there may be efficient drainage. The forefinger of the unoccupied hand may be used to press forward the angle of the jaw, which serves the purpose of assisting the saliva to drain from the mouth, keeping the tongue forward, and the air-passages free. The patient is now ready for the surgeon to perform the operation. The anæsthetist must see that the colour remains good and the anæsthesia satisfactory. The good colour can be maintained only by keeping the air-passages free and by giving air under the face-piece at about one inspiration in four. If the operation is prolonged, after half an hour, or at most forty minutes, it will be advisable to cease administering the ether by the closed method and continue the anæsthesia with chloroform or ether and chloroform mixture, *q.v.* The one precaution that is necessary in changing from ether to chloroform is to make certain that the anæsthesia is only light, and corneal and conjunctival reflexes present, when the change is made.

The signs and stages of anæsthesia and of overdose are the same as for administration of open ether, *q.v.*

Complications and dangers are almost wholly due to obstruction of the air-passages. *Laryngeal spasm*, with closure of the rima glottidis may occur, but this is always due to the ether vapour being too strong, and is frequently preceded by an attack of coughing followed by stridulous breathing and onset of cyanosis. By removing the face-piece, allowing the patient to "come round" a little, and then beginning the administration at 0, with a smaller and more gradually increased amount of ether the spasm will not recur. *Fixation of the thorax* owing to spasmodic contraction of the respiratory muscles may become alarming and should be treated by jerking the chin upwards and dragging the

larynx with it, while abdominal respiration must be encouraged by compressing the floating ribs during expiration. Rhythmic traction on the tongue, eighteen to twenty-two times a minute, is invariably successful. *Accumulation of an excessive amount of mucus about the epiglottis* may cause obstruction, but sponging out the throat, turning the head to one side, and draining the mouth with a gauze plug, should correct this. *Foreign bodies* in the air-passages are a cause of obstruction which should always be in the mind of the anæsthetist. *Overdosage* cannot occur if the precautions described above are followed and the patient is not allowed to become cyanosed. *Inspiration into the larynx of gastric contents* or partially vomited matter must be avoided by pushing the ether at the first sign of the anæsthesia becoming light, by pressing the jaw forward, and by inclining the head to one side.

After-Effects and their Treatment. The taste and smell of the ether from which the patient will suffer for many hours after the anæsthesia is often very worrying to him and is best treated by washing the moustaches, lips and gums with a mixture of eau-de-Cologne and water (1 to 2), before he regains consciousness; and when he is able to rinse out his mouth he will get much relief from the following mouth wash:—Phenol grs. vi, acidi citric. grs. v, eau-de-Cologne ad $\frac{3}{4}$ i, in two ounces of warm water. *Vomiting* is sometimes most troublesome. The patient usually vomits once or twice some bile-stained fluid containing mucus, and occasionally the vomiting may be even more frequent, but is rarely alarming in its frequency. This is best treated with sips of warm water, or warm water containing sodium bicarbonate, 15 grs. to the ounce. If taken in larger quantities it is generally returned, and it may be advisable when the vomiting is persistent to give half a pint at a time for the purpose of washing out the stomach, when the vomiting should cease. Gastric lavage with a stomach tube is seldom necessary. *Bronchitis* is not an uncommon sequel to ether anæsthesia and is to be avoided by securing efficient drainage for the saliva during the administration. *Pneumonia* is a rare but undoubted occurrence and is to be avoided by similar means.

H. S. S.

OPEN ETHER

By the "Open Ether" method is understood any mode of administering ether in which to and fro breathing into the open air is freely permitted. Any apparatus with restricted airway, or which necessitates breathing through valves, is not strictly admissible for giving open ether, and will therefore not be considered here.

In the early days of ether administration

the method used was to pour ether on to a sponge placed in the apex of a cone formed by a folded towel which was held over the face, allowing free access of air. This was of course a form of open ether administration, but after the introduction of Clover's inhaler in 1876 this method was little used and ether administration by closed methods, involving rebreathing of expired air and considerable limitation of the entrance of fresh air, was the rule. During recent years, however, open ether by improved methods has rapidly become popular, and in some hospitals, especially in America, it is used to the exclusion, not only of other forms of ether administration, but also practically of all other anæsthetics.

Apparatus. The apparatus required is simple, and consists of a face-piece and some form of drop-bottle.

The Face-Piece. The face-piece most commonly used is a wire mask of either the Esmarch or Schimmelbusch pattern, but preferably somewhat larger than those ordinarily used for chloroform, because, ether being given in larger quantities than chloroform, it is desirable both that there should be a larger area to moisten, and also that this should be somewhat farther removed from the face. Various modifications of the wire mask have been introduced by different anæsthetists, but they do not differ greatly in essentials. The mask is covered either with several layers of sterilized gauze, from ten to sixteen, or with one or two layers of stockingette. Some protection is needed for the face. This can conveniently be arranged by twisting a long piece of gauze into a ring which will encircle the mouth and nose and cover the eyes; or a piece of gamgee tissue with an oval aperture can be used for the same purpose.

The Drop-Bottle. This should be larger than that ordinarily used for chloroform. An eight-ounce medicine bottle is convenient for this purpose. It should be fitted with (1) a stopper through which pass two small tubes, one short and the other longer, as recommended by Mr. Bellamy Gardner (Fig. 4)—the ether is poured through one tube, the rate of flow being regulated by a finger pressed upon the other—or (2) the bottle is fitted with an ordinary cork in which a groove has been cut on either side, one smaller than the other. In

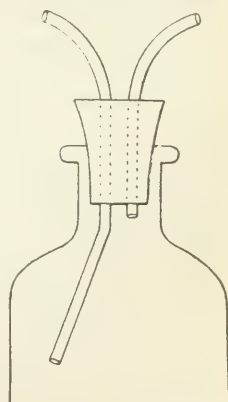


FIG. 4. — Bellamy Gardner's Ether Drop-Bottle.

the larger groove should be laid a wick along which the ether is to run. This may be either a strand of gauze cut long enough to reach nearly to the bottom of the bottle, or a pledget of cotton-wool twisted into a point. The drops will vary in size according to the thickness of the pledget and the shape of the point, being larger if this is blunt and smaller if it is pointed. Some anæsthetists use two bottles, one with a larger wick for induction and another with a smaller one for subsequent use. With a little practice, however, the rate of flow of the ether can be readily regulated by tilting the bottle. Loosening or tightening the cork will also increase or diminish the rapidity of the flow. If desired, the ether can be used direct from the bottle or can in which it is supplied, this being fitted with a cork of suitable size.

Other inhalers on the principle of the original towel cone were until recently much used for the administration of open ether. Rendle's mask is the best known of these. Into the upper end, which is perforated to admit air, a sponge is fitted. Ether is poured on to the sponge from the inside in small quantities at a time. The objection to these inhalers is that the supply of ether being intermittent, the strength of the vapour varies and cannot be so gradually increased or kept constant as in the method to be described.

Method of Administration. Induction by open ether is comparatively slow, but is not as a rule unpleasant to the patient. If the ether is given slowly and the strength only gradually increased there is no pungent odour, and no feeling of suffocation is produced. The patient's head should be slightly inclined to one side. If the teeth are defective and the jaw falls in, a prop should be placed between the gums, or instead of this the anæsthetist may insert his thumb and hold down the tongue. The ring of gauze or gamgee tissue already described should be laid, either moist or dry, upon the face, covering the eyes. The mask is allowed to rest upon this, and ether should be dropped slowly on to the lower part of the outside of the mask. The ether should be given cautiously at first, the amount being very gradually increased, and diminished if there is any tendency to cough or a feeling of suffocation is complained of. After the first beginning the whole surface of the face-piece should be kept uniformly moist. During the early part of induction the anæsthetist should encourage the patient to talk and should keep up a conversation. When signs of unconsciousness appear the ether may be given more rapidly, and at this stage it is well to wrap round the base of the mask either more folds of gauze or a towel. If need be, extra layers of gauze may also be laid on the top.

Anæsthesia usually proceeds quietly and

deepens gradually. There is rarely any serious struggling, and there should not be much mucus unless the ether has been given too freely. The breathing deepens and becomes slightly snoring, but is much less deep than is usual in etherization by the closed method. Occasionally a condition of "sub-anæsthesia" supervenes, with quiet breathing and absence of lid reflex, which may deceive the anæsthetist until the first incision produces vigorous movement. Complete abdominal relaxation is not always obtained readily, and in the case of muscular subjects it may be advisable to raise the mask slightly so as to admit air more freely and to deepen the anæsthesia with chloroform. When once satisfactory surgical anæsthesia has been obtained it is comparatively easy to maintain it by the open method. The condition of the patient is generally very satisfactory, the colour good, the circulation well maintained, the breathing regular and moderately deep. As a rule a slight corneal reflex can be allowed to persist. Much less ether will be required than was necessary during induction. By tilting the bottle to the requisite angle the ether can be made to flow more slowly, but it should be sprinkled over the whole surface of the face-piece and not directed to one part only. In the latter case the vapour is likely to be more irritating. Freezing is sometimes troublesome, but can generally be counteracted by a warm hand upon the mask. It often indicates that an unnecessary amount of ether is being used.

With open ether there is comparatively little tendency to shock, and patients will usually stand prolonged operations well, the amount of ether required being of course proportionally less the longer the anæsthesia continues. Recovery is often surprisingly rapid and after-sickness is not frequent.

Advantages of Open Ether. Open ether is to be recommended on the following grounds—

1. *Simplicity.* The apparatus required is readily obtainable by every practitioner; it is clean and can be easily sterilized.

2. *Safety.* The method is safe even in the hands of inexperienced administrators, certainly much safer than chloroform or its mixtures. There is comparatively little risk of giving an overdose, and danger signals are generally easily recognized.

3. *Diminished Cyanosis and Mucus.* There should be no tendency to cyanosis with open ether. If the airway be kept free, which is generally easy, the face remains of normal colour, or is slightly flushed. The secretion of mucus is generally less than with the closed method. It may, however, be troublesome in some cases, but these become less frequent as the administrator gains experience in the method.

4. *Convenience to the Surgeon.* The moderate depth of the respirations, as compared with the heavy laboured breathing often accompanying administration by the closed system, renders open ether more convenient to the surgeon, especially in abdominal operations. It is also said that there is less venous oozing.

Disadvantages of Open Ether—

1. *Length of Induction.* Induction by open ether is admittedly longer than by other methods. It is rarely less than six or seven minutes, and may be considerably longer. Although the process is not unpleasant, the comparatively long time that elapses before consciousness is lost is certainly a disadvantage to the patient, and the length of the total duration is often the same to the surgeon.

2. *Amount of Ether used.* At least three or four ounces are generally required for induction, and from twelve to sixteen ounces may be consumed during an operation of an hour's duration. It is true that experience enables the administrator to use less ether than is required by a novice in the method, but the amount certainly remains larger than when a Clover or Hewitt's inhaler is employed. The surrounding air may become saturated, disagreeably affecting both the anæsthetist and the bystanders, and if the operation is performed in a very small room with a fire burning may even be a source of danger. In no case should a flame or cautery be allowed within several feet of the inhaler.

3. *Refrigeration.* The continual evaporation of ether in such close proximity to the mouth and nose means that a mixture of air and vapour at a low temperature is being inspired. Experiments have shown that in a room at 80° F. 2·1 per cent. of ether vapour reduces the temperature of the inhalations to 30° F., and five per cent. to 9° F., causing a loss of about 21,000 calories of body heat for every ounce of ether used. It might reasonably be feared that this cold inhalation would tend to the subsequent appearance of chest complications, if not to other trouble due to the loss of heat. Such sequelæ are, however, certainly not common. The question of the responsibility of ether for so-called ether bronchitis or pneumonia is a vexed one, but as far as can be ascertained there does not appear to be evidence that such complications are more frequent in institutions where open ether is largely used than where other methods are in vogue.

4. *Difficulty of obtaining Deep Anæsthesia.* This difficulty exists only in certain cases, but in the case of robust male subjects and alcoholics it is, in the opinion of many anæsthetists, sufficiently serious to form a contra-indication to the use of open ether for patients of this type.

Methods of Dealing with the Disadvantages of Open Ether. To counteract the above disadvantages two methods are often resorted to: (1) the use of other anæsthetics as adjuncts, and (2) the preliminary administration of a narcotic.

1. With regard to the first method, many anæsthetists, in order to shorten induction, prefer to induce with C.E., A.C.E. or the ethyl-chloride C.E. sequence, subsequently using open ether alone. Some begin with chloroform; in this case it is well to pass to ether after consciousness is lost, but before induction is complete.

In cases where it is difficult to maintain satisfactory muscular relaxation a little chloroform or C.E. may be given occasionally to deepen the anæsthesia.

2. *Preliminary dosage with a narcotic* is of service, because it is found that if a patient has been partially narcotized a smaller amount of ether or chloroform is required to produce and maintain surgical anæsthesia. The drug generally used is morphia, either alone or in combination with scopolamine. Scopolamine is also a narcotic, but differs from morphia in that its effect upon the respiration is stimulating instead of depressing. The combination of the two drugs has apparently a greater narcotic effect than an equivalent dose of either alone. The addition of atropine is also of value, especially before ether, in order to prevent salivation and the production of mucus. Scopolamine also acts in this direction, but only to a slight degree. The usual method of procedure is to give hypodermically $\frac{1}{8}$ grain of morphia and from $\frac{1}{120}$ to $\frac{1}{100}$ grain each of scopolamine and atropine about one to one and a half hour before the operation. By the time the anæsthetic is to be given the patient will be in a drowsy, somewhat lethargic condition, but should not be so deeply narcotized as not to answer when spoken to. Ether is administered in the manner already described, and the patient passes quietly and fairly rapidly into a condition of surgical anæsthesia. Sometimes, owing to the morphia, the breathing may be very shallow from the beginning, and in these cases induction will be less rapid and may not be much shorter than when no drug has been given.

It is not always easy to decide when the patient is "ready." The corneal reflex often disappears at an early stage. The patient may be quite flaccid and irresponsive to slight stimuli, but may be roused by the surgeon's knife. On the other hand, in some cases the operation may be commenced while the conjunctival reflex is still present. The size of the pupil also is of less value as a guide than in ordinary anæsthesia. The pupils are generally moderately dilated before the opera-

tion, and frequently remain unchanged during induction, but as the operation proceeds they tend to contract.

Anæsthesia can be maintained with a very small quantity of ether. Often when the operation has been some time in progress the occasional sprinkling of a few drops on the face-piece is all that is needed. The breathing is often shallow throughout; the pulse-rate tends to fall, but the tension remains good. The excellent colour of the face throughout a long operation and in debilitated patients is often very remarkable. It is probably due to the scopalamine.

After the operation the patient often remains in a condition of more or less stupor for some hours. This is regarded by some as an advantage, by others as the reverse. Sickness is not frequent, but it does occur in some cases, and may be troublesome.

By means of this preliminary narcotizing the use of open ether is certainly facilitated, and cases which otherwise might present considerable difficulty can be easily and quietly anæsthetized.

Mrs. Alice Magan Kessel, formerly anæsthetist to the Mayos at Rochester, who administered open ether there over 20,000 times, states that she prefers to use ether alone without any preliminary drug, but has frequently used either $\frac{1}{6}$ gr. morphia with $\frac{1}{120}$ gr. atropine hypodermically, or, more recently, $\frac{1}{4}$ gr. morphia with 6 gr. quinine by the mouth—the quinine being given as a stimulant.

There is no doubt that open ether is a method of great value, but it is also true that many of its advantages can be obtained by methods that are not entirely "open." Experience in the method, and to some extent the personality of the anæsthetist, are doubtless important factors in successful administrations.

F. M. D. B.

CHLOROFORM

Chloroform is the most portable, most pleasant, least distressing to the patient, most universally applicable, and, at the same time, most lethal of all anæsthetics. It can be given to a patient of any age, and is suitable for every surgical procedure. Chloroform is a perfectly safe drug provided that it is administered in a proper physiological dose by a careful administrator who constantly watches the patient, sees that the respiration is efficiently performed and well maintained, and who never allows an operation to be commenced until the patient is fully under the influence of the anæsthetic. The essentials of safe chloroform anæsthesia are—

(1) The prior administration of atropine hypodermically to prevent cardiac inhibition by blocking the vagus; (2) the use of chloroform vapour in a safe percentage; (3) the provision of a free air-way and unremitting attention that efficient respiration is maintained; and, finally (4) the attentive and intelligent graduation of the depth of anæsthesia to suit the individual patient, the operation in question, and the requirements of the operator.

Chloroform kills by stopping the heart. Respiration may cease first, but its cessation is only a sign of the heart's gradual failure. Failure of respiration is the result of anæmia of the respiratory centre through the fall of blood pressure below the level necessary to maintain the medullary centres in working condition. Death occurring during chloroform anæsthesia, and due to the drug itself, may arise in two ways—

1. Reflex cardiac inhibition.

(a) Chloroform in too high percentage may stimulate the cardio-inhibitory centre in the medulla, and so stop the heart. This is not usual, but undoubtedly does occur, as evidenced by momentary pallor of the face and failure of the pulse.

(b) In the lighter stages of chloroform anæsthesia the excitability of the cardio-inhibitory centre is increased, and it is hyper-excitable to reflex stimulation. Any stimulus, such as the pain of the surgeon's knife, the mere act of vomiting, the application of the faradic current to test nerve continuity, *e.g.* in operations on the brachial plexus and its branches, may induce cardiac inhibition.

Both these forms of reflex cardiac inhibition are fortunately not common, but do undoubtedly occur.

Nothing that the anæsthetist can do after it has occurred is of any real avail, though commonly artificial respiration by direct chest compression tides the patient over until the inhibition passes off. Fortunately it is a physiological law that the heart tends to escape from the inhibition and to beat again.

A diseased heart, *e.g.* a fatty heart or the heart in cases of so-called status lymphaticus, is less likely to escape than a normal heart. Death due to this reflex inhibition is *absolutely preventable* by prior administrations of atropine hypodermically, which should therefore always be done. By so doing we can prevent these dramatic deaths occurring often even before any operative procedures have been commenced. It is more especially during the early period of its administration that chloroform is so apt to cause cardiac syncope. Cardiac syncope so produced is due to the specific action of chloroform on the cardio-inhibitory centre in the medulla, rendering that

centre hyper-excitable to stimuli insufficient to stimulate it at ordinary times and apart from the action of chloroform. Cardiac syncope so produced is dangerous, *because it gives no warning*. The heart stops before the respiration or synchronously with it. The requisite dose of atropine is $\cdot 00002$ mg. per kilo. of body weight. That is, $\frac{1}{2000}$ to $\frac{1}{1500}$ gr. for a child under two years of age; $\frac{1}{1000}$ gr. for a child of two years and upwards; $\frac{1}{750}$ to $\frac{1}{500}$ gr. for an adult. It is best given in divided doses, the first half, one hour before the proposed time of operation, the second half, twenty minutes before the anæsthesia is commenced. The effect of a dose of atropine in blocking the vagus and so preventing cardiac inhibition commences in twenty minutes and persists for three to three and a half hours, ample time for most operations. Even the smallest children have never violently or unduly objected to the prick of the hypodermic needle, provided the administrator is tactful and the needle as fine and as sharp as possible.

2. Direct action upon the heart.

The chloroform-laden blood reaching the cardiac muscle cells gradually weakens their beat (whether this is due to the direct action of the chloroform upon the nerve endings or upon the muscle cells matters little so far as the practical anæsthetist is concerned). The heart dilates, beats less and less powerfully, and the blood pressure gradually falls lower and lower. A time is reached when the blood pressure is so low that the respiratory centre in the medulla becomes anæmic and the respirations gradually fail. Here, then, is the reason for the incessant watching of the patient's respiration by the anæsthetist. The watchful anæsthetist will immediately lessen, or altogether withdraw, the dose of chloroform and take every measure to ensure the respiratory act being restored to its normal efficiency. With artificial respiration efficiently carried out every patient is easily saved, for with a lessened dose of chloroform the cardiac cells recover, the heart beats more and more strongly, and the blood pressure rises again. The respiratory centre, again supplied with blood, commences to act, and normal respiration is restored. *N.B.*—Death arising in this way is *not* preventable by the administration of atropine, but it cannot occur if the anæsthetist conscientiously devotes himself incessantly to watching the respiration and skilfully regulates the dose of chloroform to the requirements of the individual patient.

Chloroform may be administered in a variety of ways—from the simple method of *dropping* the drug on to a piece of lint, handkerchief, towel, etc., to the elaborate and scientifically more accurate apparatus of Du Bois, Vernon

Harcourt and others. These apparatus may be divided into two classes—

1. Those in which air laden with chloroform in scientifically measured percentage is pumped to the patient, and (2) those in which the patient aspirates the air for himself over the surface of chloroform.

Of these the former are to be preferred, but up to the present such apparatus of this type as are on the market are not portable enough. The objections to apparatus of the latter type on the ground of asphyxiation of the patient, etc., are untenable in practice.

It is a commonly accepted, but not strictly accurate, fact that a higher percentage of chloroform than five per cent. is lethal. Exceptionally three per cent. is needed to induce anæsthesia in certain patients; but usually two per cent. is all that is necessary. Anæsthesia once induced is easily maintained with percentages of 0.5 per cent. or lower.

It has been calculated that the percentage of chloroform respired by a patient when the drug is administered by keeping an area the size of the palm of a man's hand of folded lint or towel wet, but not dripping, with chloroform, held at about three inches from the face, is roughly 4.5 per cent. This is, however, unnecessarily high, and the employment of such a mode of administering chloroform by the so-called "douche" method is as dangerous to the patient's life as it is unscientific and foolhardy on the part of the administrator. Consequently every conscientious anæsthetist should, whenever practicable, avail himself of a more scientifically accurate method of measuring his drug. No wise man guesses the dose of a poison that he is about to administer to a patient in a mixture, and there is no poison (except, perhaps, cyanide) so swiftly lethal as chloroform in improper doses; therefore it is a childish objection to refuse to avail oneself of an accurate apparatus, on the plea that it is not the apparatus but the man behind the apparatus that ensures safety to the patient. No man, be he ever so skilful, is the worse for having a good instrument.

Most patients, when conscious, normally breathe through their noses; some, however, breathe through their mouths. In an unconscious person nasal breathing is not always sufficient to secure efficient passage of the air into and out of the lungs. The invariable duty of the anæsthetist is to secure and maintain a free air-way for his patient, and some method of obtaining an air-way through the mouth is commonly necessary. It is often sufficient to push the lower jaw forward until the lower incisor teeth are in front of the upper, and so maintain it by pulling up the jaw. In some patients (*e.g.* edentulous people) this is in-

sufficient—owing to the valvular action of the lips closing the air-way in inspiration—and oral breathing has to be obtained by keeping the lower jaw forward by means of pressure applied behind one or both angles of the inferior maxilla. This may be insufficient, and the employment of a gag, mouth-prop, or specially designed air-way becomes necessary. Lastly, some patients require the mouth to be propped open and the tongue held out—or even the use of the “air-way” as well. Such an air-way is a metal ring with an india-rubber tube lying on top of the tongue and depressing it; but a piece of stout rubber drainage tube projecting between the gums and reaching to the pharynx behind is equally effectual, the mouth being propped open with a gag, prop, or even an ordinary cork. One precaution which should invariably be employed is to have a piece of chain or string attached to every prop, air-way, cork or tube so introduced into the mouth and counterbalanced with another prop, etc., or tied to the patient's ear or to the anæsthetist's hand.

Whilst on the subject of holding out the tongue, the use of tongue forceps of the ordinary pattern is to be strongly deprecated as inhuman. The use of “tongue clips,” a stitch through the tongue, or holding the tongue with a piece of lint or corner of a towel held in the anæsthetist's fingers are methods far pleasanter to the patient, which ensure no subsequent recriminations, as the small wound caused by the clip or stitch is practically never noticed by the patient on recovering consciousness, whilst the pain of a tongue crushed and bruised by the ordinary tongue forceps is of long duration.

One more adjunct to really safe chloroform anæsthesia, and we can pass to the actual methods of administration. Pure chloroform when administered to a patient causes a fall of blood pressure. The patient does not become anæsthetic until the blood pressure has fallen to a certain level, which varies with each patient. Chloroform pushed further than necessary causes a still lower fall of blood pressure. Chloroform pushed to its final physiological effect causes the blood pressure to fall to zero. Various drugs have from time to time been added to chloroform with a view to preventing this marked fall of blood pressure. Of all such additions possibly absolute alcohol is the best. It certainly has the advantage of rendering the smell of chloroform more pleasant to certain hypersensitive patients. The maximum advantage is obtained with ten per cent. of added alcohol. More than ten per cent. only dilutes the chloroform without any commensurate advantage. The mixture is easily prepared. Take one drachm of absolute alcohol and add it to nine drachms of pure chloroform.

The use of this mixture—especially with very young or fragile patients or in long and severe operations—is very beneficial. It prevents (even in unnecessarily high percentages) that marked fall of blood pressure which is dangerous and maintains the depth and frequency of respiration.

When called upon to give an anæsthetic be confident in your manner, avoid all abruptness of speech or movement, gain the patient's confidence. Talk to your patient tactfully and encourage him. Do not let others talk or discuss operations. Everything should be quiet and conducive to tranquillity. Remember that the sense of hearing is very acute in a patient going under an anæsthetic, and just as they are recovering abnormally so. All that is said is often wrongly interpreted and alarms or excites the patient. Whatever anæsthetic you employ, and in whatever mode you administer it, see to it that respiration is full and free. The patient must breathe in, or he will never go under; and he must equally breathe out, or he will be overdosed by an accumulation of anæsthetic vapour in his lungs. Never use any closely-fitting face-piece, or even any apparatus, if the patient is dyspnoic or frightened. Start with lint and drop-bottle, change to what you will later. Whatever method or apparatus is adopted the rule of administration remains the same. Commence with the smallest dose that it is in the power of yourself or the apparatus to measure out. Gradually and continuously increase the strength of the respired vapour until the patient is under. Immediately the operation is fairly started gradually and continuously decrease the percentage until the smallest dose of the drug compatible with the maintenance of a sufficient depth of anæsthesia is being given. An anæsthetist should know the steps of every operation and should be prepared to increase the dose a little before any stage requiring a deeper anæsthesia is reached. No patient needs to be kept at the same deep level throughout a long operation, and that anæsthetist obtains the best results who gives his patient a sufficient yet minimal dose. Starting, then, with the smallest possible dose, we gradually and continuously increase its strength, watching the respiration partly with our eyes, but mainly with our ears. Train yourself to *listen* to the patient's respiration, and so have your eyes free to watch the patient's eyes and note the colour of his ears and face. Every alteration in the audibility and character of the patient's respiration conveys a message of information and warning to the attentive anæsthetist. Neglect this information and your patient will be too lightly or too deeply under or, worse still, dead. At first respiration is voluntary and not infrequently much too light. Talk to the patient

and encourage him to breathe deeply. "The more deeply you breathe the less strongly it will smell, the more quickly you will go to sleep." Presently the respiration will change and will become automatic—machine-like—in its regularity. Inspiration will be accompanied by a snore. This snore may be due to the falling back of the tongue, leading to the slackening of the aryteno-epiglottidean folds, and so to their flapping together. As they flap together they obstruct respiration. Inspiration being mainly a muscular effort on the part of the patient, chloroform-laden air is sucked into the lungs. Expiration being mainly an elastic recoil, is less efficient in pumping out the chloroform-laden air, and consequently this obstruction leads to an accumulation of chloroform vapour in the lungs. This gradually leads to the over-dosing of the patient. The moment you hear this snore see to the freedom of the air-way. Pull forward the jaw, get the lower incisors to lock in front of the upper, hold up the jaw. The advancement of the lower jaw pulls the tongue forward, and by tightening the aryteno-epiglottidean folds prevents this obstruction to respiration. Go on with the chloroform administration and the anæsthesia deepens. A soft snore makes its appearance and the patient is ready for operation. Push the chloroform further and the snore becomes noisy, owing to paresis of the palate muscles. The patient is now too deeply under, and the dose should be lessened until the soft snore reappears. If you give too little chloroform the soft snore disappears, expiration which should be almost inaudible becomes prolonged in audibility, marked, or even accompanied by grunting, groaning or actual phonation. The patient is coming out and you must give a larger dose of chloroform. When you increase or diminish the dose of chloroform remember that it is not the dose you are actually giving at the time that is acting on the patient—but the dose that you gave some little time before, the dose that has been absorbed by the blood from the alveolar air, carried to the heart, and pumped to the central nervous system. Therefore increase or decrease your amount for four or six inspirations only, return to your medium dose, and watch the effect of the increased or decreased dose. If the stage of anæsthesia is not sufficient, increase or decrease your dose for another half-dozen inspirations, and, again returning to the medium dose, watch the result. The respirations and the eyes will tell you if the anæsthesia is right.

Mechanical breathing with a just audible snore not obliterated by keeping the tongue forward, motionless eyeballs with no squint, and a moderately dilated pupil readily reacting to light mean a perfect and safe stage of anæsthesia.

Chloroform in a proper percentage acts upon the nervous system in a definite physiological march. It acts first upon the highest centres of memory, thought, judgment, etc., and the patient may struggle in a purposive way. The central convolutions of the Rolandic area are next affected and the struggles are no longer purposive. Automatic and reflex movements alone persist, and the patient passes through a stage of rigidity. As the anæsthesia deepens flaccidity replaces the rigid stage. First the limbs become flaccid, then the muscles of the neck, then those of the lower jaw (fifth motor nerve), lastly those of the face (seventh facial nerve), and the patient is ready for operation. The next centres to go under are those of the oculo-motor nerves. The sixth, fourth and third go under one after the other, starting with the sixth. Watch the eyes from the start and the depth of anæsthesia can be gauged. At first the pupils dilate and the eyeballs move purposively; later the eyes swing about but no longer consciously watch the anæsthetist. The pupils contract to pin-points and the patient is asleep but not anæsthetic. Next the eyes squint in various directions. Usually they squint first outwards, then downwards, then down and in. Finally the eyeballs come to rest, looking straight forwards with a moderately dilated pupil. That is, with a pupil which is a little larger than the pin-point pupil, indicative of sleep and insufficient anæsthesia. Prior to this, if we pull up the patient's upper eyelid he will close his eye forcibly; a little later, when he is more deeply under, this forcible, almost conscious closure is replaced by an attempt to close the eye by moving up the lower lid only. These two methods of closing the eye constitute the "lid reflex." The anæsthesia must be deepened until this reflex is abolished. The conjunctival and corneal reflexes are next abolished, but the usual method of eliciting them by touching the conjunctiva or cornea with the finger is distinctly to be deprecated. A good anæsthetist does not need to determine their persistence or abolition, as the character of the respiration and the motionless non-squinting eyeballs tell him all that is necessary. With more anæsthetic the pupils dilate. So long as they readily react to light the dose may be persisted in. So, watching the eyes, we increase the dose with any return of squint or marked movement of the eyeballs, and decrease the dose with any decided dilatation of the pupils. Remember, however, that dilatation of the pupil is indicative not only of a deepening anæsthesia, but also of a lessened anæsthesia. A dilated pupil may mean that the patient is coming out. In that case expiration will be more marked or grunting, or the respirations will be shallower or even held a little, or the patient may make swallowing

movements. There will be some squint or movement of the eyeballs, and the pupils will be noticed to be not truly circular, but oval or elliptical. The pupils also dilate reflexly to painful stimuli, when the patient is asphyxiated, shocked, or about to vomit. Asphyxia will be recognized by cyanosis; shock by pallor and clammy sweating; vomiting will be presaged by holding the breath, swallowing movements, straining, or heaving movements of the diaphragm. The safe rule is to cut down your dose whenever you are in doubt, see that the air-way is clear, and watch the pupils; at the same time taking care that the patient gets all the diminished dose that you are allowing him. With a diminished dose the patient will give more marked signs of coming out (*e. g.* contractions of the facial muscles, especially of the upper face, or slight movements of the thumb and fingers). Should he, however, have been going under too deeply, the pupils will contract and the respirations become fuller and deeper again.

When certain whether the patient is coming out or not we can once more resume our higher dose if necessary, but it is naturally better, when in doubt, to consider the case as one of overdosing. It is better to let several patients even vomit than allow one to get into danger. Should a patient be unfortunately overdosed proceed as follows—

Withdraw the anæsthetic, open the mouth, pull out the tongue forcibly. Pass a finger to the back of the throat and ascertain that there is no solid vomit or foreign body there. Next vigorously compress the chest to drive out air, anæsthetic, possible vomit, etc. Having performed the expiratory act first, continue with inspiration. Now lower the patient's head and chest. Get a bystander to inject strychnine ($\frac{1}{30}$ gr.) or adrenalin, pituitary extract, etc., and apply dilute ammonia on a feather to the nostrils. All the time keep up the artificial respiration without any hurry. Be careful in compressing the chest to avoid pressing roughly on the lower ribs. The liver is so turgid with venous blood that it is easily ruptured. The best and most efficient method of artificial respiration is that advocated by Professor Schäfer, and should always be adopted except when an abdominal or other wound might be soiled by turning the patient over.

The colour of the face, especially the ears, is the third and least important thing to be watched. Any blueness of the auricle demands attention to the air-way and a temporarily lessened dose. Pallor may presage vomiting or be indicative of shock. The warning given by noting the pulse is less valuable than the incessant watching of respiration. Watch, therefore, the respirations first, the eyeballs and pupils second, the

colour of the ears and the state of the pulse last of all.

Method of administering chloroform—

1. Lint and drop-bottle.

(a) Take a towel, draw a corner through a safety pin so that it projects through it for about six inches, fold back the edge for about an inch to give it greater strength.

(b) Take a piece of lint (or better domette) measuring seven by twelve inches, double it so that it measures seven by six, pinch it up into a cone and fasten it with a safety pin.

(c) Stretch a piece of lint or domette (using it double in hot countries) on a Skinner's or Schimmelbusch's frame.

(d) Hold your hand over the patient's face with outspread fingers and on it support a piece of lint, domette, handkerchief or portion of towel, etc.

Take care that the mask or material used does not actually touch the patient's face, but that a space of about half an inch intervenes. This ensures a free admixture of air, escape of chloroform expired by the patient, and prevents blistering of the patient's face by chloroform touching it. Hold the drop-bottle close to the lint to prevent any chloroform splashing through the material or falling on the patient's face should he move it from under the mask. The fourth method is very good, as it ensures the anæsthetist feeling the patient's respiration on his hand.

Whichever of these methods is adopted, the essential points to remember are that the chloroform is to be administered in small, frequently repeated doses and that the patient's respiration is to be continuously watched and maintained. Therefore proceed as follows:—Hold the mask just off the patient's face and let him have one or two breaths without any anæsthetic. Finding there is no nasty smell or suffocation, he breathes more confidently. Now drop as little chloroform on to the mask as possible, say one or two drops. Then try to drop one drop every inspiration, or, failing that, two to five drops every second or third inspiration. The dose added each time depends upon the individual patient, "mouth-breathers" needing a smaller dose than "nose-breathers"; anæmic, weak or broken-down patients needing much less than strong, often alcoholic, men suddenly struck down by accident or illness in the full tide of a vigorous life of hearty eating and drinking. The object of giving the anæsthetic in small doses at frequent intervals is that at no time shall the patient have a sudden increase of chloroform vapour presented to him, such as might lead to a reflex holding of the breath, nor that the percentage of chloroform should be higher than consistent with safety. On the other hand we must avoid giving it at too great intervals, lest the patient does not get enough

to go under. A delayed induction results in holding the breath, swallowing and vomiting, and is a great cause of subsequent post-anæsthetic sickness and misery. Steering between over- and under-dosing the patient, we go on until the occurrence of completely flaccid limbs, neck and jaw, together with regular, automatic, slightly snoring breathing and motionless eyeballs, with a moderately dilated pupil readily contracting to light, indicates perfect surgical anæsthesia. From now onwards we add, drop by drop, just enough anæsthetic to keep the patient under, roughly keeping the percentage of anæsthetic vapour the same by keeping the patch of lint moistened by the chloroform the same size: allowing the moistened area to become a little smaller if the patient is more deeply under than necessary, causing it to be a little larger should the patient show any signs of a lessening anæsthesia or should the surgeon be shortly about to manipulate some more than usually sensitive part—*e. g.* traction on the mesenteric nerves or the gall bladder.

2. *Junker's Inhaler.* Air (or air and oxygen) is blown through liquid chloroform in the bottle by means of bellows. Three precautions must be taken—

(a) There must be not more than eight drachms of chloroform in the bottle, or splashes of liquid chloroform may reach the patient.

(b) The bellows must be attached to the tube passing below the surface of the chloroform, or liquid chloroform will be pumped into the patient's mouth, with possibly a lethal result.

(c) The tubes must not be allowed to be kinked, pressed on or obstructed in any way; *e. g.* when using the mouth tube see that the end is free and not occluded by the tongue, cheeks, etc. Obstruction of the exit tube leads to an increased pressure in the bottle, which finally drives the chloroform back through the inlet tube into the bellows. This results in the india-rubber valve of the bellows sticking, and, the pump being *hors de combat*, prevents air being bubbled through the chloroform.

The value of this apparatus is that the dose of chloroform administered is more delicately measurable than by means of a drop-bottle. It is consequently more economical of chloroform; and what is more important, the bystanders do not get so much chloroform to inhale as they occasionally do with the "lint and drop-bottle" method.

An easy way of remembering the dosage is that one cubic centimetre of air bubbled through chloroform at 60° F. (the average temperature of a room) brings off one-sixtieth of a minim of chloroform in vapour, and therefore 60 c.c. (the average capacity of the bulb) brings off sixty sixtieths, that is, one minim. Now one minim of chloroform in vapour inspired

along with the normal tidal air of an average adult (about twenty-five cubic inches) is less than one per cent. chloroform vapour, and is consequently well within the margin of safety. How, then, does it happen that toxic doses are administered even when this apparently safe method is being employed? Usually because the administrator has failed to observe that some asphyxial factor has intervened. In some way expiration is not being efficiently performed and an overdose has been allowed to accumulate in the lungs, or there is too high a percentage of vapour in the face-piece, which is being fitted too closely.

The method of using the Junker is to commence with very small puffs, gradually increase them in size, and *always time the puff so that the chloroform vapour is presented to the patient at the very commencement of inspiration.* Watch the respiration unremittingly and give a short sharp squeeze of the bellows in the pause between inspiration and expiration; or, failing that, at the very earliest movement indicative of inspiration. Thus only can anæsthesia be easily induced and safely maintained. The squeeze must be sharply made at the commencement of inspiration, the pressure of the squeeze must be maintained throughout inspiration, and the ball be allowed to refill again by a sudden relaxation of the squeeze at the commencement of expiration. Obviously, if we squeeze during expiration the chloroform vapour is only blown into the air; if we squeeze at any other time than the very commencement of inspiration the vapour gets less time to diffuse into the alveolar air; if there is any partial blocking of the delivery tube the patient gets less chloroform than we intend to administer and the anæsthesia is insufficient. Equally obviously we can increase the percentage by keeping up a vigorous bubbling and may so have too deep an anæsthesia.

Commencing with the smallest puffs, we gradually increase them in size until the patient is under. Then we reduce the size of the puffs gradually until we are giving the smallest puff which will keep the patient at that stage of anæsthesia that the requirements of the surgeon or operation demand, increasing the size of puff to deepen, lessening the puff to lighten the anæsthesia. This apparatus is especially useful in confinement cases, the bottle being hung up at the head of the bed and the woman being given the ball to squeeze for herself. She cannot overdose herself if she gives one squeeze at each inspiration, nor can she be overdosed when under, because she can squeeze the ball no longer.

After-Treatment. The operation being over the patient should be transferred to bed with as little jolting as possible, be laid on the right side

—unless the operator has valid objections to that position—with the edge of the pillow just under the right cheek and the other end of the pillow doubled over under the left shoulder. The patient should not be roused or worried, but should be allowed to sleep off the anæsthetic. The risk of after-sickness is thus minimized. Should it occur the patient may be given a cup of tea—not too milky—or a pint of tepid water with a teaspoonful of sal volatile and a pinch of bicarbonate of soda. Should this be ineffective give a rectal enema of bromide of potassium (40 gr.), chloretone (10 gr.), in two ounces of black coffee. Persistent vomiting (the next day or so) is best treated by giving the patient solid food (*e. g.* the breast of chicken). Vomiting is less frequent in patients who have not been over-starved and over-purged and who have been allowed to eat two to four lumps of sugar two hours before operation.

Occasionally—fortunately very rarely—a severe form of post-operative vomiting, associated with pyrexia, jaundice, delirium, convulsions and coma, occurs, which is very liable to prove fatal. As this has occurred in patients who have never had chloroform it can hardly be called delayed chloroform poisoning. It is best treated by rectal injections of glucose in saline solution, as suggested by Mr. George Waugh.

Special Cases. Cerebro-spinal cases need very light anæsthesia after the skin incision.

Eye operations require a fairly deep anæsthesia. Operations on the jaw, tongue, nasopharynx, cleft palate, etc., should be allowed to retain their swallowing and coughing reflexes, but must be deep enough not to strain or vomit. In enucleation of tonsils, however, the swallowing reflex must be abolished, and in laryngeal cases the coughing reflex should be in abeyance. In operations on the nose, mouth breathing should be secured.

Exophthalmic and other goitres should be fully under for the skin incision and afterwards kept quite lightly under.

In operations for empyema the anæsthesia should be quite light and the coughing reflex brisk.

In circumcision the anæsthesia requires to be full, but the anæsthetist should resist the temptation of pushing the anæsthetic during the persistence of “crowing breathing.”

Status lymphaticus especially calls for the prior administration of atropine and a sufficiently deep anæsthesia.

Many operations demand the patient's posture being one with the head and shoulders well raised. There is no objection to chloroform being given to a patient sitting up, provided the anæsthesia is started in that position, or if given lying down the change in posture should be effected gently and gradually. In the Trende-

lenburg position the diaphragm is often acting under difficulty or not at all, so the anæsthetist should pay even greater attention, if possible, to maintaining a free air-way, the tongue being held out and the mouth propped open if necessary. Not infrequently in this position, the cardiac orifice of the stomach being relaxed, the contents of the stomach and upper intestine flow down into the naso-pharynx. The patient's head should be kept turned on one side, and if all the fluid does not run out in this position the anæsthetist should sponge out the pharynx.

In intestinal obstruction with marked vomiting prior to operation the anæsthetist should wash out the stomach either before or immediately after anæsthesia is commenced.

H. J. S.

CHLORIDE OF ETHYL

Since the introduction of ethyl chloride into common use as a general anæsthetic, some eighteen years ago, much has been written for and against it.

Many of the accidents attributed to the effects of the vapour of this particular substance were undoubtedly due to carelessness in its administration, treatment in inexperienced hands, or to its employment in utterly unsuitable cases. Experience, however, has proved that chloride of ethyl has been of great service to the surgeon and general practitioner in minor operations, owing to the rapidity of its action and the simplicity of the apparatus required for its administration.

Chloride of ethyl may be given in almost any form of closed inhaler, or on an open mask, although the writer does not advise the use of the latter save in the course of a sequence with another anæsthetic.

It would be invidious to mention any special form of inhaler, but it may be suggested that it is preferable to spray the vapour on to a piece of gauze, flannel or cotton-wool, placed between the face-piece and the bag, rather than to pour the liquid directly into a bag; as a more equable evaporation is produced by the former method.

The administrator should be guided by the results of his induction rather than tie himself down to give a measured dose. About 5 c.c. is the average amount to be introduced into the inhaler, this being enough to cover the majority of cases. When the requisite degree of anæsthesia has been produced, the remainder of the vapour is obviously not wanted, and, if used, will produce the troublesome symptoms of an overdose.

It is often advisable to stop the administration an instant before the patient is ready, relying upon the anæsthetic vapour still present in the lungs, which, when absorbed, will complete the

desired result. Otherwise, again there is the danger of an overdose.

Care should be taken also in the selection and preparation of cases. Chloride of ethyl anæsthesia is perhaps best known and appreciated in operations for the removal of adenoids and enlarged tonsils, as well as in dental extractions. In the former a very fine record has been established; only one fatal result having occurred in over twenty-five thousand cases recorded at one institution. Any minor operation lasting from one to two minutes may be comfortably performed under this form of general anæsthesia.

Children and young adults appear to be the best subjects, but it is not advisable to use this anæsthetic for patients under the age of one year. Brawny or alcoholic men do not take it readily.

In elderly people, too, its use is contra-indicated when nitrous oxide gas with oxygen or ether will meet the situation: there may, however, be exceptional cases, where complete muscular relaxation is not required, and the patient is known not to take "gas" well, when chloride of ethyl anæsthesia will prove very satisfactory, provided the dose is carefully regulated.

This brings us to the next and most important point. The preparation should be as careful and complete as for chloroform administration. This fact has unfortunately been often overlooked, and accidents have undoubtedly arisen in consequence. Before the administration is commenced, the patient's mouth should be kept open with some kind of prop. This is always needful in operations for the removal of tonsils and adenoids, and often in other cases as well; though it is not *always* necessary or convenient. A little air should be introduced into the bag, and the inhalation started on an inspiration in the ordinary way. It is not advisable to press the face-piece on tightly for the first breath, but better results are obtained by the exclusion of air from this time onwards. Occasionally, however, a breath of air may prove very beneficial towards the end of the period of induction, should cyanosis supervene; but this ought to be the exception rather than the rule.

In young children, especially when crying, often only two or three inspirations are required to produce sound anæsthesia; in older patients frequently only five or six; so extremely rapid is the action of this anæsthetic agent.

To the practitioner, who, perhaps, has only had a slight experience of this drug, whilst quite accustomed to the action of chloroform, this fact is of the greatest importance. It is difficult to convince him that a proper degree of anæsthesia can be obtained so very quickly.

The signs of anæsthesia are not always well

marked. The conjunctiva becomes insensitive, but not the cornea, whilst the pupils are dilated, and slight snoring supervenes; the latter need not, however, always be waited for. It may be repeated emphatically, that it is better to stop the inhalation *too soon rather than too late*. Flaccidity of the muscles is a sure test of deep anæsthesia, but this depth is not required in short operations.

Since every second is of value to the operator, time-saving methods should be adopted, especially when the air-passages are the seat of operation.

As there is no cyanosis produced in a proper state of anæsthesia with chloride of ethyl, this condition should be considered indicative of danger, and prompt measures taken to discover the cause and relieve it.

It is dangerous, for instance, to give a second dose when there is blood in the air way. In certain favourable cases, when the extremities are to be dealt with, and a little more time is required, a second and even a third dose may be given; but this is not to be considered a good routine practice.

Chloride of ethyl may sometimes be given as a preliminary to ether, chloroform, or a mixture of chloroform and ether. It is also adopted by some anæsthetists as an intermediary to these; but in general practice, neither system is to be recommended, as the transition from one drug to another is often difficult, and possibly dangerous, unless in the hands of one specially trained and practised in the art.

The principal risk in the administration of ethyl chloride is that of an overdose producing fatal syncope. Intercurrent asphyxia, arising in the course of an operation, from blocking of the air-way, may occur with this as with any general anæsthetic.

It is not within the scope of this article to describe the modes in which these dangers are to be met. Promptness is the great essential, and the administrator should be ready to act at once.

W. H. G.

MIXTURES AND SEQUENCES

A. C. E.

The alcohol-chloroform-ether mixture consists of—

Alcohol	1 part
Chloroform	2 parts
Ether	3 parts

It should always be freshly prepared and the constituents must be absolutely pure.

Administration. The mixture is usually administered by means of a Rendle's or similar mask. The sponge contained in the mask is first wrung out in warm water and then

soaked in one or two drachms of the mixture. The mask is gradually applied to the patient's face, so that for the first few breaths air is allowed to enter beneath the cushion of the face-piece. After a few moments the mask is accurately adapted to the face, so that the air inhaled and exhaled by the patient passes entirely through the sponge containing the mixture. Should the mask be closely applied at the outset coughing and straining would occur, owing to the sudden administration of strong A. C. E. vapour. The respirations increase both in depth and frequency as the induction proceeds, until they become regular, deep, automatic and slightly noisy. The pulse increases a little from the normal, both in force and frequency. The pupil contracts, but does not become as small as when chloroform alone is used. In other words, the anæsthesia obtained with A. C. E. mixture resembles that of ether, rather than that of chloroform. In ordinary cases the patient will present the usual signs of complete anæsthesia after about ten or twelve minutes—it is not a good practice to shorten the induction period further than this.

At regular intervals of a few minutes the sponge must be removed from the mask, moistened with the mixture and replaced. The A. C. E. mixture should be kept close at hand in a small bottle, preferably graduated and securely corked, from which it can be conveniently poured on to the sponge when required.

This mixture was recommended to the profession as being safer than chloroform by a commission appointed some years ago to inquire into the question of the risks attendant upon the use of the various anæsthetics.

The methods of administration employed, none of which differ essentially from that described above, are not very scientific. No attempt is made to increase and decrease the dosage with the same accuracy as with chloroform: probably even better results would be obtained if this were done. In practice, however, A. C. E. cannot be conveniently given by means of lint and drop-bottle, since the former speedily becomes saturated with the liquid. Moreover, the risks of overdosage are extremely small if ordinary care be exercised, so that the comparatively crude method of administration, which is even still employed by some for chloroform, proves safe and satisfactory for A. C. E. mixture, though dangerous for the more potent drug.

It has been urged by some authorities, as a point against A. C. E. mixture, that the evaporation rates of its three constituents are different, so that at one time more ether, at another more chloroform, is inhaled.

Although a perfectly reasonable argument

this does not seem to affect the safety or utility of the anæsthetic in actual practice.

It is doubtful if the alcohol in the mixture is of any real service; indeed many anæsthetists, among them the author, prefer to use chloroform and ether rather than A. C. E.

Chloroform and Ether

C. E. mixture consists of—

Chloroform . . .	2 parts
Ether	3 parts

It should be freshly prepared just before use.

The administration is similar to that of A. C. E.; it may be given from a Rendle's mask, or better still from the inhaler introduced by Dr. Hewitt.

For children or feeble patients who require but a very small dose of the mixture the lint and drop-bottle method may be employed; in most cases, however, this is not satisfactory, since the lint soon becomes sodden.

The anæsthesia of C. E. mixture is not so quiet as that of chloroform; the breathing is deeper and more audible, the pulse fuller, the pupils less contracted. In fact the phenomena are, as we should expect, a combination of those produced by each drug acting alone.

Both A. C. E. and C. E. mixtures are particularly suited to children and to aged or feeble patients. They are not so suitable for strong and robust individuals, and for alcoholic patients they are almost useless. The very fact of their comparative inefficacy to induce anæsthesia in the robust man is one of the strongest arguments in favour of their use for children and feeble subjects. For it is clear that an actual overdose must be a very uncommon event. It is not at all certain that A. C. E. possesses any advantages over C. E., and some observers are inclined to think that the former is more apt to produce a troublesome excitable stage and unpleasant after-effects. The latter is readily prepared by the anæsthetist when required, and is easy to administer. It is undoubtedly safer than chloroform, and the practitioner will therefore be well advised to give it the preference whenever it is possible to do so.

It should be remembered that excitement and struggling during induction are more likely to occur than when chloroform is used, especially if a concentrated vapour be suddenly presented to the patient. It is better to administer small doses, frequently and regularly repeated, than to give large doses at long intervals.

Sequences

Gas and Ether.—The induction of anæsthesia by means of gas and ether stands out pre-eminently before all others for the following reasons—

1. It is the *safest* method of inducing anæsthesia for major operations that we at present possess.

2. Unconsciousness is rapidly produced, and if the anæsthetic is properly given, there should be few, if any, unpleasant sensations during its administration.

For these two reasons alone, gas and ether ought to be the routine method of inducing anæsthesia for the majority of surgical procedures.

Whilst gas and ether is undoubtedly the best method for *inducing* anæsthesia, it is not the best for *maintaining* it. In practice the routine that I follow is to *induce* anæsthesia by means of gas and ether, to continue the ether for about fifteen or twenty minutes, and then make use of chloroform, or some mixture containing chloroform, until the end of the operation.

Occasionally, instead of changing to chloroform or one of its mixtures, open ether is given, but it is safer and pleasanter for the patient to induce anæsthesia with gas and ether.

Indications. Gas and ether should always be used to *induce* anæsthesia except in such cases as the following—

Contra-indications. (1) Bronchitis, emphysema, etc.; (2) phthisis; (3) empyema thoracis; (4) dyspnoea, angina Ludovici, etc.; (5) albuminuria and diabetes; (6) intracranial operations; (7) ophthalmic operations.

It is not suitable for *maintaining* anæsthesia during—

1. Abdominal operations and examinations, since muscular relaxation is not so complete as with chloroform, and the increased respiratory movements inconvenience the surgeon. This, however, does not apply to open ether, for if a change is made from gas and ether to ether administered by the *open method*, a perfect relaxation of the muscles can be obtained.

2. Operations on the jaws, tongue, mouth, etc.

3. Operations in which congestion and bleeding will interfere with the performance of the operation.

Gas-Ether-Chloroform.—The gas-ether-chloroform sequence is one of the most useful methods of inducing and maintaining anæsthesia. We will now discuss the advantages to be gained by changing ether for chloroform, and the proper time at which this should be done.

Reasons for changing the Anæsthetic

1. A long etherization makes the patient liable to after-sickness, bronchitis, etc., and the discomfort of smelling ether for many hours. After a short administration of ether, these after-effects are often absent, rarely marked.

2. Chloroform anæsthesia is quieter, and is on that account more convenient for the surgeon.

3. The danger of *inducing* anæsthesia with chloroform is avoided, the advantage of *maintaining* it with chloroform is preserved.

4. A more complete muscular relaxation is obtained than with ether by the closed method.

5. Excessive secretion of saliva and mucus may make the change imperative.

The nature of the operation will to a large extent determine the time at which the change is made. When dealing with intra-oral and similar operations the change will of course be made as soon as anæsthesia is complete.

As a general rule ether should be replaced by chloroform after fifteen to twenty minutes. When the change of anæsthetic is made the character of the respirations then in evidence materially influences the dosage of chloroform. As a rule the patient will be breathing deeply and regularly, and a strong vapour of chloroform must not be given for fear of overdose. At first, therefore, the chloroform should be given in small quantity—about three drops—but if necessary this may be gradually increased according to the patient's condition. After chloroform has been inhaled for about five minutes the transition from ether to chloroform anæsthesia will be complete. Should there be much salivation, etc., at the time that the change is made, the mouth and throat should be swabbed out: and if the quantity of mucus in the air-passages is excessive it may be advisable to relax the depth of anæsthesia sufficiently to allow the patient to cough and so clear the trachea and larynx. In any case where much mucus and saliva are present the administration of chloroform must be conducted slowly and with caution, for the dose which is correct under normal conditions becomes a "relative overdose" when obstruction to respiration exists, and may lead to serious trouble.

Either A. C. E., C. E., or open ether may be used to take the place of chloroform in sequence to nitrous oxide and ether.

Enough has been said to indicate that the gas-ether-chloroform sequence will be found invaluable in practice. The safest possible induction is performed, the most equable and easy anæsthesia maintained. The after-effects are usually insignificant when the patient has not been kept under the influence of ether for a long period: the return to consciousness is quiet and uneventful.

Ethyl Chloride-Ether-Chloroform Sequence.—This sequence is the natural outcome of the substitution of ethyl chloride for nitrous oxide as a precursor to ether. The reasons which make a change to chloroform desirable are, however, more urgent in this sequence, for a profuse secretion of saliva and mucus is the rule with ethyl chloride and ether.

On this account the change to chloroform

is made at an early stage, the ethyl chloride and ether being used for little more than the induction of anæsthesia.

It is worthy of note that the comparatively large pupil associated with ethyl chloride and ether does not become fully contracted until chloroform has been administered for several minutes. In the gas-ether-chloroform sequence this phenomenon is not nearly so marked, for not only is the pupil smaller when the change is made, but also it more quickly attains the characteristic dimensions of chloroform anæsthesia.

H. E. G. B.

CHOICE OF ANÆSTHETICS

In the choice of any anæsthetic several points are to be considered. Firstly, the safety of the subject both during the administration and during the recovery; secondly, the requirements of the operator; and thirdly, the nature of the operation to be undertaken. Before considering these points it would be useful to enumerate the chief anæsthetic agents in common use in their order of general safety; this order would be: Nitrous Oxide Gas, Ether, Mixtures, Ethyl Chloride, and Chloroform.

Anæsthetic drugs should always be obtained from a firm of repute and should be of the best quality, otherwise undesirable complications may occur either during or after the administration. With the object of selecting the most suitable anæsthetic for each subject, an examination of the patient should always be made, if possible the day before the operation.

The colour of the skin, lips and ears should be noticed, also the length of the neck, any abnormalities of the eyes, such as fixed pupils, or even an artificial eye.

Whilst in conversation with the patient note if he or she is alert or the reverse. And especially find out the habits with regard to alcohol, drugs and tobacco.

The pulse must then be examined, but too much attention should not be paid to its rapidity, as excitement increases the pulse rate; more important is the condition of the wall of the artery. Next inspect the movements of the chest and note its shape, for a fixed and rigid chest makes anæsthesia more difficult; the presence of bronchitis or of phthisis is a contra-indication to the use of ether. When a valvular lesion is present, moist sounds at the base of the lungs are of more significance than the existence of the valvular lesion itself, because they indicate incomplete compensation, which makes anæsthesia more difficult and dangerous.

In stout subjects, when the cardiac sounds are feeble and distant, the heart is probably fatty; such subjects are very liable to syncopal

attacks, and therefore require very great care both during anæsthesia and subsequent recovery. Cardiac displacement may indicate some intrathoracic condition causing a hindrance to free respiration. Any tumour, such as goitre or enlarged glands in the neck, when it presses on the trachea sufficiently to impede respiration, or anything which causes even slight cyanosis, is a source of risk to the patient.

The mouth and throat should be examined for enlarged tonsils, adenoid growths and loose teeth; when dentures and obturators are present they must be removed before any anæsthetic is given.

In every case where it is possible the urine should be tested for albumin, sugar, and acetone. In cases where acetone is found and the operation is an emergency, it is customary to administer ether in preference to chloroform, for when chloroform is given delayed chloroform poisoning may result.

Having thus briefly indicated the lines upon which the examination should be conducted, each drug will be considered separately, indicating the class of operation and patient for which each drug is most suitable.

Nitrous Oxide Gas, the safest of all anæsthetics, is very largely used for dental extractions. It may be given at all ages except to the very young and the very old; the range of age has been much extended by the addition of oxygen. Nitrous oxide gas increases the blood pressure, especially in the brain. It would therefore be inadvisable to administer it alone to those people who are the subjects of marked arterial sclerosis; the addition of oxygen, by eliminating the asphyxial factor, increases its safety.

When the patient is anæmic, weakly, cyanosed, very young or old, or has any disease likely to cause obstructed breathing, *e.g.* goitre, the administration of this gas should be with the addition of either oxygen or air. Nitrous oxide is frequently used as a preliminary to the administration of ether in order to shorten the induction of ether narcosis, and also to make the administration more pleasant to the patient. For moderately long operations which do not require muscular relaxation, or where involuntary movements are of no consequence, nitrous oxide gas may be used, but the longer the administration the more nearly do the after-effects approach to those of other anæsthetics; little is therefore gained by its prolonged administration.

Ether should in the author's opinion be the routine anæsthetic, especially in cases of emergency, except in certain conditions where, from other considerations to be presently enumerated, it is contra-indicated.

Roughly the age limits of ether administration

range between ten and fifty years, but a variety of considerations may cause exceptions in individual cases.

When the patient is a well-developed muscular man, who has had no previous preparation on account of the urgency of the operation, the gas-ether sequence will be both safe and satisfactory, but if such a patient is of poor physique, or is weakened by loss of blood and shock, very little anæsthetic will be required, and the open ether method will be found as a rule satisfactory. Stout subjects with short thick necks do not take ether by the closed method well, nor do men who are much addicted to tobacco, on account of the irritating action of ether on the mucous membrane of the throat, and consequent coughing and secretion of mucus, resulting in congestion or even cyanosis.

The gas-ether sequence may be used in patients who are the subjects of valvular heart disease, provided that the heart is fully compensated and that there is no limitation of the oxygen supply during the anæsthesia. In cases of laryngitis, bronchitis, phthisis, enlarged thyroid glands of neck, marked atheroma, and thoracic aneurysm, ether should not be used on account of its stimulating effect.

Ether, being highly inflammable, is contra-indicated when the actual cautery is to be used near the head and neck.

Of the various mixtures that commonly known as *A. C. E.* is the most frequently used and will be taken as a type of the rest, remembering that the drug present in largest proportion is the drug which the narcotic action of the mixture will most resemble.

For the removal of tonsils and adenoids in children, where some time is required by the operator, *A. C. E.* is very satisfactory for routine use. It may be administered with safety to subjects of emphysema and empyema; in the latter case the anæsthesia will need to be of a light character; it can also be used in chronic bronchitis. In those cases of chronic pharyngitis where ether would cause much coughing and hyper-secretion of mucus *A. C. E.* may be used.

When the patient is found to be the subject of uncompensated valvular heart disease the mixture may be used, care being taken to prevent as far as possible any struggling or holding of the breath which might induce syncope.

When the patient has a fixed immobile chest a mixture will be more suitable than pure chloroform, because of the stimulating effect of ether on the respiration, without the over-stimulating effect which pure ether would produce, and which might lead to bronchitis or pneumonia.

Ethyl Chloride is an anæsthetic drug chiefly

used for short operations, the anæsthesia obtained from a single administration of from 3 to 5 c.c. being only slightly longer than that of nitrous oxide gas. Alcoholic subjects do not take this drug well; as much as 10 c.c. may be required, and even then the anæsthesia is unsatisfactory.

In the prolonged administration of ethyl chloride muscular relaxation is not always obtainable.

This anæsthetic may be used at all ages, but is contra-indicated in cases of definite lung disease with much secretion, where there is blocking and stenosis of the air passages, or any suspicion of fatty degeneration of the heart. Smokers with chronic pharyngeal catarrh are apt to cough and struggle for air, thereby increasing their liability to syncope; ethyl chloride should be avoided in such patients.

Chloroform as an anæsthetic is particularly suited to the extremes of age.

From its depressing action on the circulation it is commonly used for operations on the brain, where hyperæmia would be a source of inconvenience to the surgeon. In abdominal operations, especially in the upper part of the abdomen, as in those upon the gall bladder, chloroform is satisfactory in securing quiet respiration, but the anæsthesia requires to be profound in order to obtain the muscular relaxation required.

When the patient is known to be suffering from Bright's disease, chloroform is indicated, because any increase of arterial tension might cause the rupture of an artery, although albuminuria has been known to have followed its use.

Those suffering from phthisis, bronchiectasis, and aortic heart disease are best anæsthetized with this drug, special care being taken to prevent struggling or any limitation of the air supply on account of the liability of such patients to syncope attacks.

Chloroform should not be used as a routine anæsthetic for emergency cases when the subject is young, strong, and otherwise healthy; nor should this anæsthetic be used for the ordinary removal of tonsils and post-nasal growths, but in those cases where the tonsils are to be enucleated a safe method is to start with *A. C. E.* mixture, then change to chloroform, keeping up the anæsthesia during the operation with a Junkers apparatus.

In stout plethoric subjects with short thick necks chloroform will be found best; but care during the induction stage is required to avoid giving an overdose.

In midwifery practice chloroform is frequently given, but though it is usually thought to be safer at this period than at any other, it is not so; it is true that at that period there is some

cardiac hypertrophy, and there is little or no fear of an anæsthetic, because of the pain the woman is suffering, still there is the same danger as in any other operation; it would therefore be better to use a safer anæsthetic such as ether, provided there are no other contra-indications to its use. Ether is particularly well suited to this class of case, because of its tonic action on the uterus, thus it would tend to lessen the danger of uterine inertia.

J. B. W.

DIFFICULTIES DURING ANÆSTHESIA

Whilst the principal dangers and difficulties during anæsthesia are concerned with keeping the respiratory and circulatory systems in good condition, the importance of the pre-induction stage must not be overlooked. In order that the patient may quietly and without resistance commence the inhalation, a few words of assurance, especially with children and nervous adults, are of extreme importance in giving the patient confidence both in himself and the anæsthetist. Silence should be maintained in the room, the clatter of instruments avoided, and any necessary adjustment of clothing or coverings carried out only *before* the commencement of the administration. By such precautions a timid child or nervous adult may usually be induced to submit with little or none of the resistance or struggling which render the initial stage so dangerous and difficult.

We know that fear and terror have accounted for some deaths, even before the inhalation of any vapour, and it is extremely probable that some fatalities which have occurred after a few breaths of chloroform, and which have been put down to that drug, have really occurred from fright. And it is not always remembered that during most of the first or analgesic stage of anæsthesia the patient is perfectly conscious of sounds and of any disturbance of his body, and that both these may be misinterpreted and exaggerated. To minimize any danger or difficulty, then, the induction stage should be perfectly quiet and undisturbed.

RESPIRATORY DIFFICULTIES

Respiration may be interfered with by—

Mechanical Causes—

1. By the presence of foreign bodies in the respiratory tract.

2. By narrowing of the respiratory tract itself, owing to muscular contraction or pressure from without.

3. By causes preventing the normal movement of the chest and diaphragm.

Causes affecting the Respiratory Centre—

1. Reflex inhibition.

2. Toxic action of the anæsthetic.

Mechanical Causes—

1. Foreign bodies in the air tract cause trouble in the early stages of anæsthesia by initiating swallowing movements in the pharynx, coughing or spasm of the glottis, and general respiratory spasm if inhaled into the trachea. In the later stages of anæsthesia, when the laryngeal and pharyngeal reflexes have been abolished, partial or complete closure of the air channel may be brought about. Artificial teeth and dentures must always be removed from the mouth beforehand, owing to their liability to be dislodged during anæsthesia. Also, should occasion arise to separate the patient's jaws with a Mason's gag, care must be taken not to dislodge teeth, which in the case of children and old people it is sometimes difficult to avoid. During the extraction of teeth care must be taken that they are removed from the mouth. It should also be remembered that teeth are sometimes liable to slip, or shoot out of the dental forceps, and the anæsthetist can prevent the inhalation of these by holding a "mouth-spoon" or a sponge on a holder, at the back of the tongue. The possible breakage of instruments (forceps, sponge-holders, etc.) in the mouth should not be overlooked, and if necessary the broken piece should be recovered. Loose sponge must not be left in the mouth; and in sponging the mouth or throat, even with the aid of a holder, care must be taken that a portion is not torn or broken off, even a tiny piece being a source of great danger or inconvenience if inhaled.

Mucus in the pharynx, trachea and bronchi is frequently a cause of impaired and difficult respiration. During light anæsthesia its presence may occasion movements of deglutition and coughing, with varying degrees of cyanosis, and render the attainment of surgical anæsthesia difficult and dangerous. When present in the pharynx it sometimes inhibits respiration, rendering the movements of the chest irregular and shallow and even causing a temporary cessation of movement altogether. On removing the mucus with a sponge respiration will immediately become normal and any duskiess or cyanosis disappear. The presence of mucus in the trachea or bronchi will as a rule give rise to much coughing in the early stages of anæsthesia, whilst in the later stages, when the laryngeal reflex has been abolished, cyanosis will appear and increase, accompanied by moist expiratory râles. In the former condition it may be sufficient to remove the mucus coughed up from the pharynx, if only of small amount, but in the deeper anæsthesia it is advisable to remove the anæsthetic until the cough reflex returns, when the patient can clear his air-passages. Such a condition is more common under ether than chloroform, and

it would probably be advisable to change to the latter after the expiratory effort and the patient has regained a normal colour. It should be remembered that there is danger in changing to chloroform during cyanosis or before the air-passages have been cleared of mucus.

In operations in the mouth and pharynx the liability of the inhalation of blood and blood clots is great, and careful and persistent sponging should be carried out. A light degree of anæsthesia should be maintained, so that the laryngeal reflex may warn the administrator of danger. In the absence of this reflex the blood may be inhaled, and the stoppage of respiration and the onset of sudden cyanosis may occur without warning. Apart from operations, the rare occurrence of epistaxis must not be forgotten.

Portions of tumours, adenoids and loose tonsils, pus and vomited matter, give rise to similar trouble, and must be quickly removed by means of a sponge. In operations involving the opening of abscesses of buccal, tonsillar or post-pharyngeal origin, the position of the head is of extreme importance, and it should be turned to one side, with the neck extended and lowered, so that the pus, if in excessive quantity, may tend away from the opening of the larynx.

Vomited matter is always liable to be sucked into the trachea, and is an especial source of danger when due to a recent and undigested meal and in cases of intestinal obstruction. In both conditions it is advisable to wash out the stomach, as soon as the patient is lightly anæsthetized, to prevent the vomiting which is otherwise almost certain to occur during or just after anæsthesia. When faecal vomiting is present before the operation, lavage is essential, and is of great benefit to the patient in getting rid of a quantity of toxic material, apart from lessening the danger of suffocation.

The treatment of the foregoing accidents must vary according to the degree of respiratory embarrassment, but in any case must be prompt. The anæsthetic should be withdrawn, the mouth must be opened, the tongue pulled forward, and the pharynx sponged clear. In the presence of slight cyanosis and a small amount of tracheal stridor this may be all that is necessary, and on the return of the cough reflex the patient will be enabled to clear his trachea.

Should laryngeal spasm occur, tongue-traction failing to overcome it, or should the trachea be blocked by foreign substance, laryngotomy must at once be performed to prevent suffocation. The head and shoulders should be lowered, and suction of the trachea performed through the opening. Artificial re-

spiration by Sylvester's method should also be commenced. Should the patient's colour not improve, the possibility of the blockage of the bronchi should be remembered, and aspiration carried out by means of a long rubber tube passed down through the opening into the bronchi. These measures, if quickly and effectively carried out, should prove sufficient to restore respiration. Failing this, inversion of the patient and insufflation of oxygen may be tried.

It may not be out of place to mention here that under moderate and deep anæsthesia the tongue may in some cases fall back and act like a foreign body in occluding the opening of the larynx. The lower jaw, during muscular relaxation, tends by its own weight to drop downwards, and in so doing carries the hyoid bone, together with the base of the tongue, backwards over the epiglottis to the back of the pharynx. In this way the opening of the pharynx becomes closed, as by a valve, only expiration taking place. The patient becomes increasingly cyanosed, and after vain efforts at inspiration the chest movements may cease. The condition, when recognized, is easily remedied by pulling the jaw upwards, and at the same time pushing it forwards from behind the angles, or, if this should be inadequate, by pulling the tongue forward with forceps. Its occurrence under chloroform, unless immediately recognized, is fraught with great danger, owing to the likelihood of the absorption of the whole of the vapour present in the air-passages, which may be sufficient to prove fatal.

2. Muscular contraction or spasm of the muscles of the upper respiratory tract or larynx frequently causes difficulty by narrowing or occluding the air-way. It is more frequently met with in florid, short-necked people, under nitrous oxide or ether anæsthesia, especially in the early stages and in the absence of an adequate air supply. Under chloroform it occurs both in the early and later stages, but seldom under deep anæsthesia. It is more common in persons with an imperfect nasal air-way. In these patients spasm of the orbicularis oris muscle may effectually close the mouth, with the result that respiration is entirely prevented and the patient at once becomes cyanosed. The spasm is easily overcome by separating the lips with a finger, and after a few breaths of air will disappear. In the edentulous a similar condition is brought about by the falling together of the lips, with the result that a valve-like action is set up, preventing inspiration. A hollow mouth-prop is the easiest means of preventing this.

Spasm of the masseters, especially in those with a full set of closely-fitting teeth, will also prevent the free entry of air.

Spasmodic retraction of the tongue, spasm of the palatal and pharyngeal muscles, and movements of deglutition, all result in narrowing the air-way and bring about a progressive cyanosis which, unless relieved, will ultimately lead to stoppage of respiration.

In regard to the *treatment* it must be remembered that these conditions are encouraged by a deficient supply of oxygen and a too concentrated vapour. In closed methods of administration care should be taken to admit an adequate supply of air when necessary, and to commence with a dilute vapour both in these and in open methods. The teeth should be separated by a small wooden or vulcanite mouth-prop, especially when there is nasal obstruction.

On the occurrence of spasm, therefore, the air-way must be reopened immediately. If the teeth are clenched they must be separated by means of a wedge, a small prop or Mason's gag inserted between them, and the jaw be pushed forward from behind the angles. In some people there will be difficulty in doing this, owing to the upper incisors overlapping the lower ones and preventing the jaw from being protruded. This indicates the great advantage that is obtained by having the teeth separated by a small prop (half an inch in diameter) in practically all cases before commencing anaesthesia. A good air-way is maintained, rendering spasm and the accompanying cyanosis less likely to occur, and, should it be necessary to separate the jaws widely, a Mason's gag can quickly and easily be inserted.

When nitrous oxide or ether are being administered—the air-way having been re-established and two or three breaths of air allowed—the administration may be continued, and the muscular spasm will quickly subside as anaesthesia progresses. But under chloroform the muscular spasm is fraught with much greater danger, and if not at once relieved there is a probability that all the vapour in the air passages will be absorbed. This, in the case of a feeble or fatty heart, and in the presence of a relatively strong vapour, may be sufficient to inhibit the heart, together with the respiratory and circulatory centres. Artificial respiration should then be performed and measures taken to restore the circulatory failure. In those cases where the circulation remains normal, and only respiration is impaired, chloroform should not be administered again until the above means have enabled the patient to get rid of his cyanosis, and then only in a diluted form, gradually increasing the dose to the required strength.

Varying degrees of muscular spasm of the larynx, giving rise to obstructed breathing, are met with. In the induction stage too strong a

vapour may cause coughing, which may be so violent as to consist of forced expiratory efforts and terminate in closure of the glottis and stoppage of respiration. This is most likely to occur in persons with inflammation or oedema of the larynx, especially if some narrowing of the glottis is present from any additional cause. The withdrawal of the anaesthetic is usually all that is required, followed by a more cautious induction.

When spasm of the glottis has occurred the mouth must be opened and tongue traction performed. Should it be necessary, intubation of the larynx and perflation, or laryngotomy followed by artificial respiration, must be carried out until normal breathing is re-established.

Partial laryngeal spasm, or stridor, may also occur during practically any degree of anaesthesia as a result of reflex stimulation. It most frequently takes place when an operation is commenced before surgical anaesthesia has been properly established, and may disappear as anaesthesia deepens, although its occurrence at this stage may make it very difficult to obtain subsequently a normal and satisfactory anaesthesia. In moderate and even full surgical anaesthesia a strong stimulus at the site of operation, such as the dilation of the sphincter ani, pulling on the spermatic cord, gut or the peritoneum, especially in the upper zone of the abdomen, may make respiration irregular, cause holding of the breath or much stridor. It is better when this takes place to withhold the anaesthetic, owing to the possibility of the absorption of a dangerous quantity of the vapour, which would be liable to occur should the stridor continue or proceed to complete spasm of the glottis. When the patient has become more accustomed to the stimulus the stridor will gradually subside and the administration may be continued. Occasionally it is difficult in abdominal operations to abolish this stridor entirely. It is perhaps more persistent under chloroform, and in such a case a change might be made to ether with advantage. The maintenance of a patent air channel and a plentiful supply of air or oxygen must be remembered.

Interference with respiration by pressure on the pharynx or trachea from without is sometimes met with, giving rise to difficult breathing and cyanosis. Among such causes may be mentioned tight bandaging, enlarged tonsils, tonsillar and post-pharyngeal abscesses, supuration or oedema of the tissues of the tongue or lymphatic glands of the neck, and an enlarged thyroid or thymus. Should cyanosis increase and respiratory arrest be threatened, the anaesthetist must be prepared to perform laryngotomy. Engorgement of the vessels of the neck and the secretion of mucus and saliva

must be avoided, and a uniform but light degree of anæsthesia, free from struggling and coughing, maintained.

3. Interference with respiration due to impaired movement of the chest and diaphragm is caused in several ways. In the aged, inelasticity of the thorax and ossification of the intercostal cartilages renders the patient almost entirely dependent on the diaphragm. Thickened pleuræ, chronic emphysema and fibroid conditions of the lung all render respiration more difficult. Such conditions, although unlikely to cause any gross disturbance during anæsthesia, yet are worthy of note owing to the defective interchange of gases, and therefore slow and imperfect elimination of anæsthetic vapours, that would occur should a relatively too deep degree of anæsthesia be permitted. A light yet efficient degree of narcosis should, therefore, be aimed at; ether should not be given, in order to avoid excessive respiratory movement and the secretion of mucus in the air tubes, which would only tend further to labour the breathing.

In pleural effusion and empyema difficulty of respiration will already exist, due to the increased pressure within the chest, and further distress will be caused if ether is administered, and further engorgement of the lungs brought about. The patient should be turned on to the sound side only when the operation is commenced and a light degree of anæsthesia maintained. Any increasing cyanosis is an indication for either a return to the supine position or a speedy completion of the operation. The pressure on the sound lung will be relieved, and the compressed lung on the affected side will be allowed to expand.

Similarly, large abdominal tumours or much ascites will hinder free respiratory movement, and as long as quiet respiration is maintained with a light anæsthesia no trouble will be met with. In operations requiring the full Trendelenburg position, especially in stout patients with large omenta, respiration will be laboured and cyanosis possibly supervene. Treatment other than the maintenance of a good air-way is seldom required, but occasionally a partial return to the horizontal may be desirable, to obtain quiet respiration.

It should be remembered that the weight of instruments or any other pressure on the patient's chest may hinder free movement. Also that tight clothing or bandages are a danger to respiration unless loosened beforehand.

Irregularity of respiratory movements, holding of the breath, spasm of the diaphragm and thoracic muscles, due to reflex stimulus, occurs during a relatively light anæsthesia. Withdrawal of the anæsthetic while the spasm

lasts, followed by a deeper degree of narcosis, is usually all that is required. Occasionally, during the rare occurrence of general respiratory spasm, it is stated that tracheal intubation and forced perflation with air or oxygen must be performed.

Causes Affecting the Respiratory Centre—

1. Reflex inhibition of the respiratory centre, giving rise to irregular movements, cyanosis or temporary cessation of respiration, occurs during light anæsthesia, and in some persons in the later stages, from strong stimulation. During light anæsthesia or the administration of ether it need cause no anxiety, respiratory movements recommencing after a few seconds, especially if aided by one or two bilateral compressions of the chest. Further irregularity of the breathing can soon be restrained by a deeper anæsthesia. Under chloroform, especially under moderate and deep anæsthesia, immediate attention must be paid to the freedom of the air-way and rhythmic compression applied to the chest. Although respiration in the majority of cases would probably soon start automatically, yet the liability of the absorption of a toxic amount of vapour sufficient to paralyse the respiratory and cardiac centres must not be risked.

2. Paralysis of the respiratory centre due to the toxic action of the anæsthetic is exceedingly rare under ether, as the inconvenience caused by violent movements of respiration, and the quantity of mucus secreted in the mouth and air passages, tend to warn the most careless administrator. Under chloroform the centre is far more susceptible and the workable area of safety is very limited. Failure of respiration may occur suddenly from this cause, or its onset may be more gradual, especially when a lowered blood pressure has rendered the centre anæmic. The head and shoulders should at once be lowered and artificial respiration commenced, the mouth being opened and rhythmic traction made upon the tongue, the throat sponged clear of mucus, and oxygen administered. Provided that the circulation is being maintained these measures should prove sufficient, but if the pulse fails the usual means of restoring cardiac action must be carried out.

C. H.

CIRCULATORY DIFFICULTIES

Heart failure, or syncope of varying degrees, is met with in all stages of anæsthesia. Its onset may be sudden or gradual, and may be due to the anæsthetic alone, or to a combination of its effects with those of the operation when it is known as surgical shock. The normal condition of stability of the centres controlling the cardiac and vasomotor mechanism is capable of meeting all ordinary demands during anæ-

thetia, but there are various considerations, such as the type of patient, his physique and state of health, which may render this a very uncertain quantity. Physical strength and a healthy appearance in no way guarantee that a patient is a good subject for anæsthetics, chloroform in particular, nor should it be taken for granted that such a person has even the average immunity to the various agents, or that the usual dosage would be a safe one.

Psychical influences are of importance not only in the pre-induction and early stages of anæsthesia, but because they diminish the capacity of the centres for adjustment in all degrees of anæsthesia, and also act in determining the susceptibility of the centres. Fear may fatally inhibit cardiac action before and during the early administrative stage. Apart from this fact, provided that the anæsthetic is administered carefully, commencing with a dilute vapour, that a light degree of anæsthesia as indicated by a small pupil and an active lid-reflex is reached, and that free respiration is maintained, no cardiac difficulty should be met with in the early stages of anæsthesia. At the same time it must be mentioned that patients suffering from status lymphaticus are known to die suddenly from heart failure, apart from operation or anæsthesia, and it is quite reasonable to suggest that such a death might occur during anæsthesia without being in any way attributable to it.

Sudden heart failure may be caused by reflex inhibition of the centres from some stimulation, such as incision of the skin, during incomplete anæsthesia. It may arise from simple overdosage. It may also occur from toxic absorption or spasm. This may arise in the induction stage, during struggling or holding of the breath; in light and moderate anæsthesia, during reflex respiratory spasm. Children, and adults with feeble or fatty hearts, or those who for any reason have an increased susceptibility to anæsthetics, are in especial danger at such times.

Other causes of sudden cardiac failure that may be mentioned are vomiting; also change of the patient's position, either from a horizontal to a sitting position, or from the Trendelenberg to the horizontal, but only when the blood pressure is abnormally low.

Although no hard-and-fast line can always be drawn between conditions of sudden or gradual failure, careful observation of the patient's pulse, both as to rate and volume, and the colour of the lips and ears, will frequently indicate the onset. An infrequent pulse-rate is a sign of too deep anæsthesia, whilst a frequent pulse, especially in the presence of dilated insensitive pupils, is also a danger sign. An overdose of the anæsthetic may produce a

gradual failure, which if not noted will end in cardiac paralysis. A moderate anæsthesia should be aimed at, and the closest attention paid to the phenomena of the pupil. Partially obstructed breathing, if allowed to continue, and especially with a dilated or already overburdened right heart, will tend to produce cardiac syncope, and the importance of maintaining adequate and free respiration is extremely urgent in this respect.

Finally, hæmorrhage may be the cause of a gradually failing heart, and on its occurrence care should be taken to lessen proportionally the dose of the vapour and the degree of anæsthesia.

Treatment. Circulatory failure, whether partial or complete, must be treated immediately. The anæsthetic must be withdrawn, the head and shoulders lowered, preferably by the body being placed in the Trendelenberg position. Warmth applied to the precordium is extremely useful.

Respiration, if impaired, must be maintained by artificial movement, oxygen given and the air-way kept perfectly patent by means of a mouth-gag, the tongue being pulled forward, and the throat sponged clear of mucus. In this way the elimination of the anæsthetic, which is essential to recovery, is assisted. If the heart is still working, intravenous infusion of saline, with the addition of adrenalin, will be of great service. A hypodermic injection of pituitary gland extract should be given. Brandy or strychnine are probably of little use in this condition, especially if the blood pressure has been much lowered.

If the heart's action has ceased, rhythmic compression may be tried in the hope of initiating contraction, provided that artificial respiration is still kept up. In abdominal operations, this may be performed by compressing the heart against the chest wall, by the hand inside the abdomen, the diaphragm intervening. In operations other than abdominal an incision can quickly be made in the middle line below the ensiform cartilage, the recti separated, and the hand inserted between the diaphragm and the peritoneum, which need not be opened.

Surgical Shock.—Although it is not intended to deal fully here with surgical shock it is certain that in surgical operations the anæsthetic plays an important part in its occurrence. The signs and symptoms of surgical shock and deep anæsthesia are so similar that it is often impossible to distinguish between them. In either condition a dilated pupil, insensitive cornea, pallor, moist skin, shallow breathing and rapid pulse may be present. Shock is brought about by severe and long operations, exposure to cold, hæmorrhage and powerful stimuli such as traction on the mesentery, viscera and intestines. Varying degrees are met with, and

it may be so slight as to necessitate only the withdrawal of the anæsthetic. The more severe conditions must be treated as for circulatory failure. Its occurrence depends largely upon the anæsthetist, and provided that a uniform and light degree of anæsthesia be maintained, as indicated by a small pupil and an active lid-reflex, in the absence of hæmorrhage surgical shock necessitating treatment practically never occurs.

C. H.

HYOSCINE-MORPHINE ANÆSTHESIA IN OBSTETRICS

The object of this article is to draw the attention of general practitioners to this excellent method of alleviating the pain of labour, a method which is only too little known in this country.

The salt used is the hydrobromide of lævo-hyosine. It should be remembered that hyosine salts are easily disintegrated in solution and are precipitated by "hard" waters. The drug should therefore be kept as tablets and freshly dissolved in distilled water for each case.

Dosage. In a recent paper on this subject the author reported upon the use of three different solutions of hyosine hydrobromide, which gave very similar results. The three mixtures contained: the first—hyosine hydrobromide $\frac{1}{100}$ gr., morphine sulphate $\frac{1}{4}$ gr., and atropine sulphate $\frac{1}{150}$ gr.; the second—hyosine hydrobromide $\frac{1}{100}$ gr., morphine sulphate $\frac{1}{6}$ gr. and atropine sulphate $\frac{1}{180}$ gr.; the third—hyosine hydrobromide $\frac{1}{100}$ gr. and morphine sulphate $\frac{1}{4}$ gr. The effect of the atropine is negligible. The administration is always subcutaneous. The first dose should be given as soon as the pains become severe. It is wrong to wait until the second stage commences and thus allow the patient to suffer much unnecessary pain.

As soon as the effects of the first dose begin to wear off a second should be given. Morphine should never be repeated, on account of its bad effect on the foetus, but only hyosine in doses of $\frac{1}{100}$ of a grain. Before the second administration the foetal heart should be carefully auscultated so as to make sure that its action is quite regular.

Action. Hyosine is a powerful narcotic. The extent of the relief of pain varies. In a series of thirty-seven cases in 16.2 per cent. no pain was felt, in 27 per cent. very little pain was felt, in 37.8 per cent. pain was decreased, and in 19 per cent. pain was felt as usual. The relief of pain commences in about ten minutes after the injection. The character of the relief afforded is well shown by the following facts. In 20 per cent. the mother was

unaware of the birth of the child, and in many cases forceps were applied without any other anæsthetic. Many multiparæ were positive that their sufferings were considerably less than at previous confinements. Hyosine also produces somnolence, the mothers sleeping between the pains, and remaining drowsy at the acme of a pain. Some patients become excited, but this is rare; many, even those who felt pain to some extent, forget that the child is born and can hardly credit it.

Other effects of this drug are flushing and dilatation of the pupils, which are practically constant.

There is great difference of opinion as to the effects of hyosine and morphine on labour pains, owing to the difficulty of estimating the strength of a pain. There can, however, be no doubt that owing to the drowsiness of the patient, she is unable to bear down as well as usual.

In thirty-seven cases there were 33 per cent. of forceps delivery, one case, however, was one of primary uterine inertia and four were cases of foetal distress (deducting these, the percentage is 18.9), whereas at Queen Charlotte's Hospital the percentage of forceps deliveries varies from 11.8 to 17.6.

Average lengths of the three stages of labour—

	I		II		III		Total.	
	Hrs.	Mins.	Hrs.	Mins.	Hrs.	Mins.	Hrs.	Mins.
Primiparæ .	23	45	1	23	0	19	25	27
Multiparæ .	12	12	0	48	0	27	13	27

It is evident that the increase in length is so slight that the diminution in the frequency and strength of the uterine pains cannot be great.

Hyosine-morphine anæsthesia has no effect on the amount of blood lost.

Effects on the Fœtus. There can be no doubt that there is some risk to the foetus. The cases should therefore be carefully watched and the foetal heart auscultated from time to time, so that forceps can be applied as soon as it is necessary. In the thirty-seven cases there were six cases of slight blue asphyxia and two children were born dead. One of these was a case of premature rupture of the membranes (twenty-seven hours before delivery), so that death would probably have occurred if the drug had not been administered. In the other case the foetal heart was weak throughout the delivery. Forceps were applied as soon as the os was fully dilated in both cases, in vain. The mortality therefore was 2.7 per cent. At Queen Charlotte's Hospital the foetal mortality is about 2.3 per cent. With ordinary precautions the drug can be used with little extra risk to the foetus.

After-effects on the Mother and the Child. Most patients fall into a refreshing sleep after labour is completed and forget the pain suffered. There is no effect on the involution of the uterus. There are no bad effects on the child after it has awakened from its drowsy sleep.

Dangers. The only danger is that of still-birth. It is extremely doubtful whether post-partum hæmorrhage is ever caused.

Indications. (1) This method is most indicated in nervous women. (2) Whenever there is great pain during labour. (3) When the cervix dilates slowly, provided the foetal heart is normal. (4) In heart disease hyoscine-morphine anæsthesia will, we think, be very useful. The only case of severe morbus cordis

in which we tried this method ended most satisfactorily.

Conclusions. (1) That the object of hyoscine-morphine anæsthesia is not to bring about complete unconsciousness, but to produce "twilight sleep," from which the patient can be roused at any moment without recollection of what has occurred. (2) That in hyoscine-morphine anæsthesia we have an efficient means of controlling pain and one that is practically safe with ordinary precautions. (3) That there may be danger to the child unless the foetal heart is carefully auscultated. (4) That the administration and repetition of the injections must be gauged by the amount of suffering.

P. L. G.

II.—HOSPITAL MANAGEMENT

COTTAGE HOSPITAL CONSTRUCTION

THE Cottage or Village Hospital owes its origin to the late Mr. Albert A. Napper, a medical man practising in Cranleigh in Surrey. In the year 1859 he, with the help of the rector, Mr. (afterwards Archdeacon) Sapte, fitted up the ancient vicarage as a Cottage Hospital at a total cost of £100. The objects of the founder were to provide a suitable place where cases of disease or accident could be treated under healthy conditions when the circumstances of their own homes rendered such treatment impossible. "A short experience of country medical practice must suffice to show the impossibility of rendering efficient aid in urgent cases of accident or disease with no other accommodation than that afforded by the too frequently miserable abodes of the poor. The nearest hospital is many miles distant, the patient too exhausted to bear a long journey, and the relatives nearly always reluctant to have him removed to a distance so great as to preclude the possibility of frequent visits." These are the founder's own words in support of what was then a new departure, and, like all novelties, was meeting with no little opposition.

A Cottage Hospital is a place where the general practitioner can perform with safety to the patient such operations as he can and ought to undertake, and where cases of disease which require skilled nursing and careful diet can be treated in a way impossible in their own homes. It is not intended to supersede or to compete with the large general hospitals in towns; nor should it be conceived on a scale which brings it within the category of general hospitals.

Mr. Napper's idea and that of other pioneers in the work was that the number of beds should not exceed six, and that in thinly populated districts the number might be limited to four. The idea governing the limitation was that while one nurse could do all that is required for six patients, any excess on this would necessitate the employment of a second nurse. These figures many so-called Cottage Hospitals have greatly exceeded; so much so, that in at least one instance a hospital with forty-two beds still retains the name and is worked on the lines of a Cottage Hospital.

It is scarcely practicable to set a definite limit to the number of beds in a Cottage Hospital, but the probability is that the most generally useful size for rural districts is from six to eight

beds, while for more populous places, large villages or small towns, so large a number of beds as twenty will not be excessive in relation to the needs of the district. As regards the right proportion of beds to population, it seems to be generally agreed that one bed to every thousand inhabitants is a safe rule; but obviously this rule must be liable to variation in regard to the nature of the population.

While in one district the population will mainly consist of the well-to-do, with a very small proportion of the very poor, in another the whole of the inhabitants may belong to the labouring classes. A rule which would be applicable to the one would clearly not apply to the other.

The advantages of Cottage Hospitals to the patients are, as has been pointed out, that in sickness or injury they can be treated in healthy surroundings close to their homes without incurring the risk of a lengthy journey, and where they can be visited by their relations. Also that in a Cottage Hospital they are treated in far better conditions as to air and healthy surroundings than would be the case in a large hospital in a populous town.

To the medical man the advantages are almost as important as to the patient. Instead of having to send off all his serious cases requiring operation or skilled nursing to the nearest general hospital, he is able to treat some of them himself, and so to enlarge the scope of his work and keep in touch with modern methods. The importance of this can scarcely be overrated; it is good for the doctor himself and it is good also for all the patients under his charge.

Another and perhaps no less important a feature of the Cottage Hospital is that in almost every instance the system of contributions by patients is adopted. The principle of requiring patients to contribute towards their maintenance in proportion to their means was adopted at the outset by Dr. Napper at Cranleigh, and it is safe to say that the instances where this rule does not obtain form a very small minority. The amount of contribution required varies in different localities; the lowest minimum appears to be two shillings per week, while the maximum is in no case more than ten shillings per week. Domestic servants are usually charged at the higher rate, a reduction being sometimes made when the employer is a subscriber. As a rule the decision as to the amount of contribution to be made by a patient is in the hands of the committee of management, but in one case

(Harrow) a carefully devised scheme of payment in proportion to the amount of assessment of the patient's dwelling has been drawn up. The amount is fixed at fivepence per week in the pound, on the assessment, with a minimum of five shillings and threepence. For domestic servants the scale is twopence in the pound, with a minimum of five shillings and threepence and a maximum of one guinea. In many Cottage Hospitals provision is made

- CRANLEIGH - VILLAGE - HOSPITAL -



FIG. 1.

amount is fixed at fivepence per week in the pound, on the assessment, with a minimum of five shillings and threepence. For domestic servants the scale is twopence in the pound, for private patients who are able to pay at a more remunerative rate. The terms for such patients range from one to four guineas per week.

Before describing in detail the planning and arrangement of a modern Cottage Hospital it will be convenient to give examples of a hospital established in a genuine cottage. For this purpose the hospitals at Cranleigh and Bocking have been selected—the one as the original hospital of the class and itself an ancient cottage, and the other as an adaptation of two modern cottages.

Cranleigh Village Hospital

The original hospital, which is now used for administrative purposes only, is an ancient oak-framed building formerly the vicarage, and is still the property of the rector of Cranleigh. It contains two floors, and the wards were the two rooms over the front part of the building. They are approached by a winding staircase, up which it must have been a matter of some difficulty to carry a helpless patient. The outer room was the men's ward and held three beds, and the inner room was the women's ward and contained a like number of patients. The small room with storeroom leading out of it was the nurses' bedroom, and the room at the back was the operating-room. On the ground floor the large room which now forms the entrance hall was the kitchen, with a back kitchen and scullery leading out of it. The other front room was and still is a sitting-room for nurses. The only W.C. was approached through the bathroom, which was ingeniously contrived out of the space at the back of the big chimney stack. From this description and the plan (Fig. 1) the difficulties of working will readily be appreciated. The difficulty of carrying patients up to the wards has been referred to; as a matter of fact the method of transport was not infrequently the doctor's back. Then it is obvious that all bed-pans had to be carried down-stairs and through the kitchen, and when emptied had to be cleansed as best they could in the W.C. The operating room was tiny, but, nevertheless, much excellent work was done in it. The hospital, as it was, is an object lesson in good work done with rough and ready means; and while it is right and proper to provide improved ways of doing the work, it does not follow that it is necessary or desirable to adopt the costly methods which may be justifiable in a large general hospital in a populous town.

Some ten years ago the hospital was enlarged by the erection of the one-storey block shown on the plan at the back of the original cottage. This block contains two wards of four beds each and an operating-room. The wards are light and airy and have efficient cross ventilation. The floor space per bed is 80 ft. 6 in. and the cubic space 845 ft. To each ward is provided a bathroom, W.C., bed-pan sink and lavatory. The object of the disconnecting lobby which

intervenes between the W.C. and bathroom and the ward is defeated by placing the bed-pan sink on one side of it; there is therefore no effectual disconnection between the sanitary offices and the wards. There is no necessity to interpose a cut-off lobby between a bathroom and the ward; and in practice the lobby is not only unnecessary but often inconvenient. Also two bathrooms are not required for eight patients. It would have been better to have placed the bathroom in some more central position where it would have been available for all the patients, and so to have simplified the sanitary wings and at the same time provided efficient cut-off lobbies. With this exception the building is excellently adapted for its purpose. No patients are now treated in the old building, and it is used solely for administrative purposes. The staff consists of a nurse-matron and assistant nurse and one servant.

Braintree and Bocking Cottage Hospital

This hospital was founded in 1876 by the late Mrs. George Courtauld. It consists of two cottages converted by the removal of the dividing wall and both staircases, and the provision of a new staircase and some other alterations. On the ground floor is a ward for three men, a large entrance hall, which serves a useful purpose as a waiting-room, the nurses' sitting-room, kitchen, scullery, bathroom, W.C., and a store for drugs, splints, etc. On the first floor is a ward for two beds and a cot, the operating-room, nurses' bedroom and servants' bedroom. In a detached building of one storey only is a wash-house, coal store and mortuary.

The hospital is pleasantly situated on high ground just outside the village of Bocking. Unfortunately it is outside the limits of the Braintree gas and water supply and sewerage, so that it has to depend on a well for its water; the sewage is disposed of on neighbouring land, and the only means of artificial lighting—except in the operating-room—is by oil lamps. In the operation theatre a small apparatus for generating acetylene gas has been lately fixed.

It is always a difficult matter to adapt a building planned for one purpose to something quite different, and the result in this instance is no exception to the rule. The operating-room being on the upper floor, if a male patient has to be carried up or down this task has to be performed by the doctor in charge of the case, since, obviously, no porter can be kept in a little institution of this kind. The fact that there is no W.C. on the upper floor and only one in the house to serve for patients as well as staff involves the necessity of carrying the bed-pans down from the first floor past the operating-room and past the kitchen door. Clearly this is very objectionable. As there is no system of hot

water circulation all hot water required in the operating-room has to be carried upstairs. This, of course, involves much labour, which would be saved if a circulation were available.

The absence of a spare room or a bedroom for an extra nurse is unfortunate from an economical point of view. At times a second nurse is wanted for a special case, and when this happens a room has to be obtained for her outside the hospital, and this entails a certain definite weekly expense which would not be incurred if a room were available.

These defects are not pointed out merely with a view to finding fault, but partly in order to emphasize the fact that much good work can be done in a building but little adapted for its purpose, as well as to indicate how mistakes can be avoided.

Site

In establishing a Cottage Hospital the first consideration is of course the site. The chief points to be kept in view are (a) aspect, (b) nature of the subsoil, and (c) area. These are concerned with the health conditions of the site. Two other conditions will have to be considered as bearing on economy: (d) access for patient and staff and (e) cost.

As a general rule it may be taken that a site well exposed to the south and protected from the north and east winds is a desirable one in point of aspect. A gently sloping site fairly elevated above the surrounding country to the south and west would answer these conditions. A too sharp inclination of the ground produces stagnation of air and proves costly in the matter of building. The kind of site to be avoided is one at the bottom of an enclosed valley or on low-lying ground which takes the drainage from the land around it.

The nature of the subsoil is an important factor in the healthiness of any habitation. The condition of the soil is influenced by two factors: (a) the power of retaining heat and (b) the level of the ground water. The soils that absorb heat to the highest extent are clay and chalk; and as a consequence these soils are much colder than soils such as sand or gravel. A more important factor than the actual composition of the subsoil is the level of the ground water. There is in all soils of a permeable nature a point at which water is met with. This water is of course derived from the rain which falls on the surface and, penetrating through the permeable strata, is held up by the impermeable rock which underlies them. The conditions affecting health in relation to the variation of level in ground water have been carefully investigated by many observers of late years; and it will be sufficient here to note that a high water level is unhealthy, inasmuch

as it keeps both soil and air damp, and that a varying water level is probably even more injurious to health than a permanent one. It may be said that, speaking broadly, deep beds of sand or gravel with good natural drainage, impermeable rocks which have sufficient slope to drain off water, limestones or chalk, are all good soils for habitation—and that the worst soils are thin beds of sand or gravel overlying an impermeable bed such as clay, and alluvial soils which consist of the deposit from rivers. If, therefore, it becomes necessary to build on a site with a high or varying water level, it is of the utmost importance to provide that the air from the ground laden with moisture and impregnated with organic impurities should not be drawn into the house. To effect this a solid impervious bed of concrete finished with either asphalt or cement must be interposed between the soil and the interior of the building. Such a precaution is indeed necessary whatever the nature of the soil may be, except, possibly, when it happens to be solid granite or some close-grained impervious stone, and is required in all building by-laws.

Particular attention must be paid to the formation of this bed in cases where the subsoil is damp or otherwise bad. In such cases concrete alone is not sufficient to keep out the ground air, and some really impervious material such as asphalt should be used.

The area of site required depends on the number of patients and on whether the sewage can be discharged into a public sewer or must be disposed of within the limits of the site. In the former case sufficient land for the free circulation of air and light all round the building is all that is absolutely necessary. In the latter, the amount of land necessary for effectually disposing of the sewage will have to be carefully proportioned to the volume of sewage to be dealt with and the nature of the soil.

The question of water supply is one which will need careful consideration. Frequently in or near country villages the hospital will have to be dependent on a well for its supply when either there is no public water service or the hospital is beyond the limits of supply. In such circumstances it will generally be the case that no public system of drainage exists, and that the hospital will have to be self-contained both in its water supply and in its drainage. It need hardly be said that the utmost vigilance is necessary in order to safeguard the well from contamination by sewage. For a dwelling-house no doubt the earth closet system, with a simple method of disposing of the slop water on the land, would be the safest method to adopt; but with a hospital such a plan would be impossible. Bed-pans cannot be emptied into an earth closet, neither can they be cleaned without a suitable sink and water supply; it is therefore necessary

to adopt a water-borne system of sewage disposal.

The old-fashioned cesspool is out of the question, and is, moreover, illegal in most districts. On the question of what system to adopt expert advice must no doubt be obtained; and the ultimate decision will be largely influenced by local conditions. A system such as the "semi-septic" sewage plant would probably suit most cases. It is neither altogether septic nor altogether aseptic, but stands midway between the two systems and seems specially appropriate to the needs of moderate-sized households. With a system of this kind the water supply, even if it be a surface well, is safeguarded from contamination within the hospital boundary; and all that remains to be done is to see that the well is protected from injury from without.

In the "semi-septic" system of Messrs. Tuke and Bell the tank into which the house drain discharges acts as a disintegrating mill; in it the solids are held back, broken down and reduced to simple compounds by semi-septic mechanical and physical action, a certain amount of reduction being due to gaseous action; the fibrous matters float to the top, forming a scum, the solids, in very fine particles, passing in suspension to the filters. The filters are, first, mechanical strainers, the fine particles in suspension being deposited in the interstices, the clarified liquid passing through to the secondary filter, or the humus tank, or direct to the ditch, as the case may be, after which bacterial and biological action (aerobic) takes place, purifying the fine particles, and at the same time cleansing the mechanical strainer. From this process there is a residue, "humus," inoffensive and innocuous, but which, if allowed to pass to a ditch, along with the otherwise fairly clean effluent, would be deposited and show discoloration. The provision of a "humus" tank, which has a scum board to keep back this grey matter, permits of its being taken out and laid on the earth or in shallow pits to dry. It there becomes a fine powder, closely resembling very fine mould, and the discoloration previously mentioned is prevented.

The question of access for patients and staff is one which must be governed by local conditions. So far as the patients are concerned a position as nearly central as possible in the district served by the hospital is of course to be desired. For the staff the advent of the motor car has eliminated much of the difficulty of locomotion in country districts; but, unfortunately, this is not without its drawbacks. The nuisance of dust arising from motor traffic is a very serious one; and at least one example could be given of a Cottage Hospital on a main road where the ward windows have to be kept closed

during dry weather. Doubtless when all roads have been surfaced with tar this nuisance will vanish; but, until that, apparently unattainable, ideal has been achieved it becomes necessary to choose a site which, though less convenient in other ways, is free from the liability of being smothered with dust.

On the matter of cost it is not possible to lay down any definite rules. The cost of labour and materials varies in different parts of the country; and an accurate comparison is only possible if all the conditions are identical. A comparison of the actual cost of twelve Cottage Hospitals in different parts of the country gives a mean cost per bed of £185 5s., but since the maximum is £272 and the minimum £88 the result is of little value. As a matter of fact cost per bed, unless the number of beds is identical in the examples compared, is misleading. The reason for this is obvious. Take, for example, two hospitals, one, A, having a total of twenty beds and a staff of five nurses; the other, B, having thirteen beds and a staff of four nurses. In each case the staff of servants is the same. If the cost is calculated in relation to the number of beds it is clear that the cost of each bed in A will bear a smaller proportion of staff than will be the case with B, for while in A there is one nurse to four patients, in B the proportion is one to 3.22. Again in each of these hospitals the extent, and therefore the cost, of the kitchen, offices and stores may be taken as identical, so that in the one case the cost would have to be divided by twenty and in the other by thirteen. On the whole the most reliable basis for calculation of cost is one based on the cubic contents of the building; the exact sum per cubic foot can be arrived at by comparison with the actual cost of buildings in the neighbourhood, making some allowance for the additional cost of special fittings and finishings required in a hospital.

Planning

It will be found convenient to deal with this part of the subject under two heads: (1) the smaller type of hospital with from six to eight beds; and, (2) the larger type with accommodation for as many as twenty patients.

1. *The Smaller Type.*

The first consideration in planning a hospital is the number and size of the wards. Taking six beds as the total it almost necessarily follows that the wards will be two in number, each containing three beds, one being for male, the other for female patients. A small ward for one bed is a desirable addition perhaps, but not an absolute necessity. The next point is the floor area and cubic space to be provided for each patient. On this it will be found that practice varies considerably. An analysis of the dimensions of a large number of Cottage Hospitals

gives a mean floor space per bed of 92 ft., the figures varying from 124 ft. to 49 ft. 6 in. The larger dimension is certainly excessive, and the smaller as certainly inadequate.

For purposes of efficient ventilation the floor space should not be less than 100 feet, and the cubic space 1000 feet. It will be seen from these figures that the height of the ward is assumed to be 10 ft. It is now generally agreed that any height in excess of 10 ft. is of no value for purposes of ventilation; in large wards some additional height is necessary partly for appearance and partly to equalize the temperature in cold weather when artificial heat is used. A convenient size for a ward for three beds is 22 ft. 6 in. by 14 ft. This gives a floor area of 105 ft. per bed. The beds would be placed with a space of 4 ft. 6 in. between them, and 7 ft. between the foot of the bed and the opposite wall.

In a ward for one bed only an area of 100 ft. would be insufficient for practical use; and it must be increased to allow sufficient room for the necessary furniture. For this purpose a room 12 ft. by 10 ft. will be found none too large.

When the total number of beds exceeds six it may be desirable to provide separate rooms for patients willing to pay a higher rate than the ward patients; this, however, is a matter which can only be determined by local requirements.

Each ward of three beds (or more as the case may be) must have attached to it a water closet and a sink-room, both of which should be approached through a lobby with cross ventilation, *i. e.* windows on each side. There is no need to provide more than one bathroom, and this should be in as central a position as possible, so as to be within easy access of both wards. As the bathroom in a hospital is so constantly placed in the same block as the water closets and sink-rooms it will be well to point out the disadvantages of the plan. In the first place there is no necessity whatever to interpose a "cut-off" lobby between the bathroom and the ward. It is indeed a distinct disadvantage for a patient to have to pass through a cold and draughty passage on his way from the bath to the ward. In the second place a bathroom should be approached from outside the ward, so that a patient on admission should go to the bathroom before he enters the ward.

The only other room directly concerned with the patients is the operating-room. This should be about 14 ft. by 12 ft., and well lighted by a large vertical window. A top light is an advantage, but not a necessity. It must be borne in mind that in a small Cottage Hospital the number of operations during the year is comparatively small, and that a considerable proportion of the total number consists of minor operations (*e. g.* adenoids, tonsils). To

take an actual example—in a country hospital with ten beds the total number of operations during 1910 was thirty-eight, of which sixteen were of the class of minor operations. The elaborate arrangements, therefore, that are deemed necessary in a large town hospital are totally out of place in a village hospital.

The remainder of the building consists of the domestic or administrative part, and comprises the kitchen offices and the rooms for the staff.

The resident staff in a hospital of the size we are considering will usually consist of a nurse-matron and one servant. A bedroom for each of these is needed and a sitting-room for the nurse. As the services of a second nurse are, from time to time, required for night duty with a serious case, or for other causes, it is a wise economy to provide a spare room. If no such provision is made a room has to be taken specially, and the cost makes an appreciable difference in the annual cost of maintenance. The kitchen offices will be similar in every respect to those in a well-arranged villa. Store cupboards, lighted and ventilated, are of course of great importance, and should include provision for the storage of splints and other surgical appliances in constant demand. No storage for drugs is necessary beyond a small cabinet for drugs required in emergency, which may be kept in the matron's room.

It is desirable that the entrance hall should be sufficiently large to serve as a waiting-room; and if space can be spared a small telephone-box should be placed there.

In addition to the accommodation described it is desirable to provide a mortuary, which should be so arranged as to serve when required as a post-mortem room. It should, of course, be entirely detached from the hospital, and as far removed as the land will permit. Sometimes, also, it is desirable to provide a washhouse and ironing-room, and this may, with advantage, be a part of the same building as the mortuary.

To illustrate the arrangements of a small hospital of the type described above, a plan (Fig. 2) is given of a hospital for six beds.

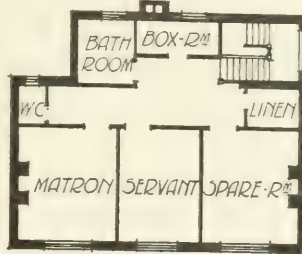
The entrance is in the centre, and is made of sufficient width to allow of its being used as a waiting-room. The entrance hall gives access to a corridor running right and left. On the right is a receiving-room for patients, with a bath screened off, and a ward; and on the left the nurse-matron's room and the other ward; while at the back is the operating-room, staircase and kitchen offices. On the upper floor over the central portion are three bedrooms, one for the nurse-matron, one for the servant, and a third for an extra nurse when required. On this floor there is also a bathroom for the staff and a small box-room. The building is planned in as economical a way as possible, having regard

to the fact that so large a proportion of the space must of necessity be on the ground-floor. The main front should face south, the operating-room having a north aspect. The wards have a full measure of cross ventilation, and the fireplace is put in the most central position possible.

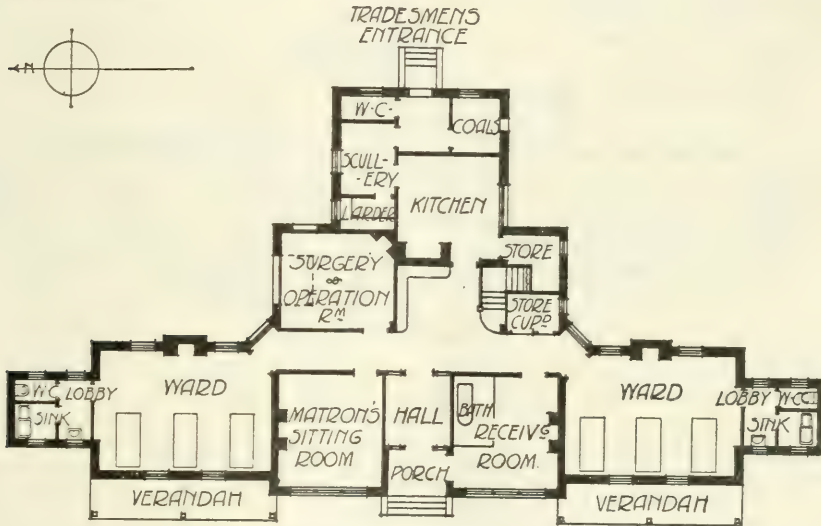
2. The Larger Type.

When the number of beds exceeds eight it

not necessary. With the increased number of beds a corresponding increase in the accommodation for the staff will be required; the one nurse in the small eight-bed hospital will become the matron, with two or more nurses under her, according to the number of beds; and one or more additional servants will be required. As the number of beds increases, so the number of



-COTTAGE-HOSPITAL-UPPER-FLOOR-PLAN-
-FOR-6-BEDS-



-GROUND-FLOOR-PLAN-

SCALE OF 10 0 10 20 30 40 50 60 FEET. -K-D-Y

FIG. 2.

will be found that the form of ward which is suitable for three or four patients is not the most convenient one for six beds and upwards. It becomes necessary with the increased number of beds to increase the width of the ward in order to get two rows of beds. For this a width of twenty-five feet will be found a convenient size; less than this would give too restricted a space between the ends of the beds, and more is

operations will also increase; and while the size of the operating-room itself need not be increased, it is desirable to provide a small room adjoining in which to put sterilizers and stores for dressings, etc.

As an example of a larger type of hospital we give a plan of the Crewkerne Hospital, which was erected in 1903. The building consists of two separate blocks, the front block containing

the wards and administrative offices, and the back block containing a small surgery for out-patients, coal-store, ambulance-house, laundry and mortuary. A covered way connects the two buildings.

In the front block are two wards for six beds each, two side wards for one bed each, board-room, staff common-room, operation-room, matron's bedroom, and kitchen offices. Part of this block has an upper storey in which are bedrooms for nurses and servants, bathroom, linen-room, and a special ward for one bed.

of this kind to enter into minute technical details of the best mode of construction for a Cottage Hospital, but certain points in which hospital construction differs from that of an ordinary dwelling-house must be dealt with.

Generally speaking, the construction of a Cottage Hospital should be of the best and soundest description, with a strict regard to economy and a rigid avoidance of anything approaching to extravagance. The use of the best materials for their several purposes is in the best sense of the word sound economy;

- CREWKERNE - COTTAGE - HOSPITAL -

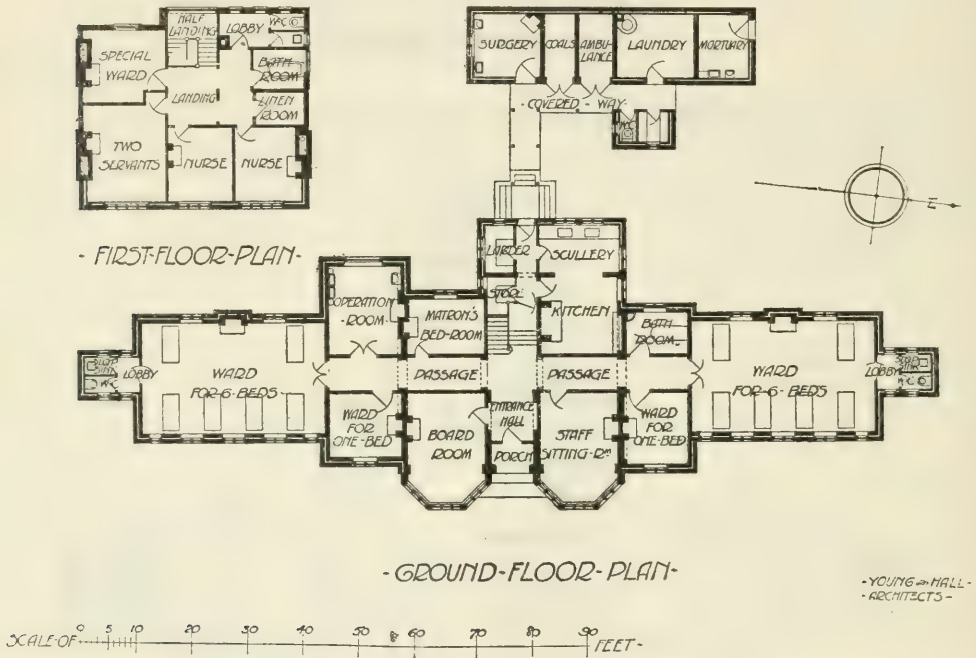


FIG. 3.

It will be seen that a plan of this type can readily be increased with very little modification; either by lengthening the wards or by adding an upper floor over the whole extent of the front block.

The question of future additions is one that is too frequently overlooked in planning a hospital. But it is most important that it should not be lost sight of. The task of adding to an existing building, when the needs of the neighbourhood call for extension, is frequently made far more difficult and costly than it need be, had the original building been planned with the possibility of additions kept well in view.

Construction

It is hardly necessary or desirable in a work

while indulgence in superfluous ornamentation is not only undesirable, but may become positively harmful. While, on the one hand, it is essential that everything which renders the process of cleaning easy should be carefully considered, on the other hand, the elaborate precautions adopted in large town hospitals for attaining the aseptic conditions which are the aim of the hospital architect, and which are frequently of a costly nature, are not required in a village hospital.

In the choice of materials for walls and roof the productions of the neighbourhood should be borne in mind, since it is a sound rule in any class of building to use, if possible, local materials. In a country producing nothing but bricks it is as absurd to import stone for

building the walls as it would be to use bricks only where stone is to be had for the digging. The same remark holds good with regard to roof coverings, with this proviso: that where there is little or no difference between the cost of slates and that of tiles, the latter should be preferred as being bad conductors of heat; a tiled roof protects the interior of a house from alternations of heat and cold much more efficiently than a slated one.

The same care that is, or should be, exercised in keeping a dwelling-house free from damp, whether rising from the ground or beating in through walls or roof, must be taken with regard to a hospital. A bed of concrete over the whole surface of the ground enclosed by the walls, an efficient damp-proof course in all walls above the ground line, and walls and roof coverings proof against driving rain, all require to be carefully provided for. In many places, especially in exposed sites in the country, hollow walls will be necessary to keep out driving rain; an alternative is to cover the walls with tiles or to render them with cement rough-cast. The hollow wall has the advantage of being a bad conductor of heat, and helps, therefore, to preserve a more even temperature; weather tiling, which is so characteristic of cottage building in Kent and Sussex, is perhaps to be preferred for æsthetic reasons; while rough-cast, lime-whitened or colour-washed, always looks well.

The chief things which require special consideration in the interior are—wall and floor surfaces, the joiners' work, *i. e.* doors and windows, and the sanitary fittings.

For the wall surfaces of wards, operating-rooms and the ward offices, for all parts of the building, in short, which are used for patients, a material which can readily be washed is essential. A hard plaster covered with one of the many forms of enamel paint gives a surface which is practically impervious and can be washed without injury, provided no material is used in the process which attacks the surface. The use of glass tiles or marble slabs in a Cottage Hospital cannot be justified on the ground of necessity. And, indeed, it is open to argument whether any form of tile or even marble slabs does not fall short of perfection, inasmuch as neither can be applied without joints; and the joints cannot in the nature of things be made as impervious as the tiles or marble, nor for that matter as a painted surface, which has the additional advantage of being perfectly smooth. The question of the best material for ward floors has given rise to much discussion, and to a variety of materials being used. The object to be sought for in a floor material is that it should present a firm impervious surface which can be easily cleaned, has no joints, and has a certain amount of resiliency. The old-fashioned

deal floor required to be scrubbed, and however well seasoned the wood may be in the beginning, the joints invariably widen and become storage places for all sorts of dirt. Besides the act of washing a floor is not a particularly desirable process to go on while patients are in bed. The evaporation after washing is objectionable, inasmuch as a great deal of the dirt which is scrubbed up in the process of washing is free to float about in the air and do definite mischief.

Teak and oak have both been used largely for ward floors; both are hard woods, but of the two teak is to be preferred if a wood floor must be adopted. All floors require to be scrubbed at times, and teak stands the process better than oak. Also it is superior to oak in its fire-resisting qualities. A wood floor, whether of teak or any other wood, must have joints; and these are the weak points of the material. However well seasoned the wood the joints must become a storage place for dust. All wood floors should be wax polished.

In some hospitals Terrazzo has been adopted. This is a mixture of marble chips and Portland cement, which certainly makes a very excellent floor and is practically everlasting. There are, however, objections to this. There is absolutely no resilience, and it is tiring to walk upon, although in our experience we have found nurses prefer it to a wax-polished teak floor. It cannot be said, however, that Terrazzo is an absolutely impervious material, the cement and some of the marble (especially the white variety) being to some extent absorbent; further, it is difficult, if not impossible, to avoid cracks.

A form of floor has been introduced within the last few years which has the enormous advantage of being absolutely jointless. This is a plastic material, the basis of which is a finely-ground sawdust with sometimes an admixture of asbestos. It is cemented in with chloride of magnesia and becomes a hard, impervious, jointless surface. There are several varieties of this kind of floor, amongst others being those known as Terrano, Doloment and Durato. This material has the advantage that it can be laid on old wood floors, and it can be worked up as a hollow skirting to meet the vertical plastering on the walls. It also has the very considerable advantage of being much cheaper than any of the other materials referred to.

Occasionally we come across a ward floor laid with wood blocks. This is probably one of the worst forms of ward floor that can be imagined. The joints required in wood blocks are far more numerous than in any boarded floor, and if a wood floor is to be adopted there is certainly no counterbalancing advantage in the use of blocks.

A detail which should not be lost sight of is

the necessity for providing some means of preventing the beds from being wheeled up against the wall and so damaging the surface. This can be done by modifying the form of the hollow skirting so that it presents an effectual obstacle to the contact between bed and wall.

The qualities which go to make a good ward floor are precisely those that are wanted in an operating theatre.

In regard to the joiners' work, *e.g.* doors, windows, etc., the special requirements in a hospital are all concerned with the avoidance of surfaces which favour the accumulation of dust. In every sash window which is not divided up by bars there are four corners in which dust will accumulate. If this sash be divided up by bars, say into four panes, the number of these corners will be increased to sixteen. It should be regarded as a rule that all windows in wards and operating-rooms and other places used by the patients must on no account be divided up by bars into small panes. The same principle must be applied to doors. It is perhaps not necessary in a Cottage Hospital to insist on solid flush doors without any panels, but the panels should not on any account be moulded, but have a plain rounded surface with the corners curved, so as to be easily cleaned. Flush doors are, however, a great advantage if the cost can be faced, because they are so easily kept clean, but they ought to be made of hard wood. Deal doors shrink and open at the joints more frequently than not; and the resulting crack in a solid door is, if anything, worse than would be the case with a panelled door.

The angles formed at the meeting of the vertical wall with the floor and the ceiling should be rounded to a radius of at least three inches, and the same treatment should be applied to the vertical angles of rooms.

In a word, the guiding principle in designing the interior finishings of a Cottage Hospital is the avoidance of all unnecessary lodging-places for dust, and the simplification of cleaning by all possible means.

Sanitary fittings in a hospital must be strong, simple in design, and with no inaccessible or uncleanable parts. The most important fitting is the bed-pan sink.

The old-fashioned sluice or sink in which a bed-pan was placed and a stream of water directed on to it from a tap was a most objectionable and even dangerous arrangement. It was practically impossible for the nurse to avoid being splashed; and to obviate this the McHardy sink was devised by the then professor of ophthalmology in King's College, whose name it bears. The main principle in this is that the bed-pan is placed in the sink face downwards, and a jet of water is projected upwards

into the centre of the pan. The nozzle of the pan is pointed downwards to the outlet of the sink, and thus the whole contents are flushed out without any possibility of splashing. The original sink was cumbersome and much bigger than necessary, and a very much improved form of sink, carried on brackets let into the wall, was produced by Messrs. Dent & Hellyer. There are now several different forms of bed-pan sink with the upward flush on the market; and also more than one in which the jet of water is admitted through the nozzle of the bed-pan. This is essentially a bad form and should be rejected. The flush is not so efficient as the upward action directed into the centre of the bed-pan, and another defect is that with this method of flushing the nozzles of the bed-pans frequently get broken.

On the question of water-closet apparatus there is not much need to go into great detail. The form is pretty clearly defined in all places where building by-laws are in force. The apparatus must have a basin of non-absorbent material, so formed as to contain a sufficient quantity of water, and so that all filth shall fall free of the sides and directly into the water. Immediately underneath the basin there must be an efficient syphon trap, so formed that a sufficient seal shall always be maintained between the basin and the drain. These requirements exclude all forms of apparatus except the "valve," the "washdown," and the "syphonic," which is a variant of the "washdown." For Cottage Hospital use a well-designed "washdown" apparatus is the most suitable; it should be supported on brackets, so that the floor can be freely cleaned in every part; and it should be supplied with a strongly made simple type of flushing cistern which gives a full discharge of three gallons when the lever is pulled. It is true that in some places the capacity of the cistern is limited to two gallons; but as a rule this restriction can be got over by a small annual payment—it is quite worth while to agree to this for the sake of the extra flush. It is hardly necessary to point out that enclosures to water-closet apparatus are dirt-traps which must on no account be tolerated in a hospital, and the seats should be simple hinged rings made of hard wood. The doors to the patients' closets should be made to open outwards, and if fitted with bolts must be provided with a key, so that the bolt can be opened from the outside. The reason for opening the door outwards is that if a patient faints or has a fit and falls, he is very likely to block the door if it opens inwards, and so render the task of getting him out difficult, if not impossible, without removing the door. In many hospitals no method of fastening is allowed on the doors to patients' closets, but the indicating bolt

with key to be used in case of need is, we think, the more seemly arrangement.

Sinks for use in the operating-room and for use in connection with the wards should be of glazed fireclay, and, like the water-closet apparatus, should in all cases be supported on brackets let into the wall. A useful form of sink for an operating-room is one which is formed with a draining shelf, both sink and shelf being formed of one piece of fireclay. Where wooden draining boards are required they should be made of teak and hinged, so that the underside can be exposed for cleaning. For the sanitary annexe a combination of a wash-up sink with a bed-pan sink, the former draining into the latter, is a useful arrangement. In a small hospital there will often be only sufficient room for one sink and a lavatory basin, and these will have to suffice for all purposes; but where space permits it is desirable to provide a small sink with a glass or marble shelf at the side for cleaning instruments. In all these sinks the waste outlet should be recessed and provided with a porcelain or vulcanite funnel or standing waste. This forms a combined plug and overflow, and can be lifted out and sterilized. A sink with a grated overflow or one formed by a series of small holes is quite unsuited for hospital work. The only other sink in a small hospital will be the scullery one; and the best form for this is one with hard wood sides and a cast-iron bottom. Glazed pottery-ware sinks are quite unsuited to the hard work of a scullery. No glaze will stand the constant impact of iron pots and pans; neither is a porcelain sink altogether the best kind for washing crockery.

The advantage of a sink with wooden sides is that the crockery is not so liable to fracture as would be the case with a hard material like glazed fireclay; while a cast iron bottom withstands the impact of iron vessels and does not injure crockery, because there is always at least a film of water at the bottom which prevents violent contact of plates and other vessels.

The lavatory basin for the surgeons' use in the operating-room should be large, made of white porcelain ware, and need not be provided with either plug or overflow. Over it should be fixed a rose through which cold, tepid or hot water is discharged by a mixing valve actuated by a lever so placed that it can be readily worked by the elbow. It should, however, be noted that the success or failure of a mixing valve depends on whether the pressure of water in the hot and cold pipes is fairly equal.

If there is a large difference in the head of water the mixing valve must be dispensed with and the pipes united with what is called a breeching piece, each pipe having its own

lever. By this means it is possible to control the supply, notwithstanding the difference in pressure.

Pedal action taps are not to be recommended, on the ground that the pedals obstruct the floor and hinder cleaning. They are, moreover, complicated and liable to get out of order.

The most suitable as well as the least expensive kind of bath for a hospital is one made in cast iron and finished inside with vitreous enamel. Enamel as applied to cast iron has been so greatly improved in recent years, that it may almost be said to be indestructible. The glazed fireclay baths are much heavier and more costly, and the surface is more slippery than that of an iron bath. Where space is limited and room cannot be afforded for access on both sides of a bath, it is advisable to adopt a swivel bath on wheels so that the bath can be swung out for cleaning the floor. The bath pivots on the waste pipe and cannot be fitted with an overflow; care, therefore, is necessary in its use, or a disastrous flood might be the consequence. The cost of a swivel bath is, however, very considerably more than that of a fixed one.

Among miscellaneous fittings that make for efficiency, are such things as hot water-pipes arranged as towel rails and as racks for bed-pans, rails for mackintoshes, glass shelves in operation-rooms over the lavatory basins to hold nail-brushes and disinfectants, and over the sinks to hold jars of solutions; a cupboard fitted with racks and shelves for the orderly keeping of brooms, and the various things used for cleaning, a store fitted with bins for patients' clothes, and fitted wardrobe cupboards in the staff bedrooms which have neither backs nor tops whereon dust may accumulate.

Ventilation and Warming

The controversy which has raged over the relative merits of the so-called natural and artificial methods of ventilation in hospital wards has happily not extended to Cottage Hospitals; and it is, therefore, not necessary to go into the details of "Plenum" or any other system of supplying the patients with heated air by forced draught. In a Cottage Hospital open windows and open fireplaces will be found to provide all that is necessary in the way of ventilation and warmth. To render ventilation effective, the wards must be planned with windows on opposite sides in order to secure cross ventilation or perflation. For warmth, an open fireplace with its radiant heat and cheery appearance will be sufficient for any Cottage Hospital ward, without the need for any supplementary heat from hot water coils or radiators.

It has been said above that a sufficient allowance of cubic space per head in a ward is 1000 feet. This is the standard adopted by

De Chaumont for adults in health, and is based on a permissible respiratory impurity of 0·2 cubic foot per 1000. More recent authorities (Carnelley, Haldane) have fixed the limit at 1·0 per 1000—which reduces the cubic space to 350. If, for hospital purposes, we adopt the higher standard, we shall find that the dimensions necessary are just those that are convenient for practical purposes.

It has been found by experience that the air of a room cannot be changed more than three times in the hour without causing draughts; and since, according to the standard adopted, an amount of 3000 cubic feet per hour must be supplied to each patient per hour in order to keep up the necessary purity of air, it follows that with a cubic space of 1000 feet per head the required purity will be kept up if the air be changed three times per hour.

There is one room, however, in which it is not desirable to have a fireplace if it can be avoided. This is the operating-room, which should, whenever practicable, be warmed by means of hot water radiators. In such a case it is necessary to provide means of ventilation other than by windows. Fresh air should be admitted at the back of each radiator, and an exhaust shaft provided at the highest point of the ceiling and as far away from the inlets for fresh air as possible. The radiators should be made to swing out on pivots to afford free access to the space behind, and for cleaning out the fresh air inlets. The efficiency of such a plan must depend solely on the wind and the difference in temperature between the outside and inside air unless it is possible to provide a forced draught by means of an electric fan.

K. D. Y.

III.—GENERAL SURGERY

TREATMENT OF WOUNDS

The great danger of wounds is the occurrence of various forms of septic infection, and the avoidance of this is a matter of primary importance. Other points in the treatment, such as methods of closure of the wound, the line of incision and so forth, are of secondary, though by no means of insignificant moment. I shall therefore direct my remarks essentially to the question of the prevention of wound infection. From this point of view we may divide wounds into several groups.

In the first place we have wounds made by the surgeon through unbroken and healthy skin. These are usually classed as simple incised wounds, and here the problem to be considered is how best to prevent infection of the wound by the surgeon during the course of the operation.

In the second place we have wounds which have not been made by the surgeon, but which have occurred accidentally. Some of these wounds may be clean cut, that is to say, simple incised wounds, but the majority are combined with considerable contusion and, in some cases, with laceration of the tissues. Hence we have, in the first place, to deal with a wound the surface of which is not thoroughly healthy, because the injury has more or less weakened the tissues, and in the second place, as the wound was not made by the surgeon, organisms, which are the cause of all these septic infections, will have gained entrance into the wound already. In regard to the latter point we must again distinguish between wounds which are seen by the surgeon very shortly after the infliction of the injury and those in which a considerable time, it may be two or three days, has elapsed before they come under notice. In the first group the problem to be dealt with from the point of view of wound infection is to attempt to destroy the micro-organisms which have already entered. In the second group this is not feasible, and the efforts of the surgeon must be directed to minimizing the effects of the infection which has already taken place.

In the third place we have incisions made through tissues which are already covered with bacteria, such as mucous membranes, or through structures which are already infected, such as inflamed or suppurating tissues. In neither of these cases can the entrance of organisms into the wound be prevented during the operation, and the aim of the surgeon is to keep the number

which enter as small as possible and to leave the tissues in a good state for resisting their attacks.

Wound Infection.—Infections of wounds are due to the entrance of micro-organisms, and in the great majority of cases, if not in all, they get into the wound from without, and not through the blood stream.

A great variety of organisms may be found in connection with wounds, but I only refer here to those which produce acute suppuration and general septic diseases. The organisms which produce septic troubles are the staphylococcus pyogenes aureus, staphylococcus pyogenes albus, and streptococcus pyogenes. Other organisms are found in wounds and produce septic troubles, but they are much more rarely met with, such as staphylococcus cereus aureus and albus, bacillus pyocyaneus, pneumobacilli, bacillus aerogenes capsulatus, the bacillus of malignant oedema, the tetanus bacillus, etc. Many other organisms enter wounds from the air, but those that are alive are, with rare exceptions, pure saprophytes, or if they are pathogenic they enter usually in very small numbers and cannot as a rule grow in the wound.

When these organisms enter wounds and grow there they set up a variety of troubles, which are grouped together under the heading of sepsis. These troubles vary from swelling, inflammation and local suppuration to diffuse cellulitis, lymphangitis, phlebitis, septicæmia, pyæmia, gangrene, etc. Once these organisms have gained a footing in the body, the subsequent course of events is not entirely under the control of the surgeon, although a good deal can be done by free drainage, ligature of veins and other means to avert the spread of the trouble.

Source of the Bacteria which usually Infect Wounds.—These septic organisms are not present in the healthy living tissues, being kept out by the epithelial covering, or if they enter, being rapidly destroyed in the blood. They, however, live readily on the free surfaces of the body, and especially in parts which are moist and where there is much sodden old epithelium. When the epithelial layer is injured these organisms may be introduced into the tissues by the instrument which caused the injury, and grow there, provided the other conditions are favourable, or they may grow in the blood or serum after they escape from the wound, and in this way they may very soon penetrate into it. While these organisms may be present on any part of the body, the

pyogenic cocci are especially found on parts where there is moisture or thick epithelium, for example on the scalp, in the axilla, the perineum, between the toes, under the nails, etc. They are also present in large numbers in the mouth and the alimentary tract. They are further present in the clothing, and on many surrounding objects, especially in hospitals where people congregate together and where there is much organic material in which they may grow. It is quite possible, also, that they may be present in air, especially when moist, but that is probably uncommon, and only happens under exceptional circumstances.

Resistance of Micro-Organisms to Noxious Agents.—The resistance of micro-organisms to noxious agents varies according as they are actively growing, or have passed into the spore stage. Only certain forms of bacteria, so far as we know, form spores, and there is a very marked difference in the resisting power between adult organisms and spores. The latter resist the action of destructive agents in a very remarkable degree. So far as we know the organisms belonging to the group of micrococci do not form resistant spores, although it is possible that some individuals in a group may have more resistant properties than others; hence they are very rapidly killed by a great variety of agents, and this is a most important point in connection with the treatment of wounds. Nevertheless, in the disinfection of the various materials which are employed during an operation, it is essential to employ means which will not only destroy naked bacteria, but also spores, because some of the spore-bearing organisms such as the tetanus bacillus, tubercle bacillus, bacilli which lead to gangrene, etc., may otherwise enter wounds and set up very grave disease.

Effects of Drying and Heating. So long as the material in which they are present is not allowed to dry the ordinary pyogenic organisms can retain their vitality for a long time, but thorough drying of micrococci, or naked bacteria (as distinguished from spores), even at the ordinary temperature, soon destroys their vitality. This is the reason why they are not as a rule present in a living state in ordinary dry air. On the other hand, the spores of bacteria are apparently quite unaffected by drying, and may retain their vitality in the dry state for an indefinite time.

Dry heat at a moderately high temperature will kill naked bacteria and cocci very quickly, but unless the temperature is very high, and is continued for a considerable time, spores may still survive. Hence, when dry heat is employed for the purpose of disinfection, it is well to keep up a temperature of about 270° F. for at least half an hour; a shorter time or a lower temperature will not ensure the destruction of spores.

Moist heat is more rapid and certain in its destructive action than dry heat, and boiling in water for twenty to thirty minutes may be relied on to kill all bacteria even in the spore condition.

Steam is intermediate between the two. Its action must be longer continued and it should be superheated and in motion, so that it may thoroughly penetrate the material to be disinfected. Superheated steam, under a pressure of 25 to 30 lb., if it has free access to the organisms, is quite effectual, but its action must be continued for at least twenty to thirty minutes. In sterilizing dressings, towels, wool, etc., the material must be packed quite loosely and a current of steam must pass through and penetrate to all parts of the dressings. If the steam is not in motion it does not penetrate and the centre of the dressings or other material will remain dry, and dry heat of 212° F., or even somewhat higher, is insufficient for satisfactory sterilization.

Effect of Chemical Substances (Antiseptics). Chemical substances were the means which were first employed in the early days of the antiseptic treatment of wounds for the purpose of killing bacteria. Just as in the case of heat, the effect of chemical substances on bacteria varies according as the organisms are in the adult or the spore form; further, the effect differs according to the surroundings of the organisms, more especially whether they are free or are present in various materials, such as albuminous or oily substances, which may prevent the proper access of the antiseptic to the bacteria. Spores show the same remarkable resistance to the action of antiseptics as they do to heat. Thus while antiseptics such as a five per cent. watery solution of carbolic acid or a 1-1000 watery solution of corrosive sublimate will destroy naked organisms in a few seconds, provided they gain thorough access to them, the same solutions may take many minutes or even hours to destroy spores.

The effect of the surroundings on the action of various antiseptics is a very important practical point. Take, for instance, the effect of albuminous materials. Some antiseptics, such as solutions of corrosive sublimate, cause coagulation of albumin, and this coagulated albumin forms a firm barrier around the organisms and prevents the access of the chemical substances to them, at any rate for a long time. Other antiseptics again, such as carbolic acid, even though they coagulate albumin, form a compound with it, which is in itself more or less antiseptic, and in this way the chemical substances may act, though much more slowly, on organisms present in the albuminous material. A good example of this is the varying effect of carbolic acid and bichloride of mercury

in destroying tubercle bacilli in tuberculous sputum. When this sputum is mixed with carbolic acid in sufficient concentration no tubercle bacilli are left alive after twenty-four hours, while with a strong solution of corrosive sublimate this result may not be obtained till a whole week has elapsed, and yet these two substances are equally active when brought in contact with organisms in salt solution.

A similar difference exists between these two antiseptics in the presence of oily substances. Carbolic acid very rapidly forms a solution in oil, and this oily solution acts destructively on bacteria. Corrosive sublimate, on the other hand, does not dissolve in oil, and if the organisms are present in an oily medium the sublimate solution may never come in contact with them. This is a point of great importance in the disinfection of the skin. The skin is covered with oily material secreted by the sebaceous glands, and if a watery solution of corrosive sublimate is applied to the skin it runs off like water off a duck's back, it does not mix with the oil, and does not gain access to the bacteria. The contrary is the case with carbolic acid, hence while skin can be satisfactorily disinfected by carbolic lotions of suitable strength, watery solutions of mercurial salts are quite inefficient.

A great variety of antiseptic substances are in use, but those which are chiefly of value are carbolic acid and bichloride or biniodide of mercury. The former is used in strengths varying from two to five per cent., according to circumstances, the latter is used in a 1-500 watery solution and upwards, the most common strength employed being 1-2000.

Relation of these Organisms to Infection.—There are three points of considerable practical importance which it is well to bear in mind with regard to the organisms which produce septic troubles.

In the first place these organisms vary in virulence, under some conditions being highly virulent, under others having only a slight degree of virulence. Apparently when they have been living for some time outside the body they lose a considerable portion of their virulence, while on the other hand, after living in the body, and especially after passing through several individuals, the virulence increases very much. This is especially exemplified when they grow in the peritoneal cavity and produce suppurative peritonitis. The fulminating septicaemia which sometimes follows post-mortem wounds generally occurs after post-mortem examinations of cases which have died of acute septic peritonitis and acute septicaemia, and there is every reason to believe that the terrible septic diseases which ran through hospital wards in the pre-Listerian period were caused by infection carried by surgeons and nurses from

one patient to another. Hence the practical point is that one must be very careful not to infect one's hands in operating on a septic case, and not to carry the infection to a clean one. Whenever it is possible, also, it is well to perform septic operations in a different theatre from that in which clean operations are done.

A second practical point to remember is that the severity of the subsequent infection depends, to a great extent, on the number or dose of bacteria introduced in the first instance, and that if for some reason or other one cannot avoid introducing bacteria, as in operations on mucous membranes, the dose should be as small as possible, in other words every antiseptic precaution should be taken as if one were dealing with a clean wound. This fact explains the success of some surgeons who do not take complete precautions to exclude bacteria from wounds, but nevertheless are very clean in their work, as apart from being strictly aseptic.

A third point of importance is that a good deal depends on the susceptibility of the patient. The general susceptibility of the patient is a matter, however, which is not to any material extent under the control of the surgeon. It is, nevertheless, the chief reason why I lay such great stress on strict asepsis, and on the prevention of the entrance of all bacteria into wounds. If this is successfully carried out one is not dependent on the resisting power of the patient. In cases where operations must be performed through mucous membranes, where strict asepsis is not possible, the suggestion has been made that the patient should be subjected to preliminary vaccination treatment in order to increase his resisting power. The difficulty is, however—apart from the question of the efficacy of vaccines—that one does not know with what particular organism the patient will be infected, nor is there always time to wait before the operation till the vaccine has produced its effect. Some years ago indeed I used antistreptococcic serum pretty extensively before severe operations on the throat and larynx, and I think with considerable benefit. The most practical conclusion, however, is that where there is reason to believe that a patient is particularly susceptible to septic infection, as is the case, for example, in a diabetic patient, very special care must be taken to avoid the entrance of any kind of bacteria into the wound, or, if that is impossible, to introduce as few as possible. And further in operating, especially in parts to which bacteria will gain access, one must be careful not to bruise or tear the tissues more than is absolutely necessary, as all injuries diminish the local resisting power.

As regards this question of susceptibility of the tissues, it must also be remembered that it varies in different tissues. For example,

the peritoneum can deal with bacteria in a way in which the cellular tissues cannot, and the same number of bacteria in the peritoneal cavity may lead to no trouble, which, if introduced into the cellular tissue, would set up serious sepsis. Lymphatic tissues, veins, bones and joints are the most susceptible tissues, and especial care should be taken as regards asepsis when operating on them.

Treatment of Wounds made by the Surgeon through Unbroken Skin in a Healthy Individual.—We may now apply the points which we have been discussing to the actual treatment of wounds, and we shall first take an operation through unbroken skin in a healthy patient. The problems which confront the surgeon here are that no organisms, except those present in the surrounding air, should gain access to the wound, either during or after the operation, and that, at the same time, the tissues should be injured as little as possible.

The first essential is that everything which is likely to come in contact with the wound, or to favour the admission of bacteria, shall be thoroughly disinfected, and wherever possible this should be done by means of heat. The instruments should be boiled for not less than ten minutes, and preferably for half-an-hour, especially if they have been previously used for septic cases. With the view of preventing the corrosion of the metal some carbonate of soda should be dissolved in the water, and the instruments should not be placed in the sterilizer till the water is actually boiling and all gases have been driven off. The only exceptions to this rule which I make are sharp instruments, such as knives, scissors or needles. Boiling them in the above manner is apt to destroy their edge; to avoid this some boil them in distilled water, and some use dry heat. Personally, I think the keenness of the edge is so important in operating that I do not boil them at all, but place them for a few minutes in undiluted liquid carbolic acid, transferring them subsequently to 1-20 carbolic solution till they are required for use.

As regards the disinfection of the materials used for ligatures and stitches, where silk, silk-worm gut, or horsehair are employed, they may be boiled in water, which, however, should not contain any carbonate of soda, and they can be kept afterwards in 1-20 carbolic lotion, or if they are not to be used for a considerable time, in absolute alcohol. As regards catgut, many methods are employed. Apart from the question of asepticity, catgut must undergo a certain amount of preparation, so as to ensure that it shall stand a reasonable strain, and that it shall not become absorbed too quickly. Catgut which has undergone no sort of preparation of this kind is quite useless, as it swells up and

the knots become undone in a very short time, and it is absorbed very quickly. Lord Lister spent a long time in experimenting with catgut, and ultimately produced the sulpho-chromic gut, which answers all requirements. In the course of its preparation the organisms which are naturally present in it in large numbers, and which come from the intestinal contents, are more or less completely destroyed, but as it comes from the shops it requires further sterilization before use, and to those who do not wish to use antiseptics this sterilization presents considerable difficulty, because if boiled in watery solutions it swells up and becomes useless. As a matter of fact, if it is kept in 1-20 watery solution of carbolic acid for two or three days its sterility may be relied on, but in my own practice I never use catgut unless it has soaked in this solution for at least a week, and as a rule before placing it in the 1-20 solution I steep it for a few hours in undiluted carbolic acid. The only disadvantage of the sulpho-chromic catgut is that thick threads are long in being absorbed, and if the material is badly prepared it may be hard and irritating. A variety of other methods of preparing and disinfecting catgut are employed, but I do not think that any of them are so good as the plan which I have recommended. Perhaps next to the sulpho-chromic gut the best is the iodine catgut as used by the Mayos of Rochester.

Sponges.—Swabs of gauze or of wool enclosed in gauze are the form of sponges that are most commonly used now-a-days. They are sterilized in the autoclave along with the dressings, aprons, etc., and are used dry. Personally I prefer marine sponges, as they absorb the blood more readily than gauze and keep the wound clean and dry, while there is not so much rubbing and consequent irritation of the cut surfaces as where gauze swabs are used. Another objection to gauze and wool sponges is that cotton threads are apt to become detached and left behind in the wound, and this may form a nidus for the growth of bacteria, should the latter gain access to the wound during the operation. The only disadvantage of marine sponges is that they cannot be sterilized by heat, but if they are well washed and soaked in soda and water and kept in 1-20 carbolic lotion for at least a week, they may be relied on as being quite sterile.

Dressings.—The dressings may consist of plain, non-medicated gauze and wool, or, as I prefer it, these materials impregnated with an antiseptic, such as the double cyanide of mercury and zinc in the case of the gauze, and salicylic acid in the case of the wool. In either case they must be thoroughly sterilized in an autoclave, and immediately afterwards the drum in which they lie must be sealed up, and

must not be opened again till the dressings are required for use. All aprons, masks, etc., must also be sterilized in an autoclave.

Gloves must be boiled, and in order that they should be kept under water they should be placed in a bag with a light weight over it. Towels and cloths which are used to surround the wound must be sterilized in an autoclave, or preferably, I think, boiled. One word of warning as to the autoclave. The ordinary small boiler which one finds in small nursing homes is quite useless, and consequently dangerous, as steam can never penetrate into the interior of the towels, dressings, etc., which are placed in them, and even if it did penetrate it is not hot enough to sterilize them. One must use a large high-pressure sterilizer.

Lastly, the skin of the operator's hands and arms and of the patient at and around the seat of the operation must also be sterilized, and this can only be done by the use of various antiseptics. It is true that some surgeons are content with thoroughly washing their hands and the skin of the patient with water, sometimes, no doubt, filtered, but this can hardly be recommended, and is fortunately not the usual practice. All sorts of methods have been devised for sterilizing the skin. In my opinion nothing is equal to thorough scrubbing with soap and 1-20 carbolic lotion. If this is done for a few minutes, and then a cloth wet in 1-20 carbolic lotion or even in 1-40 is kept on the skin for two or three hours, the disinfection will be found to be quite satisfactory. The most recent plan seems to be the use of two per cent. iodine applied to the dry skin. In the first instance the part is thoroughly scrubbed with soap and water and dried. Some time before the operation it is rubbed over with benzine, and then tincture of iodine is painted over the area of the operation. This, however, is, in my opinion, not nearly so good as carbolic acid. The iodine does not penetrate the epithelium in the same way, and in some cases it irritates the skin very considerably. Further it is quite unsuitable for the disinfection of the surgeon's hands and arms. As regards the disinfection of the surgeon's hands, many are content with simply washing their hands in sterilized water, and trust to rubber gloves to prevent infection of the wound; but it must be remembered that the hands under the gloves are not aseptic, and that if the gloves should become torn or punctured a septic finger at once comes in contact with the wound. Further, it has been found that towards the end of a long operation the hand in the glove is particularly septic, because perspiration is poured out, carrying with it probably bacteria from the deeper layers of the skin, while growth of bacteria on the surface is also going on. Hence

I always make a point of disinfecting my hands as thoroughly as I disinfect the gloves, and in putting on the gloves I fill them with 1-2000 sublimate solution, which enables one to put them on easily, and which also leaves a certain amount of antiseptic material in contact with the skin during the whole time of the operation. The result is that if by any chance the gloves are torn the hands are still aseptic. The objection to this method is that it may make the hands rough. No doubt skin differs very much in different persons, and some skins would not stand this treatment. Personally I have no trouble so long as I use carbolic acid procured by myself, which is especially pure. I believe a great deal of the objection to carbolic acid arises from the fact that the usual material obtained from the ordinary chemist's shop does not in any way deserve the term "pure" applied to it. I use specially refined material.

I may now describe the precautions which I take in performing an operation through unbroken skin to exclude sepsis.

In the first place the surroundings should be rendered as clean and as aseptic as possible. When the operation is performed in a hospital or in a nursing home with an operating theatre the conditions are comparatively easy, because the whole arrangement of the room has been designed so that it can be easily and thoroughly cleansed and all the furniture in it rendered aseptic, either by washing with antiseptics or by covering with sterilized cloths. In the case of a private house matters are not so easy, but I cannot say that I get sepsis in my cases operated on in private houses, any more frequently than I do in cases operated on in properly constructed theatres. In the case of a private house the room is thoroughly cleared out and the furniture arranged the day before the operation; the room is then shut up and the dust allowed to settle. An hour or so before the operation the nurse proceeds to make the special preparations, and all tables and furniture with which the surgeon or the nurses are to come in contact are covered with boiled or sterilized cloths or towels, the basins and dishes to be used during the operation have also been previously thoroughly boiled.

While the patient is being anæsthetized I wash my hands in running water in order to cleanse them from the coarse dirt. I may say that my assistants do exactly the same as I do. I then proceed to arrange the patient and the area of operation. The blankets or towels which keep the patient warm are completely covered with mackintoshes, which have previously been thoroughly washed with 1-20 carbolic lotion. Some forms of mackintosh material can be sterilized in the steriliser, but

it is apt to spoil them very soon. I then put on a mackintosh apron. The next step is to sterilize the area of the operation and the operator's hands and arms. This I do by first rubbing the skin with ether soap and then washing it with 1-20 watery solution of carbolic acid. I also use what Lord Lister termed his "strong mixture," which is 1-20 carbolic acid in which corrosive sublimate is dissolved in sufficient strength to make a 1-500 corrosive sublimate. I do not, however, lay any special stress on the presence of the corrosive sublimate, and am quite satisfied to carry out the sterilization with 1-20 carbolic lotion. The area of operation is well scrubbed with carbolic lotion, and while doing so my hands are also being thoroughly disinfected. In addition I wash my forearms with the same lotion. (I may say that this washing of the skin of the patient with antiseptic lotions should be done about a couple of hours before the operation and the area covered with a piece of cloth soaking in 1-40 carbolic lotion, and I carry out the second washing myself, partly with the view of being sure that it is thoroughly done and partly with the view of disinfecting my own hands and arms at the same time.) I next proceed to arrange the aseptic towels over the bed, completely covering the patient with them, with the exception of the area to be operated on. I prefer for this purpose boiled towels wrung out of warm 1-2000 sublimate solution to the dry sterilized towels, because any dust which may fall on the wet towels will be caught and held there and at the same time any non-spore-bearing organisms will in all probability be destroyed. There is thus less risk of contamination from the falling dust during the course of the operation where towels wet with 1-2000 sublimate solution are employed than when they are quite dry. The next procedure is to put on the mask if one proposes to wear it in the particular case, and it must be remembered that in putting it on one is apt to touch one's hair and possibly re-infect one's hands. The mask must therefore be put on before the gloves. Having put on the mask I rinse my hands again in 1-2000 sublimate solution and then put on either a sterilized gown outside the mackintosh apron, or, what I prefer in most cases, fasten a bib which has been boiled and squeezed out of the 1-2000 sublimate solution over the front of the mackintosh. The next procedure is to fasten on the sleeves, which are pinned to the sleeves of the mackintosh, and then last of all to put on the gloves. I have the gloves boiled and kept after boiling in a 1-2000 sublimate solution. In putting them on they are filled to the brim with this same lotion, and then the hand is inserted and the glove may be readily put on. In this way

the hand is left surrounded by a thin layer of antiseptic solution, and if the glove should happen to become punctured during the course of the operation, the skin of the fingers is aseptic and no harm is done. Proceeding in this order one may feel satisfied that the hands and gloves cannot become soiled, whereas this is extremely likely to happen if the gloves are put on early in the preparation of the patient, as is so often the case.

During the performance of the operation dust is constantly falling from the air on to the wound, the instruments and the surrounding objects, and the question is whether this dust should be disregarded, or whether an attempt should be made to minimize any possible infection which might occur from it. As we cannot see what bacteria are present in this dust, I think it is safest to assume that it may be infective and to take precautions accordingly. Hence after the instruments are boiled they are not left exposed to the air in a dry state, nor, as is often done, in boiled water or salt solution. I at once transfer them from the sterilizer to a solution of carbolic acid, 1-20 or 1-40, so that any dust which falls from the air shall be disinfected. For the same reason I use wet towels instead of dry, so that I shall not transfer this dust from my gloves to the interior of the wound during the operation. I have at hand basins of 1-2000 sublimate solution in which I rinse my hands from time to time. The only dust which I more or less disregard is that which falls into the wound. I do not wash out the wounds with antiseptics, because that would needlessly irritate them and would not get rid of any infection which may have taken place, but I do not think that any large amount of dust gains entrance to the wound during an operation, because it is carried away by the blood and by the sponging. At the same time, when I am not actually working in the wound I have it covered up with cloths; for example, if I stop to thread a needle the assistant covers up the wound with an aseptic cloth; if I have to do with a very large wound, such as an amputation of the breast, I cover up the part of the wound with which I am not at the moment working with aseptic cloths and only leave exposed to the air the particular region in which I am making the dissection. In opening a healthy joint I try as far as possible to keep the wound covered up except when I actually want to look in, and before making any movements of the joint by which air and dust may be sucked into its interior, I cover the wound with sponges or cloths. In this way I think the possible infection of the wound is reduced to a minimum, and I may say that I hardly ever see such a thing as wound infection.

In the dry method, or what is spoken of as

the aseptic method, the only difference is that the use of antiseptics is reduced to a minimum, and they are practically only employed for the disinfection of the skin. The cloths, swabs and sponges which are used during the operation are all dry, and no arrangements are made for counteracting any possible dust infection. Apart from that there is really no difference between the method which I advocate and that which is commonly in use, but I feel sure that one is running a considerable risk if one disregards possible infection of wounds, instruments, etc., from the air or from surrounding objects during the course of an operation.

When the operation is completed I employ dressings of cyanide gauze and salicylic wool which have been carefully disinfected, instead of the ordinary dressing of medicated wool. I can see no disadvantage in the former and no advantage in the latter. The object of applying any dressings at all is to avoid infection of the wound subsequent to the operation, and unless these dressings contain an antiseptic which prevents organisms growing in the dressing, the latter may develop in the discharge and very quickly reach the wound. If antiseptic dressings are not to be employed I believe it is better to apply no dressings at all. In ordinary circumstances the blood on the surface of the wound and around the stitches will dry up, and in the great majority of cases the wound should heal well under the scab.

Other Points apart from Asepsis.—To obtain union by first intention it is necessary, in addition to the exclusion of bacteria, to close the wound completely, and to leave no cavities, or what are often called "dead spaces," in its interior. If they are present they fill with blood, and while in many cases the blood clots become organized and healing occurs readily, in some cases, especially where the cavity is large, this does not occur, and the wound becomes distended with serum, which has to be let out and drained, and in this way delay in healing is occasioned. Where the space is small the pressure of the dressing may cause the sides to come together, but if it is of any size other means must be employed. These may consist in bringing the sides of these cavities together by sutures so as to obliterate them completely, the sutures being composed of catgut which is so prepared as to be absorbed in from four to eight days. Where this is impracticable a drainage tube must be inserted for two or three days, so as to let all the excess of blood escape and leave only solid clot which will organize. In some cases as in extensive excisions of the breast, amputations, etc., it is always advisable to put in a drainage tube for two or three days.

As regards stitches a great many materials

are used, according to the fancy of the surgeon, and so long as they are thoroughly sterile, and the skin has been thoroughly disinfected, the actual material is really of very little importance except as regards the stitch marks. Silver wire, silk, catgut, horsehair, silkworm gut, etc., are all employed. The essential points are to have the cut edges accurately approximated with as little tension as possible. Where skin has been taken away and a certain amount of tension is unavoidable, it is well to put in three or four stitches which enter at some distance from the cut edges and take a deep hold, and then a row of fine stitches, preferably continuous button-hole sutures, to bring the cut edges into apposition. I prefer to use silver wire for the deep sutures, while for the superficial ones I usually employ silk, and, with the view of avoiding stitch marks, it is well to use round needles which push aside the tissues rather than cut them. As they are difficult to put in, a needle holder must be employed to push them through the skin, and a pair of broad forceps to pull them through. In parts where the scar shows, as on the face and neck, a continuous subcutaneous catgut stitch may be employed, reinforced by strips of gauze fixed with collodion, with the view of pulling the edges of the skin together.

Where the edges of the skin cannot be brought together a plastic operation may be performed, or the exposed surface may be allowed to heal, or it may be covered with skin grafts at once or a few days after the operation.

Immediate skin grafting is also useful in a good many cases where a plastic operation would mean additional scars, and where also the patient might not be able to stand additional cutting and loss of blood. Care must be taken that the skin from which the graft is cut shall have been thoroughly disinfected. Where there is a deep communication, as in breast wounds communicating with the axilla, I prefer not to skin graft immediately, in case the skin has not been thoroughly disinfected, but to wait for a week or ten days till the axilla has closed.

Where neither plastic operation nor skin grafting are employed the wound must be kept aseptic and protected from the irritation of the dressing by the interposition of Lister's "protective." If asepsis is maintained the wound becomes covered with blood clot, which remains and becomes organized in its deeper layers, while epithelium spreads over the organizing tissues, but beneath the outer layer of blood clot. After two or three weeks a superficial layer of dried blood clot may be peeled off and a scar will be found beneath.

Wounds which have become Infected before they come under the care of the Surgeon.—These are of two classes, viz. (a) those where the wound is quite recent (a matter of a few

hours), and (b) those where a considerable time has elapsed since its infliction. The treatment of these two cases differs very considerably.

(a) Where the wound has been quite recently inflicted there may still be a chance of eradicating the infection which may have occurred—the organisms may not yet have spread into and established themselves in the tissues. Hence in these cases the wound should be opened up, all blood clots cleared out, all soiled and bruised tissues clipped away, and the whole surface soaked with carbolic lotion 1–20, or where it is badly soiled, sponged over with undiluted carbolic acid. The skin around must of course be disinfected and all aseptic precautions taken. Some of those who place great faith in iodine dry the surface of the skin and paint the iodine solution over it, and also paint the whole surface of the wound with iodine. Free drainage must also be established, counter-openings being made if necessary. A large proportion of cases dealt with in this way soon after the injury run an aseptic course.

(b) When some days have elapsed since the infliction of the wound the problem is a totally different one. There is now no chance of rendering the wound aseptic, and the aim of the surgeon must be to mitigate the resulting sepsis and its results as far as possible. By this time the wound will be beginning to granulate and suppurate, and practically all that it is wise to do at this stage is to secure that there shall be proper drainage for the discharge. If necessary, counter-openings must be made and drainage tubes inserted. There must, however, be as little handling of the wound as possible, so as not to tear or injure the young granulation layer, and so open up a point of entrance for the septic material into the body. It is also most inadvisable to irritate the wound by the application of antiseptics, as is so often done, as this injures the granulation cells, which form the protective layer which nature is building up against the entrance of septic material. Salt solution, boracic lotion, etc., are the most suitable fluids for washing out the wound. The state of matters here is quite different from what exists in a wound through unbroken skin. In that case, if properly carried out, living pathogenic organisms are not admitted into the wound, and it therefore does not really matter whether the tissues are somewhat irritated or not, as the bacteria are not there to take advantage of it; but in this case the bacteria are present and growing in abundance, and anything which in any way weakens the resisting power of the granulation barrier will favour the extension of the septic process. It is curious that so much care is usually taken to prevent irritation of uninfected wounds with antiseptics, while infected wounds are pulled about

and irrigated with antiseptics, just the reverse of what is important and essential.

Wounds made by the Surgeon and involving Mucous Surfaces or passing through Infected Tissues.—Here it is not possible to prevent the entrance of organisms, and all that one can do is to try to mitigate their effects. In the first place it is not advisable to introduce other organisms than those already present, and therefore all the aseptic precautions already mentioned should be adopted, and gloves should be worn to prevent the surgeon soiling his hands.

In the second place great care should be taken to leave the tissues in as strong and resistant a condition as possible. There should be no tearing or bruising of tissues, no washing with antiseptics, and as little rubbing with sponges and swabs as possible. Free drainage of discharges should be provided for, and in many cases it is well to leave the wound freely open. In these cases, where there is much suppuration or cellulitis, constant irrigation or use of the water bath are often of great value.

In using irrigation and the water bath the fluid employed should be salt solution, or some mild antiseptic, such as Condy's fluid, which does not coagulate albumin. These should be used at the body temperature. The skin around is covered with oil so as to keep it from becoming sodden, and the irrigation or water bath are kept up for about twelve out of the twenty-four hours. They are discontinued during sleep, and hot boracic fomentations are substituted for them.

It is the fashion at present to use vaccines in these cases, and sometimes they may be of value, but I have seen several cases where they have certainly done harm. Hence unless the case is getting rapidly worse I do not use them, and then only in quite small doses.

W. W. C.

INFLAMMATION

The activities of a living cell gently excited by any mechanical, chemical or other stimulus are increased. If this stimulation be excessive the cell may be greatly damaged, but so long as it remains alive it reacts. This applies also to collections of cells or "tissues." Lister, using a hot needle, demonstrated the effect of an irritant on ciliated epithelial cells. As the needle first approaches the cell the cilia become more and more active, but at a certain point the motion begins to slow down, becomes very sluggish, may cease, and, if the needle be brought too near, may never be resumed. If, however, the needle be drawn away before any great damage has been done, the cilia may again become active, and if other conditions

be favourable, the normal activities of the cell may be regained. These are some of the phenomena of inflammation. The manifestations of cell activity being so varied, it will readily be understood how different are the conceptions of inflammation according as the observer fixes his attention on all, or on some only, of the phenomena observed in cells during the course of an "inflammation."

Burdon Sanderson's definition of inflammation, "The response of living tissues to injury," . . . "The succession of changes (reaction) which occur in a living tissue when it is injured, provided that the injury is not of such a degree as at once to destroy its structure and vitality," is at once perhaps the most accurate, concise and comprehensive of the many definitions that have been given.

Inflammation has also been described as (1) a condition of impaired nutrition; (2) a special series of conditions associated merely with lowered vitality; (3) a process merely preliminary to repair; (4) a process of repair; and (5) a series of symptoms. It is associated with all of these, but not one of them connotes the whole process. By some writers inflammation is regarded as a condition in which vascular changes are primary and essential; whilst others, *e.g.* Metchnikoff, maintain that the blood-vessels have little or no relation to the inflammatory process, except incidentally. Inflammation occurring in an organism may affect any of its tissues. In certain worms and holothurians, in which no blood-vessels are met with, the phenomena of inflammation may be manifested in the fixed cells of the ectoderm or endoderm, as well as in the motile cells floating in the body-cavity. Here the manifestations must be essentially different from those met with in organisms in which a series of well-defined channels—blood and lymph vessels—carry nutriment rapidly to and from all parts of the body. It is, however, impossible to have inflammation in any vascular tissue without the elementary cells, of which not only the vessels but the surrounding tissues are built up, becoming involved.

A complex inflammatory process occurs in complex tissues, but as these tissues are made up of individual cells, each of which reacts to the presence of an irritant in a comparatively simple fashion, the whole process may be resolved into its simpler manifestations. In Metchnikoff's experiment on the gastrula of the *astropecten*, in which a thorn is pushed through the wall of the body-cavity, the floating, actively amœboid cells are attracted in great numbers to the foreign body, surround it and act as phagocytes. Some of the ectoderm and branching endoderm cells through which the thorn has passed appear to be destroyed, but others

begin to multiply and become embryonic in form. The chemiotactic action by which the amœboid cells are attracted to the foreign body is a very important factor in the inflammatory process. Metchnikoff showed that certain amœboid organisms placed in a neutral and isotonic fluid remain inactive. If food be carefully added, at some distance from these motionless organisms, they immediately begin to move towards this food (trophotaxis). If, instead of food, some noxious or toxic substance is added to the fluid, with as little mixing or diffusion as possible, the organisms again become active, but now retire, often very rapidly, from the neighbourhood of the noxious matter (negative chemiotaxis). As this material becomes diluted through diffusion, the amœboid cells, instead of retiring, again advance (positive chemiotaxis) as the cells become accustomed to the presence of even concentrated toxins, and they resume their functions under the altered conditions.

Coming now to another set of factors, Cohnheim describes the vascular changes observed in the tongue and the omentum of a frog stretched out and placed, in a warm moist medium, under the microscope. After noting the normal condition of the blood-vessels and the rate of the blood flow through them Cohnheim applied an irritant—such as nitrate of silver or acetic acid—to the tissue surface. An almost instantaneous contraction of the walls of the arterioles occurs, and then marked dilation of arterioles, veins and capillaries and increased flow of blood through them—acute hyperæmia. A slowing of the circulation follows, the individual leucocytes being seen rolling along the wall of the vessel, the red blood corpuscles keeping in the centre of the stream. The current continuing to slow, the leucocytes or the endothelial cells of the vessel walls, or both, become sticky, the former adhering to the endothelial cells, though the free portion of each leucocyte is dragged along by the moving blood, and the cell becomes elongated or pear-shaped. Ultimately after some oscillation the circulation may cease, the leucocytes develop greater amœboid activity and some wander back amongst the red blood corpuscles, whilst others appear to make their way through the wall of the vessel. At the same time the nuclei of the endothelial cells become more active and, the cytoplasm accumulating around them, the cells project into the lumen of the vessel. Near the margin of each cell this cytoplasm, with the cement substance, forms a very thin film, even though no actual "stomata" appear. The resistance to the passage of the amœboid leucocytes through the walls of the capillaries and small veins is greatly diminished and they pass readily into the perivascular lymph spaces. Similar increased cellular activity may be

observed in the irritated connective-tissue or endothelial cells, whether lining a large serous cavity or a connective-tissue space. These cells become more round and viscid; the nuclei become more active and begin to divide. Before this commences, however, fluid and a number of polymorphonuclear leucocytes, leaving the vascular channels, accumulate in the tissue spaces around the irritant material. Dawson has observed a similar migration of lymphocytes by the lymphatics. In acute inflammation blood plasma passes from the distended vessels into the surrounding lymph spaces; leucocytes and blood platelets follow, and these, breaking down, combine with the fibrinogen and lime salts of the plasma to form the fibrin that may be seen lying not only on the inflamed surfaces of the large serous cavities, as in acute pleurisy and pericarditis, but also within the small lymph or tissue spaces. Chemiotaxis is a marked manifestation of acute inflammation; degeneration of the leucocytes of purulent inflammation. When the products of *B. pyocyaneus* are injected into the anterior chamber of the eye a large number of polymorphonuclear leucocytes, attracted by these products, accumulate rapidly in front of the lower sector of the iris. If, however, before injecting the products into this chamber a small amount of the same substance be injected into the marginal vein of the ear, no hypopyon appears—the leucocytes do not leave the blood-vessels.

This may also be noted in connection with the lesions produced by the bacillus of symptomatic anthrax. Injected into the leg muscle of a rabbit it gives rise to a regular abscess, an enormous number of polymorphonuclear leucocytes being attracted from the vessels. There is also evidence of local tissue reaction, and the animal recovers. If, however, when the injection is made into the leg muscle the marginal vein of the ear is injected with the same material the animal usually succumbs within fifteen hours, and although there may be great swelling and accumulation of fluid between the muscle fibres, no emigrated leucocytes are found and the bacilli have been able to multiply unhampered by their attacks. Here, as in the example given above, the action of the poison within the vessels has neutralized that without—one chemiotactic force has neutralized the other.

Micro-organisms, the commonest causes of inflammation, acting upon the cells either directly or through their toxins, may give rise to any of the changes described above. Metchnikoff insists, moreover, that in the presence of bacteria the polymorphonuclear leucocytes at an early stage, and later the fixed connective-tissue cells, endothelial cells and mononuclear hyaline cells of the blood, have the power of

englobing and digesting bacteria that have gained access to the tissues—phagocytosis. The latter group deal not only with any bacteria that may have escaped the polymorphonuclear cells, but also with the phagocytic polymorphs themselves, especially when they have been greatly damaged by the ingested bacteria.

Von Fodor early noted that living blood and the blood plasma have distinct bactericidal properties. Then Nuttall observed that blood serum taken from a blood clot in which numerous leucocytes had disintegrated to help in the formation of fibrin was even more active. Lubarsch confirmed this, and showed that the whole blood of a living rabbit is capable of killing about 16,000 anthrax bacilli, but that fifteen drops of the serum expressed from the clotted blood of a similar rabbit will kill an equal number of bacilli.

Certain phenomena (Celsus's phenomena) are usually associated with inflammation:—(1) *Redness* from congestion of the vessels; (2) *Swelling* due to the dilation of the vessels, the increased passage of blood into the surrounding lymph spaces and absorption by the tissues, the emigration of leucocytes and proliferation of the fixed cells. In the more active organs there is, along with these vascular and connective-tissue changes, swelling and granularity of the parenchymatous cells, which absorb an increased amount of fluid, the nucleus becoming obscured; (3) *Heat* from increased or altered metabolic activity and from an increased supply of warmed blood coming from the visceral organs to the inflamed part; (4) *Pain* due to pressure of distended vessels, swollen tissues and exudations on the sensory nerves, especially as they pass through foramina in bone or through non-yielding fasciæ or fibrous membranes. To these four "cardinal symptoms" John Hunter added a fifth, loss or alteration of function resulting from damage to the tissues.

In the irritated or damaged non-vascular cornea, tendon and cartilage, where lymph channels take the place of blood-vessels, chemiotaxis and proliferation go on more slowly, otherwise the process is essentially the same as in vascular tissue. The vessels at the margin of the inflamed cornea may become permanently distended, and if the process of irritation be long continued, branches very like those seen in "granulation" tissue may be projected into the altered substance of the cornea:—pannus. Inflammation may end in resolution, in which event there is a more or less rapid return of the vessels and tissues to the normal. Again, there may be a "formative inflammation" where proliferation principally of the fixed connective-tissue cells, though other cells may undergo similar but less-marked proliferative

changes, is the most prominent feature of the process, and the new tissue, usually connective-tissue, is formed. This in time loses most of its blood-vessels and becomes fibrous and cicatricial as the cells diminish in number and in prominence and the fibrous tissue contracts. This formative process may follow great loss of tissue due to the irritant digestive and destructive action of pathogenetic organisms—abscess formation.

A similar formative process goes on in the fibrin covering acutely inflamed serous membranes, the fibrin serving as a temporary scaffolding in and on which the new tissue may be built up. On inflamed mucous surfaces no fibrin is deposited—merely a mucinous fluid in which are granules and altered leucocytes. This mucin may come from the muciparous glands, and perhaps also from, through or between the epithelium, by which the plasma appears to be modified.

In chronic inflammation of the mucous surfaces the columnar and cubical epithelial cells are often replaced by rounded or pyriform cells, which seem to lose the power of transforming the fibrinous elements of the blood into mucin, with the result that fibrin may appear upon these chronically inflamed mucous surfaces during acute exacerbations of the process.

G. S. W.

SUPPURATION

Suppuration is due to the infection of the tissues of the body with pyogenic micro-organisms. By the products of their activity inflammation of a varying degree is caused which, according to its degree of localisation, gives rise to an abscess or cellulitis.

Pus is the fluid resulting from the process of suppuration. It is of varying consistency, but typically has a specific gravity of 1030 and an alkaline reaction. If examined under the microscope it is seen to contain a number of cells called pus corpuscles; these consist for the greater part of polymorphonuclear leucocytes, but also of epithelial and red blood cells, and in the acuter forms of suppuration the red cells may be present in large quantities. These pus cells are often broken up or partially digested, and in them and in the fluid around them may be seen the organisms that are causing the suppuration undergoing phagocytosis. A culture from the pus inoculated on to appropriate media and in proper dilutions will reveal the character of the organism, or organisms if more than one variety is involved.

Pus varies much in constitution and colour, depending on many circumstances, such as the nature of the infecting agent, the resistance of the individual and the chronicity of the infection. For instance, it may vary from the thin watery

or sanious exudation seen in some forms of acute spreading cellulitis to the thick creamy pus of a carbuncle or the cheesy pus from an old tuberculous abscess. The colour is generally yellowish, but it may be red if mixed with blood, or even blue if due to the action of the bacillus pyocyaneus.

Causation of Suppuration. The organisms that give rise to suppuration are termed "pyogenic." The commonest members of this class are the staphylococci, the streptococci and the bacillus coli communis, while amongst others may be mentioned the gonococcus, the pneumococcus the bacillus pyocyaneus and, with a certain reservation because the pus is not usually fluid, the tubercle bacillus. With these must be included the anaerobic bacilli, the importance of which organisms must not be neglected, though the degree of their action is difficult to measure.

It may be said, then, that suppuration is directly due to infection, but it must not be thought that every inoculation with a pyogenic organism produces pus; there are a number of other factors, very imperfectly known at present but of extreme importance, to be taken into consideration. It is common knowledge that many wounds which must obviously be infected do not suppurate, and yet in other instances a prick from a needle may be sufficient to cause death. When an attempt is made to state in brief form the nature of these secondary factors, difficulties immediately arise on account of our limited knowledge of the subject. There have to be taken into account the quantity of the organisms entering the body, the virulence of the organisms, and the condition of the host and the part infected. It is well known that an area of the body weakened by injury or disease is prone to yield to the invasion of micro-organisms, and also that suppuration is less likely to occur in a region richly supplied with blood than in an area with a poor or deficient circulation. In fact it may be said that any cause which lessens the vitality of the body, such as cold, deficient nerve supply or chemical irritation, can be regarded as a predisposing cause of suppuration.

All these different factors, and probably many others concerning which medical knowledge is at present deficient, may be summed up in the words "resistance of the body to infection," and the attempt to explain this would be to attempt an explanation of the whole theory of immunity, which is entirely beyond the scope of this article.

Varieties of Infection. For purposes of convenience it is usual to distinguish two main types of infection, namely, that characterized by the formation of a localised abscess and that by a spreading or diffuse cellulitis. Roughly

speaking, localised abscesses are more likely to be caused by staphylococci and a diffuse cellulitis by streptococci. Though this is in the main true, it is by no means a universal rule, and it is to be urged that a diagnosis of the infecting agent should in all cases be made by means of bacteriological methods. It is surprising, if this rule is obeyed, what a number of instances are met with in which the organism actually responsible for the disease is different from what is expected.

Acute Localised Abscesses.—An acute abscess may be found in any part of the body as the result of the invasions of bacteria which have reached the part either through abrasions of the surface epithelium or have been conveyed by the ducts of glands, by the lymphatics or by the blood stream.

Clinical Characteristics. The local signs are those of inflammation, namely pain, heat, redness and swelling, and if the abscess is big enough and near enough to the surface of the body, "fluctuation" may be obtained. These signs vary very much in degree, and some of them may not be present at all or in a very minor form. For instance, a patient may have an abscess in a part of the body where the cellular tissue is very loose, and experience remarkably little pain, or, on the other hand, where the pus is under tension and nerves are pressed on, as in an alveolar abscess, the pain is excruciating. The general symptoms are malaise, fever, rise of pulse-rate, a furred tongue and other symptoms such as are associated with inflammation and infection.

Differential Diagnosis. A well-marked superficial abscess gives rise in the majority of cases to no difficulties of diagnosis, but it is a very different matter when the abscess is situated in the viscera, such as the liver, or is in connection with the intestines.

Examination of the Blood as an Aid to Diagnosis. (Leucocytosis.) The average number of white cells per cubic millimetre is 6000. Any increase in the numbers is termed leucocytosis, and this may be physiological or pathological. A physiological leucocytosis occurs during digestion, after cold baths, in infancy and in pregnancy. As a result of these changes the count may rise to 10,000 or 12,000; anything above that amount may be reckoned as pathological.

Leucocytosis occurs in a large number of the microbic infections, but it is a most important and helpful fact that it is almost always present in any form of pyogenic infection. The degree of leucocytosis varies, but in the majority of cases is between 15,000 and 20,000 per cubic millimetre. As a diagnostic agent, therefore, an examination of the blood may be of great service but it must not be used to the exclusion of the other clinical signs, for in the worst forms of

sepsis, in which no reaction of the body is taking place, the number of leucocytes is not increased and may even be diminished.

Treatment of Acute Localised Abscess. The main principle of treatment, which has no exception, is incision and drainage. As a general rule the incision should be in the most dependent part, so as to promote free drainage, and should be sufficiently large to admit the finger, so that all septa may be broken down and no recesses left in which the pus may burrow. The drainage tube used should be of sufficiently large size to allow the passage of thick pus, and for this purpose it is better to use a good rubber tube rather than a gauze wick or a cigarette drain. It is not advisable to wash out the cavity with antiseptic solutions and probably aseptic fluids are also useless—the main thing is an efficient drain.

It seems unnecessary to insist on the opening of the abscess on as rigid aseptic principles as in a clean operation, because it is well known that the introduction of further organisms into an abscess may seriously impede the healing process, and indeed may greatly increase the virulence of the existing organism.

Where pus lies deeply in the neck, in close contact with important vessels, "Hilton's method" of opening abscesses may be employed. An incision is made through the skin and fascia, as deep as is consistent with safety. A grooved director is then pushed into the deeper tissues until pus escapes along it, and then a pair of pressure forceps with the blades closed is pushed along the groove of the director and withdrawn with the blades expanded. A drainage tube is then inserted into the cavity.

Vaccine and serum treatment are rarely necessary in the treatment of acute abscess, *but the rule of finding out the nature of the infecting agent should none the less be observed owing to the possibility of a spread of infection, so that in such a case the appropriate vaccine may be given without delay.*

The treatment of abscesses must, of course, vary with different regions of the body, though the main principles remain the same whether the abscess is within the thorax or the peritoneal cavity; the treatment of these conditions must be sought under the appropriate headings.

Acute Suppuration of a Mucous Surface.—Infection of a mucous surface, such as that covering the bladder, the urethra, the air sinuses and the middle ear, is followed by the usual signs of inflammation and suppuration. The main principles of treatment obtain here also, namely, the provision of a free exit for the discharge.

Diffuse Cellulitis.—In this condition, instead of the formation of a local abscess, wide areas of tissue are infected, the inflammatory process

spreading along planes of fascia, intermuscular septa and tendon sheaths. Bacteria may also be conveyed by means of the lymphatics to the lymphatic glands or more distant parts of the body, and they may even reach the blood stream and give rise to septicæmia. The infecting agent is very likely to be one of the streptococci, particularly the streptococcus pyogenes, though other organisms may be found.

The source of infection may be very insignificant, such as a pin-prick, a scratch, or the bite of an insect. If an incision is made into the tissues a thin blood-stained fluid exudes and no true pus except in the late stages.

Clinical Characteristics. The skin around the seat of infection becomes painful at quite an early stage, and shortly after redness and œdema appear and spread, often with the most alarming rapidity. The lymph vessels running from the place usually show on the skin as red streaks, and the adjacent lymph glands become swollen and acutely tender. In the meanwhile the constitutional signs are severe. There is often an initial rigor or rigors, the temperature rises often to 103° or 105° and the pulse-rate is proportionally high. Leucocytosis, except in the most severe cases, is also present (15,000 to 30,000).

Course of the Disease. If the virulence of the infection is low or the resistance of the individual high the disease may be arrested here and the inflammatory signs diminish, or the trouble may become localised and an abscess result. On the other hand all the signs may become worse, the inflammation spread, and the skin may become covered with blebs and later boggy and soft, eventually breaking and discharging a thin form of pus. There is extreme danger then that a general infection by the blood stream may eventuate, leading to the formation of pyæmic abscesses in the lungs, brain and other viscera.

Treatment of Diffuse Cellulitis. This must of necessity vary considerably according to the site and extent of the affected area. The great aim is that it should be recognized and treated early, for there are very few cases that do not yield to treatment. In any case of cellulitis of even moderate severity incisions should be made at once through the skin into the affected tissues, and the old idea of waiting for pus to form or to see if pus will form, is to be disregarded. Bier's method of producing hyperæmia by the use of constricting bandages is in great favour with some surgeons, and there can be no doubt that good results have followed this method of treatment if combined with incisions: it should by no means be allowed to replace them. The incisions should be made through the skin into the subcutaneous tissue and should be fairly long, about one inch

in the case of fingers and two to three inches in the case of the head and limbs, not mere stabs. As the operation is extremely painful an anæsthetic should always be given if possible. A culture from the exuded fluid should always be made at the time of operation. The incisions should be plugged with dry gauze and the part dry dressed for a few hours in order to arrest hæmorrhage. Then the whole of the affected part should, when practicable, be placed in a bath of hot water to soak for several hours. It is common to add to the water various antiseptics, viz. iodine (one drachm to the pint) or sanitas or boric acid. It probably does not matter whether such substances are used or not; the main thing being to encourage the ready exit of the exuded fluid and free circulation of the blood. In bad cases the affected part is to be allowed to soak for six or eight hours a day and between whiles large boric acid fomentations may be applied.

If the cellulitis still spreads, further incisions are to be made without hesitation. After the lapse of one or two days the wounds generally begin to suppurate freely; this is in itself not a bad sign, for it shows that the tissues are reacting. In the worst cases that end fatally no pus may be formed at all. As aids to the above-mentioned forms of treatment antitoxic sera and vaccines should be used.

Cellulitis in Different Regions.—The above are the general features of cellulitis and its treatment; naturally these vary somewhat in different parts of the body.

Cellulitis of the Head and Neck.—The spread of infection in these regions may be extraordinarily rapid owing to the loose nature of the tissues and the free communication by means of the lymphatics, and for this reason even more care is to be taken than usual to prevent the spread of infection. Cellulitis of the neck below the deep layer of cervical fascia is very formidable, on account of the fact that it may give rise to mediastinitis or spread to the larynx, causing œdema of the glottis and dyspnoea.

Septic Fingers (Whitlow).—Though apparently at first sight these are but trifling ailments, they are in reality most serious, and if neglected may lead to the crippling of a hand and the loss of fingers and even of life. The infection may start from an insignificant source, such as a prick from a needle, a thorn, a splinter or even from a "hang nail." The trouble first manifests itself by pain, swelling and throbbing: the skin soon becomes red, and the fleshy part of the finger, instead of being soft and elastic, becomes hard and resistant. In the acuter forms the lymphatics show as red streaks running up the arm and the lymphatic glands become enlarged and tender. In past years it used to be the

custom to wait before making an incision to see if pus formed. This is a great mistake, for by an early incision much valuable time may be saved and the possible extension of infection up the arm and involvement of tendon sheaths avoided. A free incision about one inch long should be made into the affected area and down to the subcutaneous layer and then the treatment carried out as recommended above for diffuse cellulitis.

A culture from the finger should always be made at the time of the operation, however trivial the appearance of the inflammation, for it is impossible to tell if the case will develop serious symptoms. Also not rarely one finds the infective agent to be some unexpected organism such as the diphtheria bacillus; in hospital practice this organism has often been found in nurses and charwomen.

The results of septic fingers are often bad, as they may be followed by stiffness of the joints and adhesions between the tendons and their sheaths, and not rarely by necrosis of portions of the phalanges. Still the fingers and hands should not be amputated unless the life of the patient is endangered by the virulence of the infection, for it is wonderful how time and use will restore the function of a hopeless-looking finger. It is well known that many surgeons have stiff fingers resulting from whitlows and yet continue to operate with unabated dexterity.

Erysipelas.—For many years erysipelas was considered as a separate disease due to a specific organism. It is now recognized that the disease is due to a streptococcal infection of the skin and that, though the relationship between cellulitis and erysipelas is very close, it is rather the different locality affected than a different type of infection. In the former the skin is little affected, while in the latter it is the main seat and the underlying tissue may largely escape; the two may, however, merge into one another, and cellulitis may cause erysipelas and erysipelas give rise to cellulitis.

Clinical Characteristics. The most striking evidence is a rapidly spreading redness of the skin, which has been infected through some small scratch or abrasion which may entirely escape detection. The affected area is hot to the touch hard, oedematous and raised above the surrounding skin. With further increase of the inflammation, vesicles and bullæ filled with serum appear on the surface; the lymphatic glands are enlarged and tender.

The constitutional signs are very marked. Rigors are frequent, but not invariable; the temperature is raised to 103° or 105° and remains high throughout the disease. The patient complains of pains in the limbs and headache and periods of delirium are not uncommon. The termination of the trouble is

uncertain, for it may last from a few days to two or three weeks, and then after a period of subsidence fresh patches of erysipelas may appear on different parts of the body, as soon as one patch has disappeared another appearing (wandering erysipelas).

Diagnosis. This is generally easy, on account of the very characteristic appearance of the disease. It may have to be differentiated from simple erythema, erythema nodosum, herpes and acute eczema.

Prognosis is good, for the majority of the cases recover. The complications that are to be feared are an infection of the blood stream with resulting septicæmia, and also involvement of the base of the brain and meninges when the erysipelas is on the face. Erysipelas as a complication of operation wounds is now extremely rare owing to good aseptic technique, and if it does occur it is as a rule in connection with operations on such parts as the throat and nose and the air sinuses, which cannot efficiently be sterilized.

Treatment. Many different forms of local treatment have been vaunted as specific cures, and though the majority do well, since the disease generally runs a favourable course, it is doubtful whether any one is much better than another. The great point is that the patient is put to bed, carefully nursed and well fed. It is often comforting to the patient to keep the face covered with cotton-wool and to dust the skin with a powder of starch and oxide of zinc. Ichthyol ointment (1 in 6) is often used. Another form of treatment is to paint the normal skin around the erysipelatous patch with linimentum iodi, making a ring about half an inch wide and about one inch from the edge of the inflamed area. This induces a zone of hyperæmia which tends to limit the spread of infection. The injection of anti-streptococcal serum has often been followed by marked improvement and a fall of temperature. Vaccines may prove useful in clearing up an infection which tends to linger. G. E. G.

ULCERS

It is difficult to submit a definition which will cover all varieties of ulcers, though broadly it may be said that an ulcer is a breach of surface, either epithelial or mucous, in which inflammatory changes have gone on to the stage of granulation.

A wound causes a breach of surface, but if healing is not by first intention, or is at all delayed by the action of micro-organisms, an ulcer results.

It must be remembered, then, that almost all ulcers are due directly or indirectly to infection with bacteria, but it is also true that there is

in most instances a combination of causes acting and reacting on one another, and in seeking to ascertain the nature of any given ulcer or to prepare a classification it is necessary to inquire carefully into the predominant or primary source. For instance, a person suffering from senile atheroma of the arteries may receive a small abrasion of the leg, which in turn becomes infected and an ulcer is formed. The immediate cause of the ulcer is the action of the bacteria, which would not have found entrance if the skin had not been wounded. Such an ulcer might be placed in the category of infective or of traumatic ulcers, but in reality it should be in neither, for the essential factor is the want of circulation and a subsequent lowering of resistance to injury and infection.

For the purposes of this article ulcers will be classified according to the causative factor which is considered to be predominant.

Ulcers due essentially to Specific Microbic Infection.—When it is remembered that the process by which an ulcer is formed does not differ in any way from that by which an abscess develops, it is easily understood that in the course of acute infective diseases ulceration is liable to occur on any of the mucous, epithelial or endothelial surfaces as the result of the violence of the inflammatory process, or as the result of the bursting of abscesses, whether pyæmic or otherwise, *e.g.* typhoid ulceration of the bowel, ulcerative endocarditis, ulcerative stomatitis, diphtheritic ulceration of the trachea, and so on. In considering the nature, therefore, of any given ulcer, due regard must be had to the whole condition of the patient, though it is possible that the appearance of the ulcer may be an indication of the disease.

As regards the surface of the body the chief infective ulcers are those due to tuberculosis and syphilis.

Tuberculous Ulcer.—This generally arises as the result of a small abscess which has formed in the deep or subcutaneous tissue and burst. The ulcer is distinguished by its pale appearance, the want of proper granulations, spots of caseation here and there, and undermining of the surrounding skin. Lupus, which is another typical lesion, is a spreading tuberculous ulceration of the skin. The ulcer has a soft pale base, with imperfect granulations, and around it a number of small elevations compared to nodules of apple jelly, which themselves break down and lead to an extension of the disease.

Syphilitic Ulceration.—Most often this is the result of the breaking down of gummata which have formed in the subcutaneous tissue, but they may be either primary or secondary. A single gumma is as a rule round, with steep sharp-cut edges and with a washleather-like

base. Owing to the coalescence of several gummata, the ulceration tends to assume a serpiginous form, with a tendency to heal at one part and spread at another.

Ulcers due essentially to Trauma.—A common cause of ulcer formation is a crush or bruise, which, by direct injury to the cells, either kills them outright or so diminishes their vitality as to render them of easy access to bacteria.

The pressure of improperly applied splints or plaster bandages may so far injure tissues and interfere with the local circulation that the skin sloughs and a sore results. Certain forms of bed-sores may similarly be due to prolonged pressure.

A single trauma, not of itself sufficient to produce an ulcer, may if repeated often enough produce the same result as a single and more violent injury, as may be seen in the case of a dental ulcer of the tongue produced by continued rubbing over a sharp and carious tooth.

Ulcers due essentially to Deficiency of Vascularization.—This may be either want of arterial supply or deficiency of venous return. The importance of an adequate arterial supply is patent, for if it be entirely cut off gangrene results; with a diminished or enfeebled supply the local resistance to injuries and suppuration is lessened and the likelihood of ulcer formation is increased. Hence it can easily be understood that the difference between a chilblain and gangrene of the leg is one of degree only.

The importance of the venous return is also great. The best illustration is the very common varicose ulcer of the leg, which is most frequently found on the inner aspect of the lower third of the leg. At this point the venous pressure is at its highest, owing to the less free communication with the deep veins. The deficiency of circulation is evidenced first by swelling and œdema of the leg, and later by pigmentation of the skin and an obstinate form of eczema due to lack of nutrition. Irritation from the eczematous patch leads to scratching and subsequent breach of surface, which allows the entrance of micro-organisms. The essence of the treatment of such an ulcer is to permit of a free venous return by putting the patient to bed and elevating the limb, when healing commences without further local treatment.

Ulcers due essentially to Deficient Innervation.—Any interference with the nerve supply of the superficial tissues, such as occurs in infantile palsy, hemiplegia, peripheral neuritis or after injuries to nerve trunks, is followed by trophic changes in which the vitality of the skin is lowered. The slightest irritation, as from a tightly fitting boot, the rubbing of a splint or the application of a hot water bottle, which to a normal person would not be injurious,

may be sufficient to excite an ulcer. In such instance prophylactic treatment is the most valuable, for such sores are among the most difficult to heal.

Perforating Ulcer of the Foot is a peculiar condition generally associated with tabes dorsalis and sometimes with commencing peripheral neuritis and in patients suffering from glycosuria. The ulcer is found on that part of the foot most subject to pressure, namely, under the head of the metatarsal bone of the great toe. It is difficult to treat, as the process tends to spread until the joint or bone is reached, and destruction may be so widespread as to call for amputation of the foot.

A few cases lately have been subjected to injections of salvarsan, and though the results have been somewhat encouraging it is too early to make any pronouncement as to the value of the treatment and the permanency of the improvement.

Ulcers due to the Breaking Down of a Malignant Growth.—There is a tendency for malignant growths situated near the surface of the body to extend and infiltrate the skin. A carcinomatous ulcer is, as a rule, below the level of the skin and has a hard and warty base. A sarcomatous ulcer, on the other hand, has rather the appearance of a fungating tumour, projecting through a hole in the skin, the sides of which are inflamed but do not present the characteristic clinical signs of sarcomatous disease.

Rodent Ulcer, though classified as a new growth, very rarely gives rise to a tumour formation. It is an insidious ulcer originating in the sebaceous glands, which slowly eats its way into all the surrounding tissues. Its most common site is about the face and alæ of the nose, and it will, if unchecked, eat into the cheek and malar bones, destroy the eye and even invade the skull and brain, the patient eventually dying from septic meningitis.

The condition has to be diagnosed from lupus, tertiary syphilitic disease and epithelioma.

Treatment. Luckily the treatment has improved very much in the last few years, and it is not too much to say that if recognized reasonably early it can definitely be cured either by the use of radium, X-rays, or by the method of ionization. The necessity for excision of a rodent ulcer rarely arises now.

G. E. G.

BOILS AND CARBUNCLES

These are local infections of the skin due almost invariably to infection with the staphylococcus pyogenes aureus, which obtains entrance through the hair follicles under the influence of pressure and friction.

Boils are found most frequently on the back

of the neck and on the buttocks, where the skin is thick and subject to pressure. A hard, painful swelling results which, as long as the skin remains unbroken, is termed a blind boil. Usually the skin becomes red and breaks, a drop or two of pus coming out, whilst later a small slough is discharged. After the central slough or core has been got rid of the boil heals rapidly, leaving a small depressed scar.

Treatment. If the boil is still blind the treatment is to put the part at rest, obviating any pressure. If suppuration takes place a small incision is to be made into it and fomentations applied. At each dressing the skin around the boil is to be washed carefully, for unless this precaution is taken further infection may occur and a fresh crop of boils result.

Vaccine treatment has had remarkable success in many cases, though in others, for some unexplained reason, no good result is obtained.

Carbuncle may be regarded as a big boil or as an aggregation of boils. The essence of its difference from a boil is that it is larger and discharges from more than one opening. It is found frequently in old and debilitated persons and in those suffering from diabetes and albuminuria.

Treatment. Many forms of treatment have been applied. If the carbuncle is small a ring of collodion may be painted round it so as to produce a local hyperæmia and so abort the disease.

Probably the most satisfactory method of all is to make a free incision into it and to scrape out the slough with a spoon.

It has been found that if dressed with gauze which is soaked in sterile horse serum the process of healing is hastened. Anti-staphylococcal serum has not proved to be of any value. If the condition tends to spread a vaccine should be used.

Chronic Abscess.—By a chronic abscess is meant an abscess which develops very slowly and produces very few local or constitutional signs: they may occur in the soft parts or in the viscera, glands or bones. These are for the greater part occasioned by the tubercle bacillus, though more rarely by a staphylococcus of low virulence. It is obvious that the consideration of a tuberculous abscess should be combined with that of the disease from which it originates, and for this reference must be made to the special articles on tuberculosis. The great principle is that any surgical treatment must be taken with full aseptic precautions, for these abscesses if complicated by the addition of other organisms do extremely badly. G. E. G.

SAPRÆMIA, SEPTICÆMIA AND PYÆMIA

It has been customary in the past to define these conditions rigidly as meaning (a) the

absorption into the blood stream of toxins without the introduction of organisms, (b) the presence and growth of organisms in the blood, and (c) the formation of local abscesses caused by septic emboli in various parts of the body.

Though these definitions may be strictly true it is impossible in the majority of cases to separate them clinically, for it is believed that in almost all septic conditions varying quantities of organisms escape into the blood stream. It is only possible to say with certainty that a true septicæmia is present when a sample of blood withdrawn from a vein under rigid aseptic precautions yields, on culture, living organisms. Seeing that the quantity of blood that can be withdrawn is not large (usually two or three c.c.), and that the organisms may be present in only small numbers, it is easy to understand that they may be missed.

The Infecting Agents. Of the various bacteria that have been found in the circulating blood, perhaps the commonest is the streptococcus; but among others may be mentioned the bacillus coli communis, the gonococcus, the influenza bacillus, the pneumococcus, and with these now have to be enumerated the spirochæte pallida.

Treatment. The first essential of treatment is the removal, as far as possible, of the local cause and the clearing out of any infected area (e.g. an abscess, a urethral discharge or a piece of infected clot in the uterus), and the detection and drainage of embolic abscesses in the case of pyæmia. Next attention is to be aimed at putting the patient in the best position to resist and kill the circulating bacteria and their products. This, of course, resolves itself first into that attention to the general health, diet and nursing which is required in any acute infective illness. The next point is the application of serum and vaccine therapy, which of late years has assumed such a prominent place in our ideas.

It is to be remembered that these methods are in no wise intended, nor are they capable of supplanting surgical methods; they are meant rather to supplement and aid them, and particularly in those conditions in which, in spite of all surgical endeavour, the infecting processes are progressing.

Serum and Vaccine Therapy. The principles of treatment may be first briefly stated. The serum taken from an animal (e.g. the horse) which has been immunized previously against the specific organism contains various antibodies, which if injected into the circulation of a patient suffering from a similar infection, tend to neutralize the toxins formed as the result of the bacterial activity, and thereby a passive immunity is conferred on the individual.

The use of vaccines is based on the ascertained

fact that if small dead cultures of organisms are injected, the individual is stimulated to prepare its own antibodies and to resist and kill the infective products and their agents.

The question then arises, How are these objects to be obtained? As has previously been stated, the first and most essential thing is to ascertain the nature of the infecting organism. The most important preliminary investigation is to make cultures and film preparations from the site of infection, for not only does it tell one the nature of the infection, but also whether there is more than one organism present. It may, however, be impossible to find the initial lesion; resort must then be made to investigation of the blood and various excreta of the body, such as the sputum, urine and the cerebrospinal fluid. Of these the one most likely to yield information is the blood, and if necessary the opsonic index may be ascertained.

The bacteriological examination of all cases must be insisted on, for not only is it necessary to find out the genus of the infective agent, but also, as in the case of the streptococcus, the particular strain, namely, whether it belongs to the group salivarius, faecalis, pyogenes and so on.

The nature of the organism having been ascertained, it is next advisable to introduce as soon as possible the specific anti-serum, if there is one. If there is any delay in the bacteriological investigation it may sometimes be advisable to inject a serum on the supposition that one is dealing with a given organism, for with a little clinical experience it becomes easy to diagnose the infection with a fair degree of accuracy.

For suppurative cases the only serum on the market that is of any value is the anti-streptococcic serum, and of this there are two varieties, the "polyvalent" and the "pyogenes." The former is obtained from a horse that has been immunized against a number of different strains of streptococci, and the latter from a horse that has been immunized against the streptococcus pyogenes only. The polyvalent serum is given when it is known or believed that the infecting agent is a streptococcus, but when the exact strain is not yet fully worked out, and the pyogenes variety when the identity has been fully established by culture experiments. As has been said, the serum should be injected at the earliest possible moment. The dose should be a large one (40 to 60 c.c.) and should be injected either subcutaneously or intravenously, as in all probability its efficacy is impaired, if not absolutely nullified, if given by the mouth or rectum. Another large dose may be given on the succeeding day and be continued if any improvement, such as a fall of temperature or the clearing up of the local infected area, follows the injections.

It is difficult to summarize the value of this serum treatment. It certainly does not come up to our early high expectations; there is no certainty about its action, and probably in the majority of cases no good results are found; but, at any rate, as far as we know, it does no harm except for the occasional outbreak of a rash. On the other hand, every now and then the sera appear to effect miracles and work a cure on an apparently desperate case; therefore it is urged that some serum should be tried in all severe cases and that it should be given early, for that is the time when it has the best chance of doing some good.

Other sera that are on the market are:—The anti-staphylococcal serum. This has proved of no value. Quite recently it has been shown, though, that in some cases the injection of normal horse serum is followed by some improvement. The anti-pneumococcal serum (Pane's serum); Selavo's serum for anthrax. The anti-tetanic serum and the anti-meningococcal serum are mentioned as possible causes of suppuration, but they are more fully treated in their separate sections.

Vaccines. Vaccine therapy has been much vaunted and it is hoped that much good will result from it, though it is still too early to make a definite pronouncement on the subject. The theory is that injections of killed cultures of an organism will confer an active immunity on the sufferer, and certainly in some cases considerable success seems to have been derived from them, particularly in respect to chronic cases of suppuration, such as boils and acne. In acute septic infections fewer successes are recorded, but even here they are to be employed, but with caution, for they are not, as in the case with antisera, free from danger, as it would appear that in some cases the injection may be followed by a negative phase in which a patient's life may be endangered.

Conclusions as to Treatment. The attack on the initial lesion and the drainage of the infected area is the first consideration. A culture and film preparation should at once be made to ascertain the infecting agent and the appropriate serum administered at the earliest possible moment. A vaccine should also be prepared and injected as soon as possible.

Guides as to the course of treatment vary in each individual case, the most reliance being placed on the temperature and the general condition of the patient. Dosage varies from two millions of dead bacilli to forty millions and, roughly speaking, the acuter the lesion and the more severe the condition of the patient the smaller should be the dose, and in round terms it is better to give small doses at frequent intervals rather than large doses at long intervals.

G. E. G.

GANGRENE

Gangrene is a term that has by general consent come to mean the death of a large portion of the body, as opposed to the death of small pieces of tissue, which is termed sloughing.

Any part of the body may become gangrenous, including the limbs, intestines and the brain, but in this article attention will be directed only to gangrene of the limbs and superficial parts of the body, leaving the internal viscera to be dealt with under their separate headings.

Clinically we may speak of two varieties of gangrene, namely *dry* and *moist*. While this rough division does not include the exact cause of the trouble, it furnishes us with a valuable distinction, for, in general terms, dry gangrene is essentially due to interference with the blood supply, while in the production of moist gangrene bacterial invasion and putrefactive changes are the essential factors.

Dry Gangrene results from the stoppage of arterial supply, whether gradual from diminution of the lumen of an artery by atheroma, or sudden by laceration, ligation or the lodgment of an embolus in a vessel too small for its passage. In many persons the collateral circulation suffices to supply the peripheral parts with blood, but in some who suffer from diseased vessels the circulation fails and gangrene results. With the cessation of circulation the limb becomes pale, cold and insensitive; the colour soon changes from a pale white to blue and, if left long enough, to a greenish-black. The skin shrinks, becomes hard and dry, and gradually the appearance of the part comes to resemble that of a mummy. At the junction of the dead and living tissue "the line of demarcation" is formed, which is the result of a process of ulceration by which those living tissues in contact with the dead are destroyed, and thus the gangrenous portion may be cast off, and a spontaneous cure be effected.

Senile Gangrene is produced by the gradual diminution of the supply of blood owing to atheroma or primary calcification of the arteries. These changes are most often met with in the arteries of the lower limb, and therefore senile gangrene occurs most frequently in the foot and leg. It is common to find that for some time before the actual onset of gangrene the patient has been troubled with cold feet and tingling in the leg; if this ill-nourished leg be in any way injured the slightest inflammation may determine the cessation of an already enfeebled flow of blood.

Treatment. The first indication is to prevent bacterial infection by purifying the part and applying an aseptic dressing. The limb may be elevated slightly so as to assist the venous return, though not sufficiently to retard the

arterial supply. Pressure of any sort is to be avoided, and though the limb is to be kept warm, hot bottles are to be used with the greatest caution.

As regards the question of amputation there is some difference of opinion. Some surgeons hold that since the patients are of necessity old and feeble it is better to wait till a line of demarcation is formed and then cut off the dead matter without doing a set amputation. The adoption of this plan necessitates a delay of weeks or months, during which time there is the added danger of bacterial invasion and the conversion of a dry gangrene into the moist and spreading form. For these reasons, for which there seems some justification, other surgeons advise early amputation. If this is considered there are certain valuable indications as to the most favourable method and site of amputation. Collateral circulation is always most free in the neighbourhood of joints, and therefore amputation at or about a joint should always be preferred to amputation through the middle of a limb. Also it has been found by experience that amputation through the leg rarely succeeds when the foot is gangrenous, because the obstruction is usually in the upper part of the posterior tibial artery. Probably the most satisfactory site is either at or about the knee joint, care being taken to avoid injury of the prepatellar anastomosis by leaving the patella in the anterior flap.

The Operation of Arterio-Venous Anastomosis for Senile Gangrene. It has been suggested that when senile gangrene is threatened, but has not actually taken place, amputation may be avoided by turning the femoral artery into the femoral vein and so utilizing the wide vein to carry the blood to the peripheral parts instead of the artery. No great success can be claimed for this method.

Diabetic Gangrene.—Gangrene may occur in patients suffering from diabetes mellitus, though often it is complicated with atheromatous changes in the arteries as well. Like senile gangrene, it is often started by some trifling injury, but unlike it the parts do not always shrivel and dry, but may be moist and decomposing and tend to spread rapidly up the limb. The sole of the foot is the commonest site for this form of gangrene to start. If the dead portion is only small and dry it may be left to separate by itself, but if extensive and of the moist variety amputation must be performed, although the danger is great. The prognosis is always unfavourable, for in many cases the patient dies a few days after the operation from diabetic coma. The onset of coma may be precipitated by the action of an anæsthetic, and if an amputation has to be performed it is better to use neither chloroform nor ether, but

rather nitrous oxide gas and oxygen, or spinal analgesia.

The rules for amputation are those governing senile gangrene.

Lockwood has recently called attention to the great value of frequent administration of oxygen, both before and after the operation.

Raynaud's Disease or Symmetrical Gangrene.—This is an obscure disease said to be due to spasm of the arterioles. It is most common among women between the ages of eighteen and thirty, who are suffering from uterine disorders. The fingers and toes of both hands and feet are simultaneously attacked, and one or several digits may die. It is rare for this form of gangrene to extend to the whole hand or foot.

Gangrene from Frost-Bite.—Exposure to extreme cold causes a contraction of the arteries, which, if continued long enough, deprives the peripheral parts of their blood supply as effectually as if the efferent vessel were blocked by a ligature or a thrombus. The frozen part at first looks white, becomes insensitive and is icy cold to the touch, and if death is complete the parts become black and shrivelled, as in any other form of dry gangrene. If the deprivation of blood has not been complete or has not continued long enough to kill outright, circulation may be restored, and its return is manifested by pain, tingling and swelling, with all the phenomena of inflammation. These inflammatory changes are an added danger, for the great exudation of fluid which accompanies them may exert such pressure on a feeble circulation, and so interfere with it, as to cause another entire stoppage.

Treatment. Too rapid application of heat is to be avoided. The trouble should be recognized early by the white appearance of the skin, and the frozen part may then be nursed back to life by warming it with the hand or placing it in the axilla or breast of a comrade (this method was successfully applied on many occasions in the last Antarctic expedition). Gentle friction may be used, but the treatment of rubbing with snow so commonly advised is not strongly urged, on account of the great liability to cause abrasions of the skin.

Gangrene from Ergot.—The action of ergot is to cause a contraction of the small arterioles, which if long continued may terminate in gangrene of the peripheral parts. It is met with in those whose dietary consists largely of rye bread.

Moist Gangrene.—In this form of gangrene the essential factor is bacterial invasion, the parts instead of becoming dry and mummified remain moist, and decomposition and putrefaction, for both of which moisture is a necessary factor, set in. There is, therefore, in this case the added danger of sepsis and absorption of septic products, and the possibility that the

gangrene may increase and even extend beyond and independently of any obstruction of the main blood supply. A fatal termination is much more common in moist than in dry gangrene.

Acute Spreading Traumatic Gangrene.—This is one of the best known of the varieties of septic gangrene and is remarkable for the appalling rapidity with which it may spread. It is not limited to the parts below the site of an injury, but, on the contrary, the parts above are just as likely to be affected as the parts below. It usually occurs after extensive lacerations, such as those resulting from tram and omnibus accidents in which street mud has been ground into the depths of the wound. The gangrenous process commences at the margins of the wound, not at the peripheral parts. The skin, at first dark red, becomes green and black, and there is great swelling, which extends rapidly up the limb. The exudation is quickly followed by decomposition; vesicles form under the epidermis, which shows a tendency to peel, and bubbles of gas form as the result of the putrefactive changes. No line of demarcation is formed, but the swelling rapidly spreads, so that in twenty-four hours or less the inflammatory processes have reached the trunk.

This decomposition is due to the special activity of anaerobic organisms, particularly the bacillus of malignant oedema and the bacillus aerogenes capsulatus. Here, most certainly, early amputation is called for, because unless the infected limb be removed, early death ensues with certainty. As a prophylactic measure dirty and lacerated wounds may be treated with hydrogen peroxide, which is inimical to the life of anaerobic bacteria.

Phagedena.—This is a type of gangrene formerly common in crowded hospitals, but now rarely seen except in connection with venereal sores. It is a very rapid and destructive form of ulceration or sloughing. The gangrene may appear independently of any interference with the blood stream, and is probably due to anaerobic infection.

Cancrum Oris may be met with in children under the age of five, particularly during convalescence from such diseases as scarlet fever, measles or typhoid. The process starts in the cheeks or gums and may in bad cases be followed by gangrene of the floor of the mouth, cheeks and even of the jaws. The constitutional disturbances are great and there is grave danger of death either from septic broncho-pneumonia or septicæmia.

Treatment. A thorough removal under an anæsthetic must be undertaken and the sloughing tissues excised with the knife or scissors until the tissues bleed freely, after which the raw surfaces are swabbed with pure carbolic or fuming nitric acid.

G. E. G.

GUNSHOT WOUNDS

Gunshot Wounds include a great variety of injuries, produced by all kinds of missiles from small shot to the largest shells, and affecting every part of the body. In war most of the wounds are from rifle bullets, only a small proportion being from shrapnel bullets and pieces of shell, except in bombardments and naval engagements, when shell fire is responsible for most of the injuries. In peace gunshot wounds are rare and are commonly from shot-guns or pistols.

In every case of gunshot injury it is important to discover, if possible, the nature of the wounding agent, whether small shot, bullet or shell, and the range at which the wound was inflicted. The external wounds must be carefully examined, but on no account fingered or probed. The entrance wound of a rifle bullet is round or oval, with loss of substance, and has a punched-out appearance; its edges are slightly inverted and stained by contact with the bullet. More or less bruising may surround the wound. The exit wound varies very much; it is often indistinguishable from an entrance wound, but is usually larger, less regular in shape and sometimes lacerated. A large lacerated exit wound generally means that the bullet has smashed a bone and driven some of the fragments out through the wound. Absence of an exit wound of course means that the bullet has lodged in the body. The course that a bullet has taken through the body can be judged only if it is possible to replace the wounded part in the exact position it was in when struck, when a straight line from entrance to exit shows the track of the bullet. Even then it is impossible to be sure that any particular organ has been hit unless there are special symptoms. Spherical bullets of low velocity, such as shrapnel bullets, are sometimes deflected by striking a rib, or may follow intermuscular planes, so that their course is not a straight line. Small shot seldom penetrate deeply, except at very short range, when they strike in a mass and spread in the part, producing a severe lacerated wound. Pieces of shell cause serious bruising and laceration, with much subsequent sloughing, but do not penetrate far. If of large size they may inflict very extensive injuries.

The immediate treatment of a gunshot wound consists in the arrest of hæmorrhage and the prevention of infection. Hæmorrhage seldom calls for special measures, slight pressure and elevation of the part sufficing in most cases. Severe or persistent arterial bleeding necessitates operation for securing the wounded vessel at the injured point, and ligature above the wound should be resorted to only when direct ligature is impracticable. Sometimes when an artery

is wounded the bleeding takes place into the tissues, owing to the blood being unable to escape by the narrow bullet track, and in such cases the hæmatoma must be opened and emptied and the artery secured. Most bullet wounds will remain aseptic if not infected from without. Great care should be taken to avoid contamination when removing clothing to expose the wounds. A sterile dressing should be applied without wiping the wound, and secured so as not to shift. Tincture of iodine, if at hand, should be painted round the wound, and, if shaving is necessary, care should be taken to protect the wound while the surrounding skin is shaved. No strong antiseptics should be applied to the wound itself. The first dressing may often be left on till healing has taken place.

The wounds that are most likely to become infected are those of large size, particularly if there is much laceration. Free drainage is required for all septic gunshot wounds, and counter-incisions for drainage must be made when necessary. The usual treatment of a suppurating wound is required.

In septic wounds secondary hæmorrhage is sometimes met with, and necessitates operation for securing the bleeding vessel.

Bullets that have lodged in the body should be left alone unless they are causing definite trouble, when they should be accurately localised and removed by the nearest route.

Traumatic aneurysms and arterio-venous aneurysms are frequently seen as the result of gunshot wounds of vessels. Traumatic and varicose aneurysms require operation, as a rule; aneurysmal varices may generally be left alone.

Nerves divided in a gunshot wound should be sutured at once, if the wound is not septic. In wounds from rifle bullets at high velocity temporary loss of function of a nerve may be due to "concussion" from the bullet passing near the nerve without actually wounding it, the lesion being a physiological one produced by the intense vibrations set up by the bullet in its passage through the part. Such lesions require no operative treatment, but are sometimes difficult to distinguish from actual section of a nerve. Complete rest of the part, with massage and electrical stimulation of the muscles, are needed in all wounds of nerves.

Gunshot fractures are always compound, and frequently much comminuted. Special care must be taken to prevent infection, but as the worst fractures often have large lacerated exit wounds, sepsis cannot always be avoided. Immobilization of the limb on splints is always essential, and displacements of the fragments by muscular action, after the shock of the injury has passed off, must be watched for. Union is slow, and the amount of callus large. After

the external wounds have healed massage and movement may be commenced. Should a fracture suppurate, most of the smaller pieces of bone will necrose, and if they are left they will become imprisoned in the callus and keep sinuses open for months or years. In every septic fracture it is therefore necessary to operate, remove all small and detached fragments, and provide for free drainage. Amputation may be called for if the limb is hopelessly destroyed, or if the patient's life is endangered by septic complications. Gunshot fractures do not require screwing or plating unless union has failed, or has taken place in bad position.

Gunshot wounds of the larger joints are often mere perforations, and heal with little more trouble than flesh wounds if infection is prevented. Wounds with comminution of the articular ends of the bones, especially with large skin apertures, are dangerous, being more liable to become septic. Rest and pressure are all that an aseptic wound of a joint needs, with massage and movement after the external wounds have healed. Septic joint injuries require free incision and drainage, with removal of all small loose fragments, and usually result in ankylosis. Amputation may be needed, or excision to restore the utility of a stiff or useless limb.

Gunshot injuries of the skull always need operation, as fragments of bone are driven into the brain and must be removed. These lesions are accompanied by symptoms of more or less profound concussion, with paralysis where there has been injury to the motor region of the cortex, and sometimes muscular twitching or convulsions. After shaving and cleansing the scalp the wounds should be exposed by turning down flaps, the apertures in the skull enlarged, and all loose pieces of bone carefully searched for and removed, care being taken not to do additional damage to the brain. The dura mater should be closed if possible, and the wound drained through the bullet hole in the scalp. The after-treatment is that usual in any head injury. Abscesses may form in the brain as a result of a gunshot wound, and as they are always in or near the bullet track they are readily found. Wounds of the orbit with destruction of the eye often suppurate, and the eye has to be removed. Penetration of the eyeball by small shot usually renders its excision necessary. Fractures of the jaws must be treated by removal of fragments, careful cleansing of the mouth and fixation by means of a chin splint in the case of the lower jaw. Wound of the larynx sometimes requires tracheotomy if there is danger of asphyxia. Septic pneumonia is a common and fatal complication. Wound of the pharynx or œsophagus is likely to set up dangerous cellulitis

deep in the neck, and requires free drainage, the external wound being enlarged. It is usually impossible to suture an œsophageal wound. Swallowing must not be allowed for several days.

Gunshot injuries of the spine are very fatal. Little can be done in the way of treatment, except to carry out the usual treatment of paraplegia, great care being taken to prevent infection of the bladder by catheters, and to keep bedsores clean. Operation is almost always useless, but may be tried in cases where there is evidence of pressure on the spinal cord, causing incomplete paraplegia, when laminectomy may relieve the pressure.

Wounds of the lung, unless from large missiles, are seldom serious. Rest and treatment of the external wounds are all that are needed. Hæmoptysis is usually seen, but is generally small in amount. A common complication is hæmothorax, which should be left alone unless of large size, when it may be aspirated. A hæmothorax should never be incised, on account of the difficulty of avoiding infection of the pleural cavity. Wounds from large missiles are dangerous, on account of the likelihood of infection, leading to the formation of an empyema, which must be opened and drained. Wound of the heart is almost always fatal, though a few successful cases of suture of gunshot wounds of the ventricle are on record.

Gunshot wounds of the abdomen present considerable difficulties in diagnosis. Even the fact of penetration of the abdominal cavity may be doubtful, and in a considerable proportion of cases there are no definite symptoms of internal injury. In war, where special difficulties prevent exploratory operation, about half the cases of abdominal wounds recover without operation, but the remainder die of peritonitis. It is impossible to form any opinion, when a case is first seen, as to whether he will escape peritonitis or not. In war it has been found better to await developments, but in peace every surgeon would operate at once in any doubtful case, the abdomen being opened and all injuries to internal organs sought for and repaired. Internal hæmorrhage is another grave danger, and is an indication for immediate operation. If the abdomen is opened very numerous and extensive injuries may be found, several perforations in the intestines, laceration of the mesentery and omentum and wounds of the solid organs. Small holes in the gut can be sutured, more extensive damage may require resection of the injured portion. If the patient cannot stand a long operation it may be possible to bring out a wounded loop of intestine and make a temporary artificial anus. If general peritonitis ensues, drainage of the abdomen by

several small incisions may save the patient. Wounds of the large intestine often cause localised abscesses, which must be opened and drained. If the retroperitoneal cellular tissue is infected from a wound of the colon, dangerous cellulitis follows, which must be dealt with by free incisions and drainage, and the same treatment is needed in wounds of the rectum, with either colotomy or division of the sphincters to prevent fæces passing from the rectum into the bullet track. If the bladder is wounded it must be kept empty, either by tying in a catheter or by a suprapubic or perineal cystotomy, and extravasation of urine must be watched for. Intrapertoneal wounds of the bladder should be sutured. The general treatment of abdominal injuries as regards posture, feeding and nursing must, of course, be carried out in cases of gunshot injury, and the administration of saline solution subcutaneously or by the rectum may be required. C. G. S.

TUBERCULOSIS

Tuberculosis, from the surgeon's point of view, must be studied entirely in lesions of the skin, bones, joints, the genito-urinary tract and lymphatic glands, though intestinal and peritoneal tuberculosis are gradually coming within the scope of his work, and surgical treatment, in the form of the production of artificial pneumothorax, is being advocated in the treatment of certain forms of pulmonary phthisis. As to the source of the infective agent—the tubercle bacillus—in these cases, there now seems to be little doubt that it may be either human or bovine, but that, especially in children, the tubercle bacillus of bovine origin may play a part only second in importance to that played by the bacillus derived from the human patient affected by tuberculosis.

Channels of Infection. The tubercle bacillus appears to make its way into the body first by the great *primæ viæ*, the respiratory and alimentary passages, but incidentally it may also enter through solutions of continuity of the skin, especially in the region of the channels by which tubercle bacilli are discharged from tuberculous lesions, the various natural orifices, sinuses communicating with tuberculous abscesses and tuberculous ulcers. The various mucous membranes and the skin in normal healthy individuals hold back all but very insignificant numbers of tubercle bacilli and so prevent the invasion of the tissues by any number with which these tissues, especially when healthy, cannot deal fairly easily. Ulcerated tonsils, carious teeth, damaged mucous membranes of the intestine or covering the pharyngeal ring, of lymphoid tissues, as also

catarrhal or bronchial pneumonia, often associated with other specific infective diseases, allow of ready invasion of the surrounding tissues. In these latter cases there is: (1) an accumulation of dead or dying cells—an admirable nidus for the growth of any tubercle bacilli taken in—and (2) a lowered resisting power of the tissues beneath the epithelial surface.

In the alimentary canal the lesions at the point of entrance of the tubercle bacillus can seldom be made out, the first evidence of the presence of the bacillus being met with in the mesenteric glands; evidence of the disease is found in the retro-peritoneal, posterior mediastinal, bronchial and anterior-mediastinal glands, in those in the hilus of the liver or in similar glands. Where, as often in children, a tuberculous peritonitis is set up, adhesion of the liver to the under surface of the diaphragm may follow, and there is extension of the tuberculous process by the lymphatics of the diaphragm to the posterior and anterior mediastinal glands.

Again the tuberculous process may extend from the naso-pharyngeal adenoid ring and tonsils, or from the root of a carious tooth along the cervical lymphatics, involving the glands on the way, and passing, especially when there has been adhesion, to the costal and parietal pleuræ, and so on to the apex of the lung, or again to the post-sternal and mediastinal lymphatics and glands.

It may now be accepted that "congenital" tuberculosis is extremely rare, and that "inherited" tuberculosis is practically non-existent. On the other hand, inherited predisposition, especially as evidenced by a tendency to enlargement of the lymphatic glands under chronic irritation, is of common occurrence, and there seems to be little doubt that the scrofulous condition described by early surgeons and physicians was a manifestation of this special irritation of the lymphatic system. When once the bacilli have gained access to the body they may spread by any of the natural channels, but local extension usually takes place by the lymphatics up to the nearest lymphatic gland, and general metastatic distribution is effected principally by the blood-vessels, especially in so far as the bones and joints are concerned.

Inherited predisposition cannot, however, be ignored. Moreover, children of tuberculous parents are naturally exposed to more "infection" than are the children of healthy parents. Acquired predisposition to tuberculosis is as complicated as is the inherited, but all conditions of malnutrition, whether due to lack or imperfect quality of food, overwork, want of rest, bad hygienic conditions, impure air, accu-

mulation of waste tissue products, especially in direct contact with the cells of the tissues, chronic irritation and lowered vitality through continued inflammatory processes, may all be regarded as predisposing factors. The tubercle bacillus is essentially a tissue parasite, and contains an endotoxin that under ordinary conditions is set free slowly, though when by any means bacteriolysis is brought about this toxic material is set free much more rapidly. In its presence and under its action there is, almost invariably, in the first instance a proliferation of the cells with which it comes into contact, often associated with absorption of fibrillar tissue. The endothelial cells of the blood-vessels undergo similar proliferation. Following this proliferation, especially in the case of resistant connective-tissues, there may be formation of a fibrillar or fibrous capsule immediately around the tubercle bacilli. This is often associated with the formation of giant cells, sometimes described as large plasmodial cells, in which endogenous division of the nucleus is taking place without any corresponding division of the cytoplasm. Again, these giant cells are described as lymphatic or blood vascular spaces or channels lined by actively proliferating endothelium, of which the nuclei occupy the margin of the "cell" and coagulated plasma the centre. Whatever may be the structure and origin of these cells, they are characteristic of chronic tubercle in which fibrous tissue is readily formed. Acting on less resistant cells the tubercle bacillus, especially if virulent and present in large numbers, gives rise to more rapid proliferation, which process is soon followed by "caseation," a condition in which the weakened tissue cells having reached the limit of their powers of proliferation, undergo first coagulation necrosis, then fatty changes; and, as the fluid is absorbed by the surrounding tissues, the degenerated cellular mass becomes distinctly dry and cheesy.

Although there is often some increase in the number of blood-vessels at the margin of a tuberculous mass, the blood supply is cut off very rapidly from the centre, the endothelial cells of the blood-vessels undergoing the same processes of proliferation and coagulation necrosis mentioned above, blood is no longer carried beyond the margin of the tuberculous nodule. An embolic process also plays a part in this cutting off of the blood supply; thrombosis supervening, the flow of blood through the degenerating part is interfered with still further. Tuberculous granulation tissue consists essentially of proliferating connective-tissue, in which is a collection of leucocytes and lymphocytes. This tissue is vascularized in its early stages much as is ordinary granulation tissue; ulti-

mately, should it become fibrous, a natural cure results. Little or no caseous material may be formed, but where caseating centres do occur they are often surrounded by a capsule of fibrous tissue. Further, this caseating centre and even some of the surrounding fibrous tissue may become calcified (calcareous) through the deposition of phosphate and carbonate of lime and magnesium in the inactive tissue. Much of the caseating material may be absorbed, but evidence of its presence always remains. Under favourable conditions the tubercle bacillus in these encapsulated caseous foci may remain inert for considerable periods, but it must be borne in mind that any disturbance of, or break in, the capsule may lead to a recrudescence of the disease through the distribution of infective material from this latent centre of infection, especially if the predisposing conditions associated with the primary disease are again present. A patient predisposed to tuberculosis must always be on the outlook to minimize the activity of these predisposing causes, and to maintain his health at the highest standard possible.

A tuberculous cold abscess consists essentially of degenerating or caseating tissue cells with, in certain cases, the results of streptococcal or staphylococcal infection. In the pure tuberculous abscess the softening process goes on very slowly. The contents of the abscess vary somewhat under these different conditions, but the soft cheesy or curdy character of the pus of the tuberculous abscess is very distinctive, however prominent be the part played by the pyogenic organisms. The wall of a tuberculous abscess consists of a firmer cheesy material surrounded by vascular granulation tissue in which are giant cells similar to those described above; at the point where the caseation is commencing the closing of the vessels and the coagulation necrosis of the cells is marked. Sinuses may lead from such an abscess, especially when associated with tuberculosis of bone. The walls of these sinuses are composed of granulation tissue, not markedly caseous but otherwise very similar to that forming the walls of the abscess. At the mouth of the sinus the granulation tissue is often fairly exuberant and, on examination, giant cells and tubercle bacilli may be found, the former in considerable numbers, the latter more sparsely, though in certain cases these bacilli are fairly numerous, especially in the watery or curdy sero-purulent fluid that is discharged from the abscess.

Tuberculous disease of the genito-urinary tract may commence in the kidney, when it is usually unilateral. First giving definite evidence of its presence in the submucous tissue of the pelvis and calyces, it invades the medullary pyramids and then the cortex. The

new tuberculous tissue resembles that found elsewhere, and extends into the substance of the organ in the form of separate follicles, which run together and give rise to large tuberculous nodules which rapidly undergo caseation; calcification may also occur. Between these masses fibrous septa may still be seen. The treatment in such cases may be summed up in nutrition, tuberculin and excision. In the bladder there may be but a few miliary tubercles in the submucosa at the base, usually in the trigone. These, running together, caseating and disintegrating, give rise to the formation of a tuberculous ulcer with thickened rough edges and floor in, and on, which yellow caseous patches may be seen lying on congested tissue. This condition may be secondary to tubercle in any part of the body, but it is usually associated with, or secondary to, tuberculous lesions of the testicle, the kidney and prostate.

Tuberculosis of the testicle may be primary or it may take its origin in the epididymis. It is usually associated with tuberculosis of the vesiculæ seminales, the vas deferens and the prostate. If it be borne in mind that the testicle is made up of tubules separated from each other by connective-tissue in which run lymphatics and blood-vessels, and that the isolated tubercle follicles and granules, commencing around bacilli spread by these various channels, run together and undergo coagulation necrosis and caseation, there will be no difficulty in understanding the process. In the advanced cases in which the disease comes under the notice of the surgeon, large, irregular, yellowish, cheesy masses are seen, surrounded by fibro-cellular, greyish, gelatinous-looking tissue. Small grey miliary tubercles may sometimes be seen in the more normal testicular tissue lying some distance from these main masses. The prostate is often involved in these cases, masses of tubercle of considerable size, which readily become caseous and extend into the wall of the bladder or rectum, being met with. The Fallopian tube is sometimes affected by the tuberculous process, the mucous membrane being involved, especially near the fimbriated extremity. Thickening, caseation and ulceration, in sequence, may lead to dilatation and cyst formation. The walls of the tubes may become markedly thickened should the process be chronic.

Tuberculous disease of the mucous membrane of the urethra, vagina, uterus and ovary may all, though rarely, come under the notice of the surgeon, usually as part of a general genito-urinary infection.

Tuberculosis of the adrenal bodies, of the appendix vermiformis, of the mouth, tongue, parotid gland, œsophagus, naso-pharynx and larynx, of the mamma, of the penis, especially

after circumcision, and of other exposed parts, may all occur. It must be remembered that in all cases where mucous epithelial surfaces are involved we have catarrh as a preliminary condition, and that submucous follicles run together, form masses and lead to ulceration, that the process may extend into any surrounding tissue and may, under favourable (or unfavourable) conditions, attack bone and practically any of these tissues. Whether surgical interference is justified or not, laparotomy for tubercular peritonitis, the removal of a tuberculous appendix, or the like, must depend on circumstances, the needs and condition of the patient.

Tuberculosis of the skin, which may result from accidental inoculation, has already been referred to. In these cases epithelial tissues appear to be specially irritated, although the neighbouring lymphatic glands are not readily involved. This is the case, too, in "lupus," a tuberculous condition of the skin and mucous membranes in which numerous small tubercle follicles appear in the cutis vera and in the submucosa. These small nodules run together. The epithelial covering of these nodules may grow more luxuriantly and give rise to a warty-looking growth, though frequently there is a peculiar gelatinous-looking tissue shining through a thin epithelial layer. Finally, there may be ulceration, more or less extensive. The tuberculosis in these cases is usually of a very chronic type. Many well-formed giant cells are present, and though tubercle bacilli may be demonstrated in sections and their presence determined by inoculation, they are few in number. The tubercle bacilli isolated from lupus tissue include more varieties, both as to virulence and modes of growth, than are obtained from any other source or set of sources.

Healing often takes place and dense cicatrices are formed, but there is always a great tendency for the process to spread. General treatment, Finsen ray treatment and tuberculin, combined with removal of the distinctly tuberculous tissue by means of the curette, have given the most satisfactory results in this class of case.

By far the most important manifestations of tuberculous disease from the surgeon's point of view are those observed in the bones and joints.

Following Koenig's work, published in 1884, Watson Cheyne and Alexis Thompson¹ added much to our knowledge of these affections. The latter insisted on the importance of the distribution of the blood-vessels in determining the sites of the lesions at the ends of the bones, in the epiphyses, and in the soft parts around the joints. He pointed out that the nutrient artery of the shaft is distributed to the diaphyses

of the bone, and that the epiphyses and synovial membranes have a separate supply from the articular arteries. H. J. Stiles,² basing his observations principally on Lexer's work, observes that the vessels supplying the bones and joints are derived from three systems, the *diaphyseal*, from the main nutrient artery, which divides into an upward and a downward branch, each breaking up dichotomously into a network at the end of the bone to which it runs, anastomosing slightly with the next group, the *metaphyseal* arteries, "a number of small vessels which penetrate the metaphysis close to the epiphyseal cartilage." The third system, the *epiphyseal*, consists of a few small vessels which, piercing the cartilage at the end of the growing bone, supply the epiphyseal centres of ossification. "These two latter sets of branches are derived from the vessels which go to form the periarticular anastomosis, and it is from this anastomosis that the ligaments and synovial membranes receive their blood supply." As there is free anastomosis between these two latter sets of vessels and those which supply the ligaments and synovial membranes, the whole series would be more or less closely associated in any infection set up by material distributed through them. Again, all three sets of vessels have their final anastomoses near the ends of the long bones, and any infective agent carried by the blood-vessels is usually deposited in the region of these networks, especially where the circulation is slowest.

Stiles points out that very slight traumatism may give rise to detachment or loosening of the epiphysis, and "that as a result of contusions and joint strains traumatisms may be produced in the neighbourhood of the metaphysis, which although they do not always produce a macroscopic result, nevertheless may give rise to capillary hæmorrhages, and thus may serve to explain how it is that slight strains are liable to be followed by tuberculosis, the bacilli being arrested by the local damage to the circulation." Tuberculosis of the joints of the child appears to be more frequently metaphyseal than epiphyseal, and all agree that tuberculosis seldom commences in cartilaginous tissues, that in the upper limb the elbow joint is more frequently affected than either the shoulder or the wrist; that at the hip joint the neck of the femur or some portion of the innominate bone is usually affected, whilst in the knee, owing to the large size of the epiphyses and their early ossification, primary synovial disease is more frequently met with than in any other joint. Stiles claims that the most important tuberculous disease of the long bone occurs at the growing end of the diaphysis, and he gives to this condition the name of "tuberculous metaphysitis," dis-

¹ Reports from the Laboratory of the R.C.P., Edin., vol. ii., 1890.

² Proc. American Medical Association, vol. lxii., 1911.

tinguishing it from tuberculous epiphysitis and tuberculous diaphysitis. In bone, as elsewhere, tubercle appears as grey tuberculous nodules, single or in groups which run together to form masses with caseous centres. In certain cases extension and caseation appear to go on rapidly, moreover, tuberculous necrosis, following tuberculous infarct of an area apparently supplied by terminal branches of the diaphyseal arteries, may appear. A form, described by Koenig as chronic circumscribed tuberculosis, is met with often "in the spongy ends of long bones and in the interior of small bones." The size of the tubercles may be from that of a millet seed up to that of a small marble, the periphery is usually somewhat vascular and gelatinous-looking and surrounds a yellow caseous or putty-like mass in which fine granules or spicules of dead bone may be found. Alexis Thompson maintains that this form results from the fusion of isolated tubercle granulations that have grown in the walls of the medullary arterioles, through which the circulation is usually stopped. The gelatinous tissue is cellular, and in it, at the margin of the focus, are giant cells, around which a fibro-cellular tissue may develop. The second form, or diffuse, caseous, infiltrating tubercle, extends rapidly. It may occur in such varied positions as the spongy bone of the acetabulum—giving rise to a form of hip-joint disease—and the phalanges—"strumous dactylitis"—in which the medulla of the bone is invaded by caseous tubercle to such an extent that the blood supply is cut off from the surrounding dense bony tissue; in this case the periosteum is also frequently involved, and there may be suppuration. The third form, tubercular necrosis of bone, is probably the result of a tuberculous infarct in which a chronic tubercular osteitis is set up, resulting in the increase of fibrous tissue formation, death of the cells and calcification of fibrous tissue in the infarcted area. At the margin of the mass is rapidly growing fibro-cellular tissue, which in some cases retains the appearance of tuberculous granulation tissue; in others it becomes more distinctly fibrous. The dead mass, when isolated, is found to be very dense and eburnated, but it is only when this tuberculous or fibro-cellular tissue is removed by maceration that the wedge-shaped sequestrum is set free from the bone in which it lies.

The changes in the synovial membranes are fully described by Koenig, who divides them into three groups.

1. Miliary tuberculosis, like that seen on any serous membrane, which seldom occurs by itself, and is simply the result of distribution of tubercle bacilli by the minute blood-vessels that supply the synovial membrane. They may be seen alone or may be found associated with other alterations in the synovial membrane.

2. A somewhat nodular tubercle, which may be mistaken for a rheumatoid arthritis deformans. The synovial membrane is thickened, thrown into folds, and extends beyond the normal limits of the articular surface. The tissues of the joint are often translucent and extremely vascular, and the surface may be covered by a layer of fibrinous lymph, particles of which, becoming detached, are thrown into the cavity of the joint, where they are spoken of as "melon-seed" bodies. Firmer masses derived from detached particles of synovial membrane, and possibly also of the semilunar cartilages, may also lie free in the joint.

3. Tuberculous inflammation, gelatinous or pulpy degeneration, is by far the most frequent form of synovial tuberculosis. The membrane—which is soft and oedematous or gelatinous, and greyish in colour—is greatly thickened, the fringes at the margin are usually injected, and the joint surface is smooth and glistening, or in certain cases rough, owing to deposit of coagulated fibrinous lymph. The ligaments and articular cartilages, in advanced cases, are more or less softened, and the other soft tissues around the joint become gelatinous, whilst in the soft grey gelatinous tissue, small caseous degenerating points or large collections of cheesy matter may be seen. The gelatinous tissue, at first vascular, contains enormous numbers of tubercle follicles in which giant cells are well seen. As the process becomes more marked, and especially as caseation supervenes, endarteritis obliterans may be noted, a condition met with in all cases of tuberculosis of the bones and joints. It is now generally accepted that most cases of bone tubercle are secondary to some other primary focus in the body, that, as a rule, it is associated with some injury to the bone or joint, and that the infective material is usually, whether in the bone or the soft parts, brought up by the blood-vessels; that it may occur in connection with a generalized miliary tuberculosis and that certain cases of tuberculous disease may be never diagnosed; that tuberculous disease commencing in a joint comes on slowly, and is often associated with little or no pain, though there may be localised tender swelling, some alteration in the outlines of the bone or some softening of the surface, or an abscess leading to the formation of a sinus in the neighbourhood of the bone. Even when both bone and synovial membrane are involved, there is usually no increase of fluid in the articular cavity. When there is invasion of a joint from a tuberculous bone, say through invasion of the articular cartilage, a sudden and severe pain is usually an indication of such extension. Thompson maintains that severe bone lesions are indicated by rapid joint disorganization, extensive suppuration, and destruction of bone leading to sudden

development of deformities of the nature of pathological dislocations.

A form of tuberculous synovitis, the "hydrops tuberculo-sus" of Koenig, is characterized by comparatively slight change in the synovial membranes. In the pale, turbid synovial fluid met with in such a joint, fibrinous melon-seed bodies, or organized, loose bodies such as those already described may usually be found. The synovial membrane may be much thickened, or there may be simply small miliary tubercles scattered over the surface of the synovium, of which as a rule there is little thickening, such as is seen in the gelatinous form of degeneration. In certain cases there may be some slight thickening of the soft tissues at the margin of the articular cartilages.

The spinal column is, in young people, one of the most important seats of tuberculosis, which occurs, in a large proportion of these cases, before the tenth year, and of every three of these nearly two occur before the age of five years. As in other bones, the localisation of the process is determined by the vascular supply, which is derived from two sources, the posterior spinal artery and the intercostal arteries. From the former are two sets of branches, one to the body of each vertebra, another to the epiphyses and the intercostal cartilages. The intercostal vessels send out small branches to the anterior portion of the body of the vertebra. The tubercular process may commence in the centre of the body of a vertebra, thence extending towards the periphery. In other cases it is epiphyseal, whilst in a third set the disease commences in the anterior portion of the spinal column, whence it may extend backwards and, in certain cases, the process may continue upwards and downwards until a considerable area is involved. In most of these forms caseation and softening of the bodies of the vertebra occur, the intervertebral discs, if involved, often becoming gelatinous before showing cheesy softening. Of course, in more chronic disease, and especially following tuberculous inflammation of the periosteum, irregular new bone formation may go on in the tuberculous thickening. It is obvious that, as the result of the softening of bones that have to carry such great weight (the disease occurs usually in the lower dorsal region), curvature of the spine must result; and as the bodies of the vertebra, and not the spinal and lateral processes, are attacked most frequently the angular deformity is in an antero-posterior direction, though along with this there may be and often is some lateral curvature, the result of irregular softening. The types and mode of advance of the disease, the formation of subperiosteal abscesses, the "boring" of pus and the formation of fistulæ are similar to those seen in, or in connection with, other

tuberculous bones. The processes of repair and cure are also of the same type as are met with in other forms of tuberculosis osteitis and periosteitis.

There appears to be an increasing conviction amongst surgeons that it is necessary to remove tuberculous bone freely by gouging, curetting, or even by sub-periosteal resection, as recommended by Stiles, who refers to the great bone-forming powers of the periosteum in those cases in which it is not actually involved in the tuberculous process.

Tuberculin should never be neglected in the treatment of surgical tuberculosis. Surgical tuberculosis is more isolated, vital organs are not involved, and the tuberculin reactions, even when excessive, are not accompanied by severe symptoms. Moreover, the tissues affected are not readily destroyed, and the healing reaction of the fibrous tissue formation is more readily obtained. The reaction obtained as the result of the formation of the primary lytic antibodies can be watched and controlled, whilst the secondary antitoxic antibodies can, by fomentation, the production of passive congestion and similar methods, be brought into direct and continuous contact with the tubercle bacillus and its products. In connection with operations for the removal of tuberculous material from bone or elsewhere, it cannot be insisted too strongly that a course of tuberculin treatment in which Wright's negative phase has been passed through, and a positive phase obtained, should wherever possible be given, in order that infection from the disturbed tuberculous material may, as far as possible, be minimized. General conditions of nutrition, good hygiene, rest, graduated exercises and the like, are essential in the routine treatment of surgical tuberculosis. G. S. W.

SYPHILIS

Syphilis is an infectious disease due to a protozoon, the spirochæte or *treponema pallida*, discovered by Schaudinn in 1905.

Bacteriology. The spirochæte *pallida* is two or more times the length of a red blood corpuscle; it has fifteen or more coils, each coil being of the same size; it tapers finely at both ends. These features serve to distinguish it from the other spirochætes.

The organism is found with ease in the secretion from a chancre, with difficulty in the serum produced by blistering a papule, and with great difficulty in all late lesions.

It is best seen living by examination of an unstained film with a dark ground illumination, or dead in a permanent specimen by mixing a drop of the secretion from a chancre with a drop of Indian ink (Günther and Wagner) and

making a film. White coiled spirochaetes stand out against the dark Indian-ink background.

In section it is best seen in silver impregnated specimens from the suprarenal glands, liver or lung of a congenital syphilitic.

The spirochæte pallida has been cultivated on inspissated horse serum, but only with the greatest difficulty.

Serology. Agglutination, as in Widal's test for typhoid, does not apply to syphilis, but detection of the antibody in a syphilitic subject, by what is known as the Wassermann reaction, is one of the most valuable aids to diagnosis in medicine. A positive Wassermann's reaction is diagnostic of active syphilis, whether clinical manifestations are present or not; therefore treatment is indicated. Treatment in practically all stages of syphilis, provided it be adequate, is capable of converting a positive reaction into a negative one.

For the reaction 1-2 c.c. of blood are required, and every physician should insist on the original Wassermann's reaction being done, and not the modifications which go by that name, which are quite unreliable.

Owing to the fact that gummata may occur eight months after infection, and that no one can tell when the secondary stage ends and the tertiary begins, I propose to divide syphilis up into—

1. Chancre.
2. Stage of general infection, with appearance of rash, sore throat, etc. Eruptive stage.
3. Recurrent syphilides.
4. Gummata.
5. Latent syphilis.
6. Visceral syphilis.
7. Nervous syphilis.
8. Congenital syphilis.

Chancre.—The site of infection appears as a papule, an erosion on the surface of which quickly follows, or the erosion may not be preceded by a papule. The first appearance of the sore is between two and six weeks from the time of inoculation.

No reliance should be placed on this fact from a diagnostic point of view, because a patient will blame the last connection and date everything from that, infection having really taken place earlier.

The old rule of the number of sores present—multiple—soft sores; single—syphilis—is quite unreliable. A single sore on the corona is usually, but not invariably, syphilitic; sores on the skin of the penis, which are as commonly multiple as single, are almost without exception syphilitic.

A single large, deep and well-circumscribed sore anywhere on the penis is syphilitic, and probably secondarily infected with cocci; such a sore may rapidly increase in size and cause

destruction of the whole penis—phagedænic chancre. Induration, when present, is diagnostic, but its absence does not in any way negative syphilis; small syphilitic sores on the corona are frequently not indurated, and the multiple chancres—small, superficial, circular, very sharply circumscribed sores occurring usually on the glans penis—never are. A chancre in the mouth of the urethra is indurated in one diameter only, either antero-posteriorly or laterally. A chancre in this situation is often overlooked, so that when other symptoms appear the case is described as *syphilis d'emblée*. A chancre on the skin of the penis is not indurated in the usual sense of the word, but is peculiar in that when lifted up it is raised as a whole, does not wrinkle, and feels like parchment—therefore called “parchment induration.”

Of the greatest value in differential diagnosis is the appearance.

A syphilitic sore is sharply circumscribed, not irregular or undermined at the edge; the erosion is either on a level with the surrounding skin or raised above it; therefore a sore should be examined sideways.

The surface of the sore is, as often as not, dry, especially is this the case with chancres on the skin of the penis; when moist they are not covered with pus, they bleed easily on friction, and do not discharge. Finally, there is none of the surrounding inflammation which is so typical with soft sores, because Ducrey's bacillus is a pus-producing organism, while the spirochæte pallida is not; and this is also the reason why soft sores are undermined and ragged at the edge and in the centre depressed beneath the surface—an ulcer in contra-distinction to an erosion. The ulcer is covered with pus and discharges freely.

A patient may have a double infection, in which case the soft sore does not heal readily, but persists, and ultimately increases in size, becomes indurated and develops into a chancre. It is therefore advisable not to let a patient with a soft sore out of sight for two months, and only then will it be justifiable to tell him for certain that the sore was an innocent one. The lymphatics draining the sore are the next structures to become affected, and these can usually be felt as hard strands, or sometimes as a string of beads; the dorsal lymphatics of the penis are always the most palpable. The glands next become enlarged. Enlargement of the inguinal glands occurs in almost every case of gonorrhœa and soft sores, so that a casual palpation is worse than useless.

The characteristic of glands enlarged by syphilis is that they alter rather in consistency than form. Syphilitic glands remain discrete, they retain their oval form, but become harder and round on the surface, instead of flat as

normal glands are. Even if they reach a large size they are always hard.

Lymphatics cross over the middle line of the body, consequently both inguinal regions are generally affected, whether the sore is on one side or not.

Extragenital Chancres.—A chancre may appear anywhere, and there is really nothing absolutely characteristic about its aspect, but fortunately there are three points which make a diagnosis simple: (a) a sore is single, (b) it appears slowly and advances gradually, therefore when the patient comes for advice it has usually been present some time, (c) the glands draining it are markedly enlarged. The last point is all-important. A chancre in the mouth, or on the lips or cheek—the most frequented sites for extragenital chancres—are invariably accompanied by an enormous enlargement of the lymphatic glands, often to the size of walnuts, owing probably to the richness of lymphatics in this region. The glands may suppurate, due to a secondary coccal infection.

Treatment. The moment a sore is diagnosed treatment should be undertaken at once, and no one should more dream of waiting for other manifestations to appear than he would for secondary deposits from a primary growth. Excise the chancre when possible; if not possible, cauterize and rub in ung. hydrarg. This should never be omitted, since it will bring about a disappearance of the induration.

As there is no such thing as syphilitic immunity, a chancre may break down again and give rise to a fresh infection—chancre redux. It is, again, not at all uncommon for a gumma to appear on the site of a chancre.

Before treatment a Wassermann's reaction should be done, as the amount of treatment necessary will be influenced thereby. If negative it is probable that the stage of general infection has not been reached, *i. e.* that the body has not had to form antibodies, and two injections of salvarsan (0.5 grm.), given at seven to ten days' interval, will generally suffice to bring about a cure. If on the point of reaching the stage of infection, although before treatment a Wassermann was negative, an injection of salvarsan is capable of giving rise to a positive Wassermann in the blood drawn off before the fourth day after injection; and this being the case, a course of mercurial injections should be resorted to and the treatment closed by a third injection of salvarsan. If the third injection is still capable of setting free enough "reagin" to cause a positive Wassermann, injections must be repeated until such is not the case. Salvarsan increases the resistance of the patient by stimulating the production of antibodies (reagin); therefore if no antibodies are formed—*i. e.* a negative Wassermann's reaction obtained in the blood

taken twenty-four hours, on the fifth and between the tenth and fourteenth days after injection—it may be taken in the light of our present knowledge as indicating a cure.

The treatment should be especially thorough in cases of extragenital chancres in the head region, owing to the proximity of the important nervous elements, which the organisms may reach by direct extension. Cranial nerve lesions are commoner after extragenital than genital chancres.

Stage of General Infection.—Like all general exanthemata, the general infection of syphilis causes a rise of temperature, headaches, albuminuria and a rash. Polyadenitis is characteristic of syphilis; the glands above the internal condyle of the humerus, in the triangles of the neck and in the sub-occipital region are usually enlarged.

The headaches are due to hyperæmia of the meninges brought about by the presence of the organisms. They may get into the synovial membranes and periosteum of the bones, causing joint and bone pains.

The rash is diffuse and most marked on the trunk, appearing first as a roseola, which is quickly replaced by macules and then by papules. The papules may persist and become pustules; these may break and form small ulcers, or crusts may heap upon them, producing the so-called rupia. On the other hand, the papules may retrogress and then become scaly—psoriasiform syphilide.

As there are stages, and fresh lesions keep on making their appearance, a macule, papule and pustule or scaly papule may be seen on the same patient—a polymorphic eruption, characteristic of syphilis. As the infiltration of the corium with small round cells and plasma cells is so pronounced in syphilis it gives rise to the raw, coppery, lean-ham colour of the papules.

Still more characteristic is the development of a papule on the macule and so on, in that it first appears as a small raised spot in the centre of a circumscribed red area—the macule.

Faint circular scaly lesions round about the nose and mouth are quite characteristic—seborrhœic syphilide; so are papules at the junction of the hair and forehead—corona veneris.

Especially in women, most marked on the neck and anterior folds of the axillæ and absolutely pathognomonic of syphilis, are small circular depigmented areas—leucoderma syphilitica. Not uncommonly they are arranged in a rosette fashion. Not infrequent is the presence of a hyperpigmented spot in the depigmented area. The latter is formed where a macule, and the former where a papule has been. Macules and papules also occur on the scalp, and they may cause the hair to fall out, giving rise to a diffuse alopecia and not to circumscribed bald areas.

Papules on the scalp may so develop as to resemble raspberries—frambœsial syphilide. In moist areas they can develop and become condylomata.

Lesions similar to those described on the skin develop in the mouth, starting as hyperæmia of the fauces and later producing mucous patches and papules.

The presence of spirochaetes gives rise to inflammation, and as they may be present in any structure during the eruptive stage, any symptoms may develop. Iritis is very common; much rarer are lesions of the optic and auditory nerves, which have lately received much attention, as they have been reported as occurring more frequently after salvarsan. The lesions are usually unilateral; they improve under further administration of salvarsan or under mercury and iodides, and they do not occur if more than one injection is given or the treatment is augmented with mercury. They are true syphilitic lesions, and need never occur when adequate treatment is prescribed.

Recurrent Syphilides.—Syphilis is noted for its period of latency, dangerous in the extreme, since damage to vital organs may be steadily progressing without the patient's knowledge; and so long as there are no symptoms it is difficult to get a patient to undergo treatment. The more syphilized a nation becomes the more latent is the course of the disease, consequently the greater frequency of late visceral and nervous manifestations. On the other hand, the less syphilized a nation is the more severe are the cutaneous manifestations, and the disease behaves more like an infective fever, which syphilis originally no doubt was.

This shows the absolute necessity of early and vigorous treatment.

Recurrent syphilides are easy to diagnose, so far as the skin affections are concerned. They probably all arise from the original papule. The papule contains spirochaetes, which in time extend peripherally; so that when they reappear it will be as the whole or part of a circle.

Another characteristic of recurrent syphilides is that they are grouped, and each group is circular.

An early form of recurrent syphilis is the small follicular syphilide—a circular group of follicles, each having a tiny papule.

Not infrequently the papules are bigger and not necessarily follicular—lichen syphiliticus.

In the centre of a circular group of papules may be a large papule, probably the original one—corymbose syphilide.

The two latter are always most marked on the back, and the most characteristic lesions are generally seen in the transverse mid-scapular line.

These three recurrent syphilides usually appear during the first year or two, and the last two are extremely resistant to treatment.

A recurrent syphilide which may appear any time after infection is the orbicular syphilide, characterized by faint red rings seen most commonly on the inner sides of the thighs in women, or flexor aspects of the forearms.

An orbicular syphilide may appear anywhere, but lesions are always most clearly seen where the skin is fine and hairless; if occurring elsewhere this is usually overlooked, as the lesions may be very faint.

The later recurrent syphilides, although grouped, do not form such perfect circles, the papules being more irregularly arranged.

These are only further stages of the lesions above described, and resemble the lichen syphiliticus or the corymbose syphilide on a larger scale, with bigger papules and more intervening space, some of the papules being absent owing to the death of the spirochaetes in them, thus accounting for the more irregular arrangement. These lesions respond well to treatment, and when they disappear leave pigmentation behind.

Again, the orbicular syphilide may be represented on a large scale, but instead of being a perfect circle, the lesion may only be a crescent. The crescent may be perfect or irregularly made up of papules; in its concavity there is not infrequently a large area of hyperæmia—serpiginous syphilide.

Any of the papules making up these late recurrent syphilides may ulcerate, and the ulcers are usually covered with scabs. When the lesions heal under treatment, naturally scars will result. Ulceration is very common when such lesions occur on the face. The face lesions are very characteristic, and although they may occur in any part, they are most usually found on or around the alæ of the nose and below the lower lip. In the latter situation one pole not infrequently touches the mucous membrane.

The scarring is the most typical feature, since although the circular group may have been small, it will be made up of several distinct scars, which at no time showed any tendency to coalesce.

Small grouped discrete scars on the face are pathognomonic of syphilis.

All recurrent syphilides disappear quickly under salvarsan, however resistant they may be to mercury, and although the pigmentation resulting will be at first increased owing to the action of the arsenic, it will ultimately, or in a few months, completely disappear.

The best treatment is to give first of all six weekly intramuscular injections of mercury, and then four to six intravenous injections of

salvarsan (0.4-0.55), with about seven to ten days' interval between each, and continue the mercurial treatment until the salvarsan course is finished. Whether four or six injections of salvarsan are requisite can only be gauged by doing a Wassermann reaction of the blood which has been drawn off a day or two after the last injection.

Gummata.—Although it is possible to produce a chancre by rubbing in the secretion from a gumma on the eyebrow of an ape, for all practical purposes gummata may be regarded as non-infective, and they are more probably produced by some vessel change rather than by the direct presence of the spirochæte. The organisms undoubtedly cause the peri- and end-arteritis which deprive the part of its blood supply, and consequently necrosis occurs.

A gumma starts as a hard nodule in the skin, which is red and raised; the surface then breaks and an ulcer is produced. Once a gumma has formed it does not tend to spread peripherally, so that although several may be in close proximity, the scars remaining after they have healed will be the same size as the gummata and will not have coalesced. The scar tissue resulting from a gumma is often very dense, and as it progresses the fibrous tissue contracts, which may be extremely dangerous where a vital organ is affected. Gummata of the soft palate are extremely common, and if this has not been completely destroyed the scar tissue formed may be sufficient to cause troublesome adhesions. Gummata of the larynx are dangerous because healing may lead to complete stenosis, requiring tracheotomy. Gummata of the skin respond readily to mercurial treatment, which is by no means the case when the pharynx and larynx are affected. Another favourite site for gummata is in the periosteum. In the case of the hard palate perforation is usual, and perforation of this bone, in both children and adults, is pathognomonic of syphilis. Perforation of the nasal septum is quite common, although there are many other causes besides syphilis. Periostitis of the long bones does not lead to ulceration, but often to acute pain and hypertrophy of the bone underneath, *e.g.* hard node of the tibia; on the contrary, when the pericranium is affected, ulceration is common, and underneath there is an absorption of bone—the soft node. The difference is simply due to the amount of blood supply; a rich blood supply causes absorption and vice versa. The pericranium being more vascular than the periosteum of the long bones, a gumma in the former situation will lead to absorption of bone and in the latter to an overgrowth.

Treatment. The same as for the recurrent syphilides. After the salvarsan and mercurial course, iodides should be given, in this as in all

stages, as one of their chief actions is to cause elimination of the excess mercury which might otherwise be stored up. Iodides and mercury should not be administered together, since the former inhibits the action of the latter. In no syphilitic stage is salvarsan more urgently indicated; gummata disappear rapidly and no fibrous tissue contraction results. The scar occurring after treatment with salvarsan is noted for its pliancy and softness and is not depressed; the skin, in fact, is like tissue paper. The importance of this can be recognized at once when stenosis of the larynx threatens. However refractory to mercury the gummata of the pharynx and larynx may be, the pain on swallowing solids disappears within a few hours of an injection of salvarsan, and the ulceration clears up rapidly. Gummata of the tongue may so completely heal up under salvarsan that papillæ may even reform on the mucous membrane. The acute pain in periostitis disappears almost instantaneously after one injection. All patients with late syphilitic manifestations are especially liable to be run down, emaciated and anæmic. In such the roborant effect of salvarsan is most striking.

Latent Syphilis.—This is one of the most important stages, because, in the absence of symptoms, a patient may imagine himself cured and get married, or he may seek advice as to whether he is cured or not. As no symptoms are present a Wassermann's reaction is done—if positive the course is clear, if negative, it does not certify a cure, and leaves the patient in an uncertain position. Fortunately salvarsan has the action of stimulating the production of "reagin," so that if an injection—a so-called provocative injection—is given in this stage and the blood examined twenty-four hours, fifth and between tenth and fourteenth day, almost every case giving a negative Wassermann's reaction before the injection will give a positive after, showing that the patient is still syphilitic. If all the tests are negative and a year or more has elapsed since the last course, the patient can be regarded as cured.

Visceral Syphilis. Tongue.—Apart from the mucous patches which have already been referred to, it is not uncommon for the whole tongue to swell during the early stages of syphilis. The result of the swelling is to cause a diminished blood supply to the dorsal mucous membrane, with the result that the papillæ atrophy and a glazed surface is left; being tender and as a result of external irritation and diminished blood supply from within, the mucous membrane attempts to form a structure analogous to the stratum corneum of the skin—white patches or *leucoplakia*. The fibrous tissue in the parenchyma contracts, so that the tongue in time becomes smaller. This further decreases the

blood supply to the mucous membrane, with the result that it cracks and forms fissures.

Chronic Superficial Glossitis.—This condition, in my opinion although syphilitic, is directly caused by the internal administration of mercury, since it is much more common in this country, where pill treatment has been the rule, than in countries where mercury is always administered in the form of inunctions and injections. A patient with chronic superficial glossitis will improve but little under further mercurial treatment, even if inunctions or injections are prescribed, while carcinoma only too frequently develops. Although salvarsan will not bring the tongue back to its former condition, it affords the patient intense relief and may render the tongue quite supple. Even if carcinoma has developed, treatment with salvarsan would give the patient much relief, as it improves the foundation on which the malignant growth rests.

Liver.—During the eruptive stage jaundice of both hepatogenous and hæmatogenous origin may occur. The former is the commoner and is either due to a catarrh of the bile ducts or to enlargement of the lymphatic glands pressing on the ducts at their point of exit. Late jaundice is due to gummata, which may be localised or diffuse, the latter causing cirrhosis.

It is safe to treat jaundice in the early stages with salvarsan, but dangerous in the late, owing to the diminished resisting power of the parenchyma cells, which are so necessary to complete the excretion of the arsenic. Interference with the arsenic excretion might lead to further destruction of already damaged cells and result in acute yellow atrophy, which is invariably fatal.

Kidneys.—During the eruptive stage albuminuria in varying degrees occurs almost without exception. The percentage of albumin passed is rarely high, but provided it is of syphilitic origin, salvarsan is not contraindicated. In the late stages the presence of albumin is due to a chronic interstitial nephritis, which means that there is general arterio-sclerosis. Such cases will require most careful treatment and salvarsan had better be withheld.

Vascular System.—Interstitial myocarditis is a not uncommon syphilitic complication, and although it may not lead to palpable physical signs, it usually gives rise to anginoid attacks—pain and a feeling of heaviness over the heart—and palpitation. If diagnosed, salvarsan should not be given. Cases of marked arterio-sclerosis, owing to the frequent implication of the coronary arteries and aneurisms, strongly contraindicate treatment with salvarsan. One of the actions of salvarsan is to cause reactionary inflammation, which causes a swelling of the lesion; therefore it can easily be understood that a slight amount of reactionary inflammation

and swelling would produce closure of a coronary artery already narrowed by an endarteritis.

Nervous Diseases.—Syphilitic affections of the nervous system can be divided into two groups, non-degenerative and primary-degenerative.

To the former belong cerebral syphilis, spinal syphilis, cerebro-spinal syphilis, myelitis and pseudo-tabes.

During the acute stage of these diseases salvarsan should not as a rule be given, and under no conditions should ever more than half a dose be prescribed, since the reactionary inflammation which might result around a basal gummatous meningitis, for instance, in raising the intracranial pressure, would be sufficient to inhibit the action of the centres around the fourth ventricle. Repeated small injections combined with mercury will often result in such cases being temporarily cured. Most of the non-degenerative nerve lesions occur soon after infection, and are very liable to recur, therefore early and vigorous treatment is strongly indicated. On the other hand, the degenerative lesions, such as tabes and G.P.I., occur some years after infection and cannot be benefited by salvarsan treatment. Indeed, in the latter, salvarsan is dangerous and should be withheld. Of the utmost importance in differential diagnosis is an examination of the cerebro-spinal fluid. A strong positive lymphocytosis, and a strong positive Nonne-Apelt reaction, point to the lesion being a primary degenerative one, and occurs more commonly in G.P.I. than tabes. A positive Wassermann's reaction is likewise more common in G.P.I. than tabes. All the three tests may occur in non-degenerative lesions, but are not usually so strongly marked. In cases of cerebro-spinal syphilis it is not uncommon to get a positive Wassermann's reaction in the cerebro-spinal fluid and a negative in the blood. The three reactions, especially in the non-degenerative lesions, can be made to disappear by the use of salvarsan.

Congenital Syphilis.—Pregnant syphilitic women treated with a course of salvarsan and mercury as mapped out above will not abort but produce healthy non-syphilitic children. No child born with syphilis should be treated with salvarsan, nor be suckled by its mother to whom an injection has been given. Internal administration of mercury should be resorted to, also mercurial inunctions and the wearing of certain articles of clothing impregnated with mercury. When the symptoms have disappeared and the general condition of the infant has improved, intramuscular injections of salvarsan can be safely employed, and the dose should range from 0.001 to 0.005 grm. per pound weight. Salvarsan is of very little use in syphilis hereditaria tarda.

Enlargement on Treatment. (a) Mercurial inunctions are valueless unless a trained rubber

can undertake the case. For mercurial injections the following formula for a painless grey oil (Captain Adam's formula) is the best—

R Hydrarg. 20 parts
 Anhydrous lanoline 30 parts
 Chlorbutol 2 parts
 aa by weight.
 Liq. Paraffin to 100 by measure.
 5 minims = 1 grain Hg.
 S. give 5-10 minims weekly.

Injections can be made either into the buttocks or scapular muscles.

(b) Should potassium iodide not be tolerated, give a mixture of the sodium and ammonium salts. If the patient shows an idiosyncrasy to any inorganic salt of iodine, some organic preparation should be used, as iodoglidine.

(c) **Salvarsan.** Before submitting a patient to treatment he must be thoroughly examined, and before the injection is made be prepared as for a surgical operation.

After each injection the patient must remain in bed at least twenty-four hours and take no exertion for three days. A syringe with a three-way stopcock is more convenient than the usual infusion apparatus, one of the chief reasons being that in the latter, when the needle is in the vein, blood flows back into the syringe, and if hæmolysis occurs either with the saline solution alone or salvarsan mixture, an isotonic solution is not being employed, and the patient will have a severe reaction afterwards.

The saline solution must not be less than 0·7 per cent. or more than 0·9 per cent., and absolutely pure sodium chloride should be used (Merck).

The water must be freshly distilled and boiled before use. The reaction which follows the injection is due to the impurities in the distilled water, which can only be avoided by using it absolutely fresh. The toxic symptoms described as occurring after salvarsan are undoubtedly primarily due to using impure water and a non-isotonic solution, which injure the tissue cells and render them incapable of resisting the arsenic.

The sodium hydrate, 0·8 per cent. solution, should be boiled before use, and the strictest aseptic precautions taken with the glass vessels and apparatus employed.

If all the precautions laid down are obeyed any patient can receive seven or more intravenous injections with impunity.

Dose for man 0·4-0·6.

Dose for woman 0·3-0·45.

Dose should be repeated in between seven and fourteen days.

The glass tube containing the salvarsan should be thoroughly examined before the

contents are dissolved in four ounces of saline solution, to see that there has been no air inlet—if suspicious steep the tube in absolute alcohol.

Having dissolved the powder, add 10 c.c. of double decinormal sodium hydrate solution (0·8 per cent.), when a precipitate forms. Add more NaOH until solution becomes clear again—about 10 c.c. more are usually required—and make up to ten ounces with saline solution. Procedure for a tube containing 0·6 grm.—filter solution and have temperature just below body temperature.

Course of Treatment. Excise chancre and give two intravenous injections of salvarsan. If Wassermann's reaction is negative a day or two after last injection, patient is cured; if not, start at once with mercury and continue salvarsan injections until reaction becomes negative in the blood taken a day or two after the last intravenous injection. When this has taken place give iodides for three weeks and test blood three times more within the next twelve months. In the eruptive stage and in patients with late lesions two to four grammes of salvarsan will usually be required to cure the patient, and in every stage except the chancre it is always better to give six intra-muscular injections of mercury before commencing the salvarsan. Remember every case must be judged upon its own merits, and although one or two injections might suffice to cure one patient, six or seven might be required for another suffering from exactly the same lesions.

Neosalvarsan. Neosalvarsan, which bears the laboratory number 914, is salvarsan so prepared that the addition of sodium hydrate becomes unnecessary. The substance is a yellow powder extremely soluble in water, and the resulting solution is neutral. 1·5 gramme neosalvarsan equals 1·0 gramme salvarsan.

Neosalvarsan oxidizes quickly, and the oxidized product is toxic, therefore the solution must be prepared immediately before use and not shaken or stirred more than is absolutely necessary. The water in which the powder is to be dissolved must be warm enough to inject, *i. e.* about 18° C. to 30° C., as it is wiser not to warm the solution later, for fear of increasing oxidation. Absolutely pure distilled water must be employed, without the addition of saline, 35 c.c. to 0·1 gramme of powder. The resulting solution is hypotonic and it causes hæmolysis, as seen in the blood which flows into the syringe. This does not matter when the solution circulates in the blood stream, and I have never seen hæmoglobinuria or other symptoms follow.

In healthy individuals I commence with a dose of 0·8 gramme, and if well borne increase the dose weekly up to 1·5 gramme until the Wassermann's reaction is negative on the

forty-eighth hour and seventh day after the last injection. When such is the case I test the blood again on the fourteenth, twenty-first, and twenty-eighth days, and am only satisfied when all are negative. All stages together, about seven injections are required. To these are added eight to ten weekly intramuscular injections of mercury, of one to two and a half grains each.

In several cases I have given two injections weekly of doses ranging from 0·8 gramme to 1·5 gramme, with no toxic symptoms arising therefrom. In such cases I test the blood on each day the injection is given and repeat the injections until two Wassermann reactions running are negative, and then again weekly for a month, passing the patient when all are negative. At the same time I give eight to ten weekly intramuscular injections of mercury.

It is possible to give three doses weekly, and although they are borne well by many patients, I have noticed toxic rashes supervene, and one case complained of headaches and giddiness, and had a persistent rise of temperature for a few days which was followed by jaundice. Therefore in the present early state of our knowledge it is wiser not to give more than two injections weekly.

The same precautions that applied to salvarsan apply equally to neosalvarsan, *i.e.* half doses should be given in nervous cases, etc.

Symptoms disappear quicker under neosalvarsan than salvarsan, and neosalvarsan would appear to have greater action than salvarsan in converting a positive into a negative Wassermann's reaction.

I have come across no unpleasant symptoms following the use of neosalvarsan when one or two injections weekly are given, and the after-effects are practically nil. It has one disadvantage, *viz.* that the vein is thrombosed at the site of injection after the second or third dose—it may or may not become patent again.

J. E. R. McD.

TUMOURS

With the increase in our knowledge of bacterial and other irritants or stimulants upon the tissues, especially in relation to the proliferative changes that they induce, it has been necessary, from time to time, to revise, to some extent, our ideas as to the nature of the growths classified as tumours. Some have been removed from the group, but there still remain many which (on the one hand) cannot be looked upon as mere hypertrophies or (on the other) as inflammatory growths. They occur in positions and under conditions in which they can be of no use to the organisms in which they appear, they serve no function, they live an entirely

independent life, do not keep pace in growth with the normal tissues, degenerate early, often making great drains on the organism in which they grow for their nutrition, and cause damage by their mechanical presence, by their chemical products or as the result of their tremendous power of growth, invasion and absorption of surrounding tissues. In spite of these very marked characteristics it has been found impossible to assign to them any definite causal agency. Many attempts have been made, but as yet no etiology, either predisposing or direct, is recognized; many hypotheses have been advanced and supported by more or less definite evidence, but tumours, neoplasms or new growths are still kept in a class apart, for the reason that they cannot be placed amongst pathological lesions concerning the causation of which we have any definite knowledge. Something is known of their structure and something of their life-history, but when we attempt to systematize our knowledge of anything beyond this, we are met by so many apparently exceptional cases that the "rules" lose much of their value.

From the point of view of the surgeon this is not so important as it is to the pathologist. Nevertheless, the etiology, ontogeny and life history of the tumour have a close bearing on the treatment and prognosis of the case in which it occurs.

The tumour or neoplasm may be defined as an atypical new growth composed of tissue or tissues derived from pre-existing normal tissue—a growth consisting of embryonic or more or less developed tissue elements, which, however, have frequently a different arrangement and occur in different relative proportions from those of the normal tissues, a growth which has an active, independent vegetative existence, quite irrespective of the needs of the organ or tissue in which it grows, and of all surrounding local conditions except as regards its nutrition and the removal of its waste products. Rapidly as it grows it serves no useful purpose in respect to its host, either as regards functional activity or reparative power. It never develops into normal tissue either as to structure or arrangement, and to that extent is invariably heterogeneous. It degenerates readily, especially in the parts distant from the nutrient supply, the rapidity of growth rendering it difficult for the host to supply a sufficient amount of nutrient material with which to maintain the full vegetative activities of the tumour, which ultimately may undergo fatty or caseous degeneration, calcification, or mucoid, colloid or other degenerative changes.

As pointed out by Thoma, these growths are, but in slight degree, governed by the laws regulating the tissues by which they are sur-

rounded. They are autonomous, and their vegetative or proliferative activity is so great that the tumour cells appear to be "endowed with the power of apparently continuous and unlimited proliferation" (Beattie and Dickson), although all are composed of tissues which have their homologues in the body at some stage or other of its development. Hence microscopical examination may be insufficient for the diagnosis of tumour tissue. Certain cancer cells, for example, bear a very close resemblance to normal epithelial cells; and examination of so-called "cancer juice" may fail to give us any definite information as to the nature of the tissue from which it has been derived. If, however, the cancer cells can be examined *in situ* in relation to the connective-tissue stroma in which they lie, the diagnosis may often be made comparatively easily. Similarly, round-celled or mixed-celled sarcoma tissue resembles normal granulation tissue, in that both consist of a mass of cells of an embryonic connective-tissue type in which run a number of more or less elementary blood-channels. Any search for distinctive or characteristic tumour elements must end in failure, but a careful study of the position, proportion, stage of development and arrangement of the various tissue elements must always be of very great value in the determination of the nature of the growth.

When it is remembered that granulation tissue may be produced as the result of a proliferative activity set up by various kinds of micro-organisms, that certain chemical irritants induce great proliferative activity on epithelial surfaces, that epithelium may invade the granulation tissue covering ulcerated surfaces, that fibrous tumours may occur in a cicatrix, that a low type of epithelioma may occur as the result of constant irritation of the shins in the fireman working in front of the fire-box of a locomotive, it will be realized how difficult it is to draw a hard and fast line between tumours, inflammatory growths and "granulomata."

Classification of Tumours

Any classification of tumours, to be satisfactory, must be based on the derivation of the tissues from, and in, which a tumour develops. When embryology was a young study this appeared to be a comparatively easy matter, but with modern developments it becomes more and more evident that a final classification on this basis is as yet not to be thought of; Adami, following Waldeyer, has, however, grappled with this difficult question and has drawn up an embryological classification which harmonizes well with known clinical data. His classification is of special value in so far that it includes and explains certain tumours that have for long puzzled the pathologist working on old embryolo-

logical lines, and is based on a division of the various tissues of the body into two great groups, according to their derivation—

1. The *Hylic* (from ὑλη, crude or undifferentiated material) or body-pulp group.

2. The *Lepidic* (from λεπίς, λεπίδος, rind, skin or membrane) or the "lining-membrane" group.

In utilizing this classification I have inverted Adami's order of the groups, that the less complicated connective-tissue tumours may be considered before the more complex tumours, in which, in addition to the simpler tissues, "groups" of epithelial or endothelial cells have to be dealt with.

Adami gives the following classification of the normal tissues, and on this bases his classification of tumours:—

I.—Hylic or Primitive Pulp Tissues

Organs and tissues in which the special characteristic is that the specific cells lie in, and are separated by, a definite stroma, homogeneous, or fibrillar, in which there may or may not be blood and lymph vessels.

1. *Epiblastic*. Nerve cells, neuroglia.

2. *Hypoblastic*. Notochord.

3. *Mesenchymatous*. Fibrous connective tissues, cartilage, bone, reticulum of lymph glands, bone marrow, fat cells, involuntary muscle tissue, spleen, blood-vessels, blood corpuscles.

4. *Mesothelial*. Striated muscle, including cardiac muscle.

II.—Lepidic or Lining-Membrane Tissues

Tissues in which the blood-vessels do not penetrate the groups of specific cells, in which, although the stroma of mesenchymatous origin may be present between the groups of cells, there is none between the individual cells.

1. *Epiblastic*. Epidermis. Epidermal appendages of hair, nails, enamel of teeth, etc. Epidermal glands. Epithelium of the mouth and salivary glands. Epithelium and glands of nasal tract and associated spaces. Epidermal portion of hypophysis cerebri. Lens of eye. Epithelium of membranous labyrinth of ear, anus, male urethra (except prostatic portion).

2. *Hypoblastic*. Epithelium of digestive tract and glands connected with it. Specific cells of liver, pancreas, tonsils, thymus, thyroid. Epithelium of trachea, lungs, bladder, female urethra, male urethra (prostatic portion).

3. *Mesothelial*. Lining cells of pleuræ, pericardium, peritoneum. Specific cells of suprarenals, kidneys, testes, ovaries (Graafian follicles). Epithelium and glands of Fallopian tubes, uterus, vagina, vasa deferentia, vesiculæ seminales, etc.

4. *Endothelial*. Lining endothelium of blood-vessels and lymphatics.

In subdividing these tumours, Adami takes into consideration: (1) the grouping of the cells (hylic and lepidic); (2) their origin—epiblastic, hypoblastic or mesoblastic; (3) the method of growth—typical or atypical—of the tumour tissue. The tumours growing in a typical fashion fall naturally into the clinical group of non-malignant or benign tumours, the atypical growths coming under the heading of malignant tumours, most of which give rise to metastatic growths.

Group I.—Hylic or "Pulp" Tumours

1. Of *Epiblastic Origin*—

Tumours whose characteristic constituents are overgrowths of tissues derived from the embryonic pulp of epiblastic origin.

(a) *Typical*. True neuroma, glioma.

(b) *Atypical*. Gliosarcoma.

2. Of *Hypoblastic Origin*—

Tumours derived similarly from embryonic pulp of hypoblastic origin. Chordoma.

3. Of *Mesenchymal Origin*—

(A) *Mesenchymal Hylomas*. Derived from tissues originating from the persistent mesoblastic pulp, or mesenchyme.

(a) *Typical*. Fibroma, lipoma, chondroma, osteoma, myxoma, leiomyoma, angioma, myeloma.

(b) *Atypical*. Sarcoma (derived from mesenchymatous tissues), with its various subdivisions fibrosarcoma, spindle-celled sarcoma, oat-shaped-celled sarcoma, chondrosarcoma, osteosarcoma, myxosarcoma, lymphosarcoma, chloroma, angiomasarcoma; of origin still debated, melanomasarcoma.

(B) *Mesothelial Hylomas*. Tumours which are overgrowths of tissues derived from embryonic pulp of definitely mesothelial origin. Rhabdomyoma.

Group II.—Lepidic or "Rind" Tumours

(A) LEPIDOMAS OF THE FIRST ORDER—

1. Of *Epiblastic Origin*—

Tumours whose characteristic constituents are overgrowths of tissues derived directly from the epiblastic lining membranes, or epiderm.

(a) *Typical*. Papilloma, epidermal adenomata (of sweat, salivary, sebaceous and mammary glands, etc.).

(b) *Atypical*. Squamous epithelioma, carcinoma of glands of epiblastic origin.

2. Of *Hypoblastic Origin*—

(a) *Typical*. Adenoma and papilloma of digestive and respiratory tracts, thyroid, pancreas, liver, bladder, etc.

(b) *Atypical*. Carcinoma developing in the same organs and regions.

(B) LEPIDOMAS OF THE SECOND ORDER, OR TRANSITIONAL LEPIDOMAS—

3. Of *Mesothelial Origin*—

Tumours (mesotheliomas) whose characteristic constituents are cells derived in direct descent from the persistent mesothelium of the embryo.

(a) *Typical*. Adenoma of kidney, testicle, ovary, urogenital ducts; adenoma of uterus and prostate; adenomas originating from the serous membranes, "mesothelioma" of pleuræ, peritoneum, etc.

(b) *Atypical*. Cancer of the above-mentioned organs or structures; squamous endothelioma, so-called, of serous surfaces, epithelioma of vagina; adrenal mesotheliomas, hypernephroma.

4. *Endothelial Lepidomas*—

Tumours originating from the endothelium of the blood and lymph vessels; lymphangeio-endothelioma, hemangeio-endothelioma, perithelioma, cylindroma, psammoma, cholesteatoma.

TYPICAL HYLIC TUMOURS OF EPIBLASTIC ORIGIN—

The **Neuroma** (a) composed of nerve fibrils, occurring usually at the cut end of the nerve, or (b) composed of ganglion cells, is rare. Most of the so-called neuromas "on nerve trunks" are fibromas or myxomas, or, when found in the central nervous system, gliomas.

The **Glioma**.—A non-malignant tumour composed of connective tissue similar to that found in the nerve centres. It occurs in the brain and spinal cord, especially around old cysts and in cases of syringo-myelia, more frequently in the former than in the latter and in children than in adults. It grows slowly, gradually replacing the nerve tissue, into which it merges at its margins. It is grey, translucent or greyish or dark-red according to its vascularity. Even when hæmorrhages occur it may usually be distinguished from a sarcoma (see below) in the same position by the greater firmness of the peripheral portion of the tumour. The tumour is made up of numerous branching cells, the processes of which form a somewhat dense felted network. Many of the tumour cells appear to surround the blood-vessels, of which, however, the endothelial plates may usually be distinguished.

ATYPICAL HYLIC TUMOUR OF EPIBLASTIC ORIGIN—

The **Gliosarcoma**.—A small round-celled malignant tumour, usually arising in the retina, infiltrating the surrounding tissues and setting up metastatic growths at a distance.

HYLIC TUMOUR OF HYPOBLASTIC ORIGIN—

The **Chordoma** (derived from the notochord ?) is made up of a number of rounded cells lying in spaces in a homogeneous substance forming

a tissue very like elementary cartilage. The tumour is non-malignant.

TYPICAL HYALIC TUMOURS OF MESENCHYMAL ORIGIN—

The tumours of this group correspond most closely to what, hitherto, have usually been termed simple histoid tumours. They grow comparatively slowly, are usually single, rounded, flattened or lobulated, and are surrounded by a fibro-cellular capsule, the result of a chronic local proliferative inflammation of the connective tissue set up by the presence of the tumour. They are non-malignant and give rise to little inconvenience or injury except by their weight and mechanical pressure. On section, vascular fibrous trabeculae are seen running from the capsule in between the individual lobules of which the tumour is composed. Such tumours undergo fatty, calcareous, colloid or mucoid degeneration, and hæmorrhages and ulceration may occur as the result of mechanical injury or the irritant action of chemical substances or putrefactive products. The name given to the tumour usually suffices to indicate its structure.

The **Fibroma**, or fibrous tumour, usually arises in pre-existing fibrous tissue, subcutaneous and submucous tissues, periosteum, fasciæ and interfascicular tissue of nerves, especially in the skin, in the mamma and ovary, or in the wall of the uterus, as a small rounded growth in the pyramids of the kidney, as a cheloid growth in scar tissue, or as in the so-called loose cartilages of the knee joint, as a hard, firm, dry, glistening white, or brownish, slightly vascular tumour; when less firm, it is pinkish and even gelatinoid. When lobulated each lobule is made up of concentric layers of fibrous tissue, usually softer and more open in the centre. Under the microscope the fibrous tissue, if firm and hard, contains comparatively few nuclei, but the softer tumours are made of a more delicate fibrous stroma with numerous cells, of which the nuclei are elongated or rounded. A lamellar form occurs as a hard cartilaginous mass, usually where a laminated fibrous tissue is met with normally, as in the pleura, on the surface of the spleen and liver, or on the inner surface of the blood-vessels. It is usually a flattened, yellowish, translucent thickening, with or without pigment.

The **Lipoma**, or fatty tumour, grows in the subcutaneous tissues, especially in parts subjected to pressure—the shoulders and buttocks, the abdominal wall and the breast. It may also be found as an arborescent growth in the appendices epiploicæ and in the synovial fringes of joints. Even in tissues which normally do not contain fat—the dura mater, the submucous tissue of the intestine and, rarely, the liver and heart, between

muscles and in bone—this tumour may be present as a single or multiple flattened, rounded or pedunculated growth. When large it is always lobulated. The yellowish tissue of the lobules is usually softer and more plastic than ordinary fatty tissue, the cells larger, and the tissues as a whole more vascular than in normal fat. In some of the connective-tissue cells the process of fatty infiltration may be incomplete.

The **Chondroma**, or cartilaginous tumour, arises in the periosteum of bones, especially at the ends of the metacarpal bones and in the phalanges of the fingers and toes. In the bones themselves, in the parotid and other salivary glands, in the testicles, skin, lung and mamma, and even in the cartilages of the ribs and larynx. The growths are usually multiple, firm and elastic, though they may undergo mucoid degeneration. The tumour “cuts” with the peculiar creak of cartilage or, if calcified, with a gritty feeling. The translucent bluish, pearly or pink cartilaginous substance stands out very distinctly from the white glistening trabeculae and the walls of the capsule. Both cells and matrix vary somewhat in type. In a mucoid matrix the cells branch; in a firm and hyaline matrix well-formed capsules may be seen around the cells. Between these two extremes all intermediate types are found. Calcification often takes place. When a cartilaginous tumour is softer it grows more rapidly, often giving rise to secondary metastatic, more gelatinous, growths, especially in the lung. The more rapid the growth, the more irregular are the cells, some of which may be of enormous size, like those found in the cartilage of the cephalopods. Imperfect bone may also be developed in these growths. These **myxochondromas**, as they are called, must be looked upon as malignant chondromas and are really atypical members of the group (see below).

Osteomas, independent of the tissue in which they occur, are, as pointed out by Adami, rare, although what he describes as osteomatoid conditions, in which there is a localised or general overgrowth of the bone, are of common occurrence. Both groups are found actually in bone, but chiefly at the point of junction of a bone and its cartilage, in fasciæ, periosteum, tendons and ligaments, in the pia mater and dura mater, in the choroid and sclerotic coats of the eye, at the apices of the lungs, in the skin and mucous membranes, and sometimes even in the penis and in muscular tissues. They are usually divided into two groups, the exostoses, or those growing from the surface of the bone, and enostoses, or those growing within the bone. Or, again, they may be divided, according to their structure, into eburnated—intensely hard

growths with a structure somewhat like that of the cement of the tooth; compact—like the tissue met with near the surface of a normal long bone, with its Haversian canals, osteoblasts, and regular Haversian system, or the spongy osteoma—made up of tissue similar to that of which the ends of long bones and the bodies of the shorter bones are formed.

An **Odontoma**, or dentine tumour, may grow from the root, neck or crown of a tooth.

The **Myxoma** usually occurs in submucous, subcutaneous or other connective tissues, in the intermuscular septa between the bundles of nerves, in periosteum and in sub-serous fat, and has the general characters of the other tumours of this group, though the vascular capsule and trabeculae are specially delicate. On section, the tissue between the trabeculae projects beyond them, is clear and gelatinous, and looks like a mass of boiled tapioca in which small hæmorrhages, recent or old, may be seen. In the breast, myxomatous tissue may extend between the acinous glands, or may encroach on these acini, growing into them and distending them much as does granulation tissue when it forms a so-called cystic sarcoma. In the tissue between the trabeculae are large branching cells, each with one or more deeply stained nuclei in the centre. These cells are embedded in clear hyaline material, in which also are numerous cells like lymphocytes and a number of polymorphonuclear leucocytes.

The **Myoma**, leiomyoma, or non-striped muscular tumour may occur in any position in which non-striped muscle is normally present—the gastro-intestinal tract, the wall of the bladder, the prostate, especially in old men, the skin, especially of the scrotum, and the kidney near the apices of the papillae; in the uterus it is often termed a "uterine fibroid" because of its naked-eye appearance. It may be small and rounded, or it may reach an enormous size, when it is usually lobulated. A firm, fleshy, somewhat elastic mass growing in the muscular wall of the organ, say the uterus, the tumour is usually paler, though it may be brighter, than the surrounding muscular tissue. The lobules have a peculiar laminated appearance on section, almost like balls of cotton cut across. The fibrils of the bundles of muscle fibres are arranged parallel to each other, each being made up of spindle-shaped cells which overlap at their ends to form the fibre. A rod-shaped nucleus occupies from a quarter to a third of the centre of the fibril. This muscular tissue is frequently embedded in fibrous tissue. The two tissues can usually be differentiated by appropriate methods of staining or by treating the sections with a forty per cent. solution of caustic potash or a twenty per cent. solution of nitric acid, both of which cause the fibrous

tissue to swell up but leave the muscle rods intact.

The **Angeioma**, composed of new dilated blood-vessels, is of two forms, (a) the cavernous angeioma found in the liver and skin, and (b) the simple capillary angeioma, in which the dilated new vessels still preserve their tubular form, with or without a considerable increase in the amount of connective tissue between them. This latter tumour is found most frequently in the line of the closed facial and branchial clefts and near the various orifices of the body, the positions sometimes corresponding to the distribution of a special nerve, *e.g.* the facial branches of the fifth nerve. The Angeioma is also met with in the brain, kidney, spleen, uterus, muscles, bone, hollow viscera and mamma. A similar tumour composed of new lymphatic vessels is described. Adami includes the myeloid or giant-celled sarcoma in this group, but for the present it seems advisable to include it in the sarcomas or non-typical hylie group. The lymphoma or ordinary adenoid-tissue tumour, the lympho-sarcoma in which there is an increase of the lymphoid cells at the expense of the stroma, and the lymphadenoma of Hodgkin's disease are also placed here, though this latter growth is looked upon by Adami as comparable with cheloid and as resulting from chronic irritation.

ATYPICAL HYLIC TUMOURS OF MESENCHYMATOUS ORIGIN—

These form a group which consists mainly of the sarcomas, tumours in which the tissues remain embryonic in type, the more embryonic the greater the vegetative activity of the cells and the more marked the malignancy. Formerly they were looked upon as being derived from mesenchymatous mesoblast, but Adami insists that not only mesothelial tissues, but certain tissues of epiblastic or hypoblastic origin may give rise to sarcomatous tumours which grow rapidly and usually assume the form of some imperfectly developed connective tissue. The nuclear element of the cell is, as a rule, very prominent, the intercellular substance is small in amount, and blood-vessels are usually imperfectly developed, their walls consisting simply of tumour cells slightly modified.

Like other atypical tumours they are all unencapsuled, are malignant and spread locally and generally by the blood-vessels, appear to contain no definite lymphatics, and as a rule do not spread by the lymphatics. They undergo various degenerative changes, fatty and mucoid, caseation, calcification and hæmorrhagic; and ulcerative changes similar to those occurring in the typical hylie tumours.

These tumours, developing along very different lines, vary considerably in structure,

malignancy and clinical history, but certain typical representative forms may be noted.

The **Small Round-celled Sarcoma**, perhaps the most malignant member of the group, is met with especially in the fasciæ and the loose alveolar subcutaneous tissues, or in any connective tissue, except in the lymphatic structures. As a secondary growth it appears first in the lungs, then invading those organs in which there is a complex capillary system.

On section the tumour is pale pink, is surrounded by no capsule and has no interlobular septa, though pre-existing irregular firmer bands, the remains of fibrous tissue, may be seen running through the substance of the growth. Yellowish creamy patches (fatty degeneration) or small red, brown or yellow points (hæmorrhages) are almost invariably in evidence. On microscopical examination the essential tissue is made up of small round cells, each with a very large nucleus and distinct nucleoli. These cells, between which there is seldom more than a small amount of granular homogeneous material, may be seen invading the surrounding tissues. Near the blood-channels, in direct contact with the blood current, they are compressed and elongated or flattened, and may be detached and carried to vascular organs, where they set up secondary growths.

The **Large Round-celled Sarcoma** grows in much the same positions as the small round-celled form, but is much less malignant. It may be associated with the rhabdomyoma and, in certain cases, appears to have an alveolar arrangement resembling that of the endothelioma. The cells, though spoken of as rounded, are somewhat irregular in shape. The nucleus is of large size and in some cases is multiple.

The **Spindle-celled Sarcoma** is usually divided into three forms—oat-celled, small spindle-celled, and large spindle-celled. Just as the small round-celled sarcoma simulates very closely young granulation tissue, so the small spindle-celled sarcoma has a distinct resemblance to granulation tissue of older growth.

These tumours have much the same naked-eye appearances as the small round-celled sarcomata, except that they are firmer and contain fewer blood-channels. The large spindle-celled form is the least malignant of the sarcomas and is formed of the most highly developed tissue.

All the simple typical hylic tumours have their corresponding sarcomatous varieties, fibrosarcoma, myxosarcoma, liposarcoma, chondrosarcoma, osteoid- and osteo-sarcoma, lymphosarcoma, leiomasarcoma, rhabdosarcoma, and gliosarcoma—in which the development proceeds for a certain distance towards a special tissue, but always fails to reach it.

In this group is also included **Melanosarcoma**.

Melanotic tumours, however, may be derived from different sources. In some cases they appear to be endotheliomatous in type, especially when growing in the skin; or, again, they may be made up of mixed sarcomatous cells, or of spindle-cells. The pigment is distributed irregularly in these tumours, and the malignancy appears to vary according as the pigmentation occurs in highly developed connective-tissue cells (in which case the malignancy is slight), or in imperfectly developed cells of a higher type in which the pigment-forming function is altered, though not necessarily excessive (in which case the malignancy is more marked).

TYPICAL HYLIC TUMOUR OF MESOTHELIAL ORIGIN—

The **Rhabdomyoma**, composed of striped muscle fibre, is usually small, well-defined, and occurs in the kidney and genital tract, in the heart-muscle, in the extremities and in the orbit. The structure of these muscular tumours is not always very distinct, and in some cases they are very imperfectly and irregularly developed and approach very closely an atypical or sarcomatous form (*vide supra*).

TYPICAL LEPIDIC TUMOURS OF THE FIRST ORDER—

It is when we come to consider the lepidic tumours (lepidomata), or tumours of the primary lining membrane, that the value of Adami's classification becomes fully apparent. The tumours of the typical form must, in certain cases, be looked upon as being the result of some chronic irritation. Warts, papillomata, condylomata, cutaneous horns may all be taken as types of such tumours of epiblastic origin, in which there is proliferation of the epithelium on a cutaneous surface, supported by a vascular connective-tissue stroma.

Adami's "blastomatous papillomas" and adenomas are similar growths of hypoblastic origin in connection with mucous membranes of the nasal and respiratory passages, along the lower part of the intestinal tract, in the stomach and gall bladder, and in the genito-urinary system. The structure of many of these is essentially that of an ordinary papilloma, except that the connective-tissue processes are more delicate and are covered with cubical, columnar or even goblet cells. Similar papillomatous growths may be found within cysts, ovarian cystic growths, or other forms of adenomatous tumours. In other cases we have an adenomatous structure in which the epithelium pushes its way into the connective tissue, as does that of an embryo during the development of a secretory gland, and during the evolution of the mammary gland as it becomes functionally active. These adenomatous growths may retain a certain secretory power, and the secretion,

accumulating, may give rise to retention cysts. The stroma varies very considerably, both in character and amount; sometimes it is cellular, at other times hard and fibrous. The epithelium retains the form of a lining membrane.

In the true adenoma there is more than a mere increase in the amount of inter-acinous tissue. These tumours have many of the characters of the typical tumours of the hylic group, in that they are surrounded by a fibrous capsule, grow slowly, and appear to be composed of a mass of fibrous tissue over which are scattered small chrome or creamy yellow points, and numerous cysts of various sizes from which may be expressed creamy, opaque, serous, gelatinous or semi-solid material. It is characteristic of these adenomatous tumours that the basement membrane between the epithelium and the connective tissue is usually fairly well defined. It is difficult to distinguish between the adenomatous condition as set up by irritation and inflammation and the adenoma proper described by Adami.

ATYPICAL LEPIDIC GROWTHS OF THE FIRST ORDER—

As in the typical group, the epithelial cell is here the primary tumour element, and may be either epiblastic (squamous or cubical) or hypoblastic (columnar, goblet-shaped, or in certain cases cubical) in origin. By its unrestrained growth, proliferation and invasion of connective tissue it gradually assumes an importance in the deeper tissues that does not belong to it in the typical forms. The epithelial cells are more irregular in shape, and may be massed together in large numbers; they are not separated from the subjacent connective tissue by any basement membrane. As the epithelium grows down into the lymph spaces, it appears to give rise to great proliferation of the surrounding connective-tissue cells. These cells ultimately produce fibrous tissue, which forms the walls of the alveoli or spaces in which the masses of epithelial cells are contained. It has been found by injecting nitrate of silver that the alveolar spaces communicate with one another and with the lymphatic spaces of the surrounding tissues, and it is by these lymph spaces apparently that the epithelial cancer cells make their way from one point to another, not only along the ordinary connective-tissue spaces, but along the free lymphatic system in the adventitia of blood-vessels, between fascial planes, and along other natural channels of the body.

These, the cancerous tumours, are defined by Greenfield as belonging to a class in which there is "growth of some or all tissue elements in excessive degree and erratic form, in which there is great vegetative power, the members of

which are highly parasitic and malignant, infecting locally by direct transport, and through the lymphatics and blood-vessels," the secondary growths affecting any tissue. An important member of this group is the **squamous-celled epithelioma** (epiblastic), in which cells corresponding in type to those seen on squamous epithelial surfaces invade the connective tissue below and give rise to proliferation of the surrounding connective-tissue cells. These epitheliomas are usually irregular, moist-looking masses with peculiar roughened surface (with small white prominent points and ridges), from which an irritant watery or ichorous fluid issues. The margin of the tumours is usually indurated and surrounded by small firm nodules, each distinctly marked off from the surrounding tissues. On scraping the ulcerated surface with a knife, small white points come away; these are found to be masses of epithelium. There is an extraordinary development of epithelium passing down for some distance into the subjacent tissues in finger-like processes, which in turn send out numerous secondary processes, each having at its periphery well-defined cells similar to those met with in the rete Malpighi, whilst in the centre of the processes are flattened layers of cells composed of horny squames, or large colloid cells. The horny squames form the typical cell-nest. These tumours grow slowly, and spread by the lymphatics, but are not very malignant, secondary growths occurring first in the lymphatic glands, and then in almost any tissue. The varieties of epithelioma are due almost entirely to the source of origin, rate of growth and position of the tumour.

The other members of this group, the **Carcinomas**, vary in structure and consistency according to (1) the number and character of epithelial cells, rounded, globose or cubical (epiblastic skin and duct cancer), or columnar, or cylindrical, or cubical (hypoblastic), like that found in large cancerous ulcers of the rectum, stomach, thyroid, pancreas, liver, etc.; and (2) the amount and consistency of the fibrous tissue in which the walls of the alveoli are formed. The alveoli may be large or small, and the tissue may be cellular or fibrous. Where the cells are large and columnar, and the amount of fibrous tissue small, we have an encephaloid condition, a soft, rapidly-growing, brain-like or medullary cancer; whilst when the alveoli are small, the connective tissue firm and dense, and the epithelium cubical, we have what is known as a scirrhus cancer, occurring in such positions as the breast, pylorus, œsophagus, rectum, testes, ovary, kidney, salivary glands and pyloric end of the stomach; the cells, of whatever type, are most perfectly formed where the growth goes on most slowly.

A **Columnar-celled Epithelioma** (hypoblastic)

is met with in the large intestine, especially at the flexures and in the rectum, the liver, and even in the lung.

Perhaps the most interesting of all tumours are those classified by Adami as **Transitional Lepidomata**, mesotheliomas and endotheliomas, which he divides into four groups: (1) those, usually adenomata and carcinomata, arising from the development and vestiges of the Wolffian and Mullerian ducts; (2) those arising from organs which, while they come into intimate relationship with these, nevertheless as regards their essential constitution are of separate mesothelial or mesoblastic origin (ovaries, testes, kidneys and adrenals) adenomata, adenosarcoma, carcinoma, sarcomatodes, and hypernephroma; (3) other mesothelial tumours, often of cancerous type, derived from the serous surfaces; and (4) the endothelial tumours, endotheliomas in which perhaps should be included the angiomas (typical) and angiosarcomas (atypical).

Teratomatous Tumours

In dealing with surgical tumours it may be somewhat out of place to consider any of the teratomatous groups; but certain of the mixed tumours met with in the kidney, parotid and maxillary glands, lachrymal glands, cheeks and gums, and in the genito-urinary system, especially in children, seem to contain tissues derived from the germinal layers of another embryo, although the whole three layers may not be involved. The most important of these are the tumours met with in the kidney, in which smooth or striped sarcoma-like cells are found along with cells approaching much more nearly to the ordinary connective-tissue type. In the same position tumours containing not only tubules resembling kidney tubules, but even distinct epidermal tissue, have been met with.

Two other groups of tumours of some interest are the **Placental** or **Hydatidiform Moles** and the **Chorionepithelioma Malignum** or **Carcinoma Syncytiale**. Although these have been described as being essentially different, one as typical and the other as atypical, as regards malignancy there appears to be little doubt that they are closely related, and that just as the chorionepithelioma grows with great rapidity within the uterus, so, under certain conditions, the hydatid mole may continue to grow and fill up the terminal uterine sinuses with polypoid masses.

It is now generally accepted that the chorionepithelioma arises from chorionic epithelium, both layers of which are represented in the specific cellular elements of the tumour. The tumour, therefore, is clearly of embryonic and not of maternal origin. It is interesting to note that in forty per cent. of the recorded cases a placental mole has been found in the immedi-

ately preceding pregnancy. In many of the other cases the growth has occurred in the testicle, in the vaginal walls, the labium majus, Fallopian tube or the ovary. The tumour, which is intensely malignant, is built up of nucleated protoplasmic masses resembling syncytial cells, accompanied by groups of small cubical or polyhedral cells with comparatively large nuclei. There is no connective tissue between the individual cells of these groups. Large mononucleated cells are also seen, and here and there structures resembling chorionic villi with syncytial and Langhan's cells, almost normal in arrangement, may be met with. Masses of degenerated tumour, hæmorrhages and collections of fibrin and leucocytes are scattered throughout the tumour mass.

Etiology

At one time it was accepted that there could be no continuous proliferation of epithelial or connective tissue apart from some continuously acting irritant, and a parasitic etiology was put forward as affording the best explanation of tumour growth—the parasite being supposed to invade the cell, modify or alter its vegetative activity, to divide along with it, continue within the resultant cells, and to be carried within it to continue the process in other positions. This can scarcely be accepted as the only explanation when it is realized that, given the necessary conditions, the epithelium from a skin graft removed from one individual may grow and spread rapidly over a “granulating” surface in another person, moreover that at the margin of a healing ulcer the epithelium extends regularly over connective-tissue granulations, sometimes dipping down into crevices and forming groups which may easily be mistaken for commencing squamous epitheliomatous growths. Here, certainly, is no evidence of any parasitic inclusion within the epithelial cell. More than a quarter of a century ago Charles Creighton referred to the leucocyte as possibly playing the part of a fertilizing agent to the epithelial cell. This suggestion has recently been revived by Farmer, Moore and Walker, who claim that when leucocytes invade epithelial cells a distinct mitotic division appears in both invading and invaded cells, definite spindles being formed, or “the spindle figures become confused, as is ordinarily the case in the first cleavage of the ovum”; and they claim that “a mixture of the chromosomes derived from the leucocytes and tissue cell respectively is distributed between the daughter nuclei resulting from this mitosis.” Dünchmann, Ruffer and others have also drawn attention to the presence of leucocytes in epithelial cells, but they regarded it as the result of invasion and digestion by leucocytes of the epithelial cell. The thesis has been advanced

by Marshall and others that the epithelium of cancer is not subjected to nervous control, as is ordinary glandular tissue as regards function and growth by nerves going to the gland. On the removal of this control an atypical glandular or epithelial growth ensues. Such an explanation is both ingenious and possible, but only hypothetical.

In view of the successful inoculation experiments carried out by Hanau in Switzerland, by Jensen in Denmark, by Apolant, Ehrlich and others in Germany, and by Bashford, Murray and their colleagues in this country, it can no longer be doubted that cancerous growths, both carcinomatous and sarcomatous, may be transmitted from one animal to another of the same species. It appears, however, that the conditions under which this transmission may be effected are exceedingly limited. For example, the tumour can be transmitted only to animals of the same species kept under constant conditions and on the same food, even varietal and individual differences being of importance in this connection. Experiments with, apparently, the same material, and carried on under what appear to be identical conditions, give only a certain percentage of successful results, and even then, although in the majority of successful transmissions the resulting tumour resembles that from which the material was originally obtained, in a certain small proportion of cases an epithelial or carcinomatous graft may give rise to an atypical connective-tissue or sarcomatous growth in the animal into which the tumour is grafted. The cells of the transmitted tumours appear to be the direct descendants of the original tumour cells; the secondary tumour, therefore, is a growth entirely independent of the tissue cells of the host, which do not enter directly into the tumour tissue; the tumour, to that extent, is a true parasitic growth, dependent upon its host only for its nutriment and support. Similar experiments with cancer from the human subject have never succeeded. Cancer tissue introduced into the peritoneal cavity of an animal, or into a wound made in the connective tissues, as pointed out by Shattock, appears to act almost as does any other piece of dead or dying tissue. The alveolar stroma is gradually absorbed by the granulation tissue which forms rapidly around the "foreign" mass; the epithelium disappears almost equally rapidly, and ultimately nothing may remain but a small mass of new cellular tissue, which in time becomes converted into a fibrous cicatrix. It must be observed, however, that when a cancerous growth invades the peritoneal cavity, extension takes place with tremendous rapidity, secondary growths appearing almost simultaneously at numerous points on the serous surface.

Whether, as has been suggested by Waldeyer

and Thiersch, the connective tissue in a healthy individual prevents the overgrowth of epithelial tissues (by exerting a restraining influence that becomes diminished with advancing years); or whether Cohnheim's hypothesis of embryonic residues cut off and lodged in abnormal positions, remaining embryonic in type and latent for a period in after years, being then stimulated to form neoplasms or tumours, be accepted; or whether these two hypotheses be combined and developed, as has been done by Ribbert and Powell White, any satisfactory explanation of the etiology of tumours is still to seek. Even the suggestion made by Farmer, Moore and Walker, that in tumours there is a "reversion of somatic cells to the cell type characteristic of gameto-genetic tissue," or Hansemann's hypothesis of anaplasia or a reversion of cells to a more primitive embryonic type, in which the vegetative activity is always more marked than in the more differentiated cell; or, again, the suggestion that parasitic stimulants act on the cells, are nothing more than suggestions as to the mechanism by which certain neoplasms arise. No real clue has been gained as to the nature of the factors which enter into the incitement of these abnormal activities.

What are Benign and what are Malignant Tumours?

Easy as at first sight it might appear to lay down hard and fast rules as to what tumours are benign and which are malignant, this is by no means an easy matter; it is necessary to utilize for this purpose all the information obtainable. Anatomical and histological characters are of course important, the presence or absence of a delimiting fibrous capsule, the presence or absence of hæmorrhages or areas of degenerating tissue—mucoid, colloid, fatty—the similarity to or dissimilarity from normal fully developed tissues; in epithelial tumours the presence or absence of a definite basement membrane, the structure of the blood-vessels, the rate of growth—all these must be called in to help in determining the character of a tumour; whilst, as Beattie and Dickson point out, to these must be added the site of origin and the known proclivities of similar growths in other previously observed cases. Malignancy may be determined by an increase of the vascular supply or by exposure of the part to irritation, for a slow-growing tumour of the stomach invading the liver grows much more rapidly and may become highly malignant.

Again, certain adenomas, slightly malignant when growing in the sigmoid flexure or rectum and having little tendency to cause secondary growths, when found growing in the stomach or duodenum develop much more rapidly and give rise to numerous metastatic growths.

Virchow, in his address before the International Medical Congress at Copenhagen, suggested that although metaplasia from one type of tissue to another is conceivable, we are unable to produce evidence that after tissues have reached a certain stage of development there is any reversion or transformation beyond a certain point, *e.g.* in a connective-tissue tumour there may be evidence of the presence of fatty tissue, of cartilage, bone, fibrous tissue, myxomatous tissue, and in some cases even of muscular tissue, and there may be a gradual transformation of a fatty tissue to a myxomatous, of a fibrous tissue to a myxomatous, or the converse, but there is never any evidence of any transformation of epithelial cells into connective tissue. Epithelial tissues, however, may undergo very considerable modification in type, *e.g.* the cubical epithelium lining the bile ducts and even the gall bladder may, in certain cases of cancerous growth in these positions, become converted into an epithelium having all the characters of that found on a free cutaneous surface. These metaplastic changes are undoubtedly of importance as indicating some abnormal or altered stimulation or nutrient condition, for, although there is often an attempt on the part of the epithelium of the tumour to perform certain definite functions, the attempt is never completely successful. For example, H. J. Waring has demonstrated the presence of pepsine in the cells of cancer developing in the mucous membrane of the stomach; similarly pancreatic ferments have been demonstrated in the cells of cancer of the pancreas. It is usually recognized that tumours, especially malignant tumours, originate locally and at a single point, although multiple primary foci may be met with, especially amongst the benign group. These primary foci increase in size and, in the case of the non-malignant tumours, the localisation is complete, a rounded or lobulated growth being surrounded by a connective-tissue capsule in which are supported the blood-vessels that supply the tumour with nutriment. Tumours grow in the direction of least resistance, the most rigid tissues being by no means always the most resistant. Malignant tumours, by their actively proliferating cells, may bring about rapid absorption of surrounding tissues, and are seldom, if ever, surrounded by any definite fibrous capsule, though the actively growing somewhat compressed tumour tissue at the margin may sometimes be mistaken for a fibro-cellular tissue such as is formed round the slow-growing non-malignant tumour. Tumours grow at very different rates but, speaking generally, it may be accepted that the simple or non-malignant tumours are of much slower growth than are the malignant, and that

the malignancy of a tumour accords fairly closely with this rate of growth, which, however, must depend to some extent upon the supply of nutriment available. Where the proliferative activity of the cell is greater than can be maintained by the amount of nutriment available, degenerative changes which may lead to a diminution in the size of the tumour, rather than an increase, may ensue. Tumour tissue, with its great vegetative activity, seems to become more and more active the more it is interfered with. This applies not only to the malignant tumours, but also to the non-malignant recurrent fibrous tissues described by Paget, who noted that unless a tumour was removed in its entirety a recurrent growth of a somewhat more cellular type and of increased vegetative activity made its appearance; this recurrence, he pointed out, is due to the multiplication of the cells of the portions of tumour left at the operation.

In spite of all the work that has been done during the last twenty-five or thirty years, it must be acknowledged that all the advance made in the treatment of tumours has been based on the results of clinical observation, and has fructified in successful treatment only in so far as the surgeon has sought to remove freely, by operation, every trace of the primary cancerous growth, taking with it as much of the surrounding tissue as possible and clearing out all groups of glands in the neighbourhood of the primary growth.

It must be recognized that it is far better to run the risk of an error in diagnosis than to put off an operation until all possibility of removing the growth has completely gone by. Mistakes in diagnosis have been and will be made, and I am convinced that such mistakes account for many, if not all, of the so-called "cures" of cancer. There may be cases in which, owing to the very slight malignancy and slow growth of a tumour, the cancer is not accountable for the death of the patient, and it may be that just as in the case of a gland which may undergo a regular and definite process of involution, so in rare cases and under specially favourable conditions aberrant growths may undergo a similar involution. These conditions are all so rare that they may be left out of account in dealing with an individual patient.

NOTE.—Brook and Stiles's method of demonstrating the presence of epithelial structures in connective or fibrous tissue is of considerable practical value to the surgeon in helping him to determine, even with the naked eye, how far the cancerous growth has spread locally. On the removal of a tumour a series of sections are made in its greatest diameter and through the tissue at the margins. These fresh sections are placed for five minutes in a solution of five per cent. nitric acid, in methyl-

ated spirit, or in water. They are then transferred to plain tap water and left in this for another five minutes. The fibrous and connective tissue swells up and becomes somewhat translucent, whilst the epithelial tissue, whether on the surface or in the cancerous growth, remains opaque. Any minute opaque spots, therefore, seen at the extreme margin of the removed mass are evidence that the removal has not been sufficiently extensive. G. S. W.

INJURIES

The points to be considered in every injury are the nature of the producing force, the anatomical site of the lesion, the prognosis, possible sequelæ and treatment.

Contusion or bruising is marked by extravasation of blood into the damaged tissues. Where the tissues are lax, as in the eyelids and scrotum, the extravasation is greater and the blood may collect in a space, such as the tunica vaginalis or under the occipito-frontalis, forming a hæmatoma. In hæmophilics excessive extravasation from very inconsiderable violence may occur. Where the skin is tense, as over the subcutaneous aspect of the tibia, the extravasation may endanger the vitality of the over-lying skin, and may produce blisters which provide a ready avenue for septic infection. Contusion of highly sensitive parts such as the testis, the abdomen over the solar plexus and the thorax over the heart, may be followed by a degree of shock out of all proportion to the violence applied. Contusion of nerves may be followed by partial paralysis; of muscles by partial atrophy; of bones by a subperiosteal hæmatoma, which may organize and form a periosteal node. Contusion of a bursa may lead to an acute bursitis, and of a tendon to an effusion into its sheath. Contusion of tissues already removed from the normal may lead to serious consequences, such as thrombosis in varicose veins, gangrene where the blood-vessels are atheromatous, or increased rapidity of growth in neoplasms. Contusions lower the local vitality, and thus organisms circulating in the blood may obtain lodgment and bring about an acute pyogenic or chronic tuberculous lesion.

Treatment consists in elevating the part, and in applying pressure by wool and bandage to limit the effusion, to promote its absorption and to protect the damaged area. Massage, by improving the local circulation, offers the best means of hastening absorption of the effusion, and should be employed for ten to fifteen minutes once or twice daily, the rubbing pursuing the direction of the venous and lymphatic drainage. A hæmatoma should be aspirated, and extreme tension of the skin relieved by incisions.

Incised Wounds are produced by sharp-cutting instruments such as knives and broken glass. The suicidal or homicidal cut-throat illustrates the manner in which the anatomical site adds to the seriousness. On the front of the wrist incised wounds are commonly produced by broken glass, and may lead to permanent impairment of function and loss of sensation in part of the hand beyond. The possibility of the infection of all open wounds with the tetanus bacillus should always be kept in mind.

Treatment consists in controlling the hæmorrhage, disinfecting the surrounding skin, and exploring the wound to ascertain, recognize and suture the structures divided. We have thoroughly tested the iodine method of disinfecting the skin in emergency work, and are perfectly satisfied with its efficiency. The ordinary tincture of iodine is applied with a brush or swab of gauze or wool. To combat the risk of septic infection, all such wounds should be washed out with warm saline or with a mild antiseptic such as boracic lotion.

Injured blood-vessels should be ligated, and the divided ends of tendons and nerves sutured with fine silk or chromicized catgut, threaded on fine round needles. The skin wound is closed with horsehair or silkworm gut and preferably without drainage, but the sutures should be interrupted so that one or two stitches may be snipped should drainage become necessary. The wound and skin should be again painted with iodine, and a dry gauze dressing applied. In the extremities a Bier's bandage may be used as a prophylactic against sepsis.

Punctured Wounds may involve a closed cavity such as the abdomen, thorax, skull or a joint, where septic infection would greatly increase the risks. Puncture of a blood-vessel may lead to the development of a traumatic aneurysm. The *treatment* is similar to that for incised wounds, but it is often necessary to enlarge the wound to permit of thorough cleansing. The point of the instrument producing the wound is sometimes broken off, and remains embedded in the tissues. This possibility should not be overlooked and a radiogram should be taken to make certain.

Contused Wounds are produced by blunt objects meeting soft parts overlying bone, such as the scalp or shin. The edges may be clearly or irregularly cut, but the surrounding parts exhibit ecchymoses. The possibility of fracture of the underlying bone must be remembered, especially in scalp wounds. The *treatment* is similar to that for incised wounds, but the contused tissues make healing slower.

Lacerated Wounds follow from tearing, wrenching and crushing by objects of irregular surface. Machinery and run-over accidents, mine and

quarry accidents, wounds from firearms at close quarters and from explosions, and bites of animals are of this nature. They are frequently complicated by fractures, by severe damage to blood-vessels and nerves, and by dirt being engrained into the soft parts.

The immediate risk is shock. Primary hæmorrhage is rarely dangerous, owing to the tearing of the blood-vessels leading to their rapid occlusion by clots. Later risks are reactionary hæmorrhage within a few hours, secondary hæmorrhage after a few days, sloughing of the damaged tissues and actual gangrene from impaired blood supply. More remote risks are impairment of function from loss of muscles or tendons, from division of nerves, or from cicatricial contraction in the process of healing.

Treatment varies with the extent of the damage. In the extremities amputation is indicated if there is severe damage to blood-vessels and nerves, rendering the continued vitality of the tissues improbable, if the wound cannot be made comparatively aseptic, or if the restoration of adequate function is impossible from comminution of bones and laceration of muscles. When amputation is decided upon, the flaps should not contain badly bruised tissues. If shock is very marked, it is better to defer amputation for a few hours, meanwhile treating the initial shock on approved lines.

Conservative measures are to be preferred whenever possible. In order to preserve any part of the upper extremity, risks may be run that would not be justifiable in the case of the lower extremity. The wound should be thoroughly washed out with weak lotions such as warm saline or boracic lotion, and sprayed with hydrogen peroxide. Rough scrubbing and strong antiseptics are contra-indicated as they serve to devitalize the damaged tissues further, reducing their resistance to infection rather than ensuring the removal of it.

The surrounding skin should be disinfected by painting with tincture of iodine; soft parts with gross dirt engrained into them should be clipped away; fractured bones should be set and any loose fragments devoid of periosteum removed; divided structures such as nerves and tendons may be sutured with fine chromicized catgut; the wound should be packed with gauze, left open to allow of free drainage and immobilized in an easily removable splint. A Bier's bandage should be applied whenever possible, well above the site of the lesion, and for the greater part of each day, as a prophylactic against sepsis. We have also found that the bandage diminishes the patient's discomfort.

If sepsis ensues and the patient shows signs of septic absorption, amputation should not be

delayed. If the wound refuses to heal and continues to discharge, the probable cause is a necrosed portion of bone or a foreign body, and a radiogram should be taken. Where there has been loss of a considerable portion of skin as in avulsion of the scalp, skin grafting may be performed immediately if the asepticity of the wound is assured, or later when sepsis has been overcome.

In Burns and Scalds the severity of the lesion is proportionate to extent rather than to depth, because a denuded surface is an absorbing surface, and the danger is septic infection.

Treatment consists in preventing septic infection, in combating shock, and later in preventing deformity and loss of function, or in remedying these by plastic operations.

A general anæsthetic, especially in children, is advisable in dressing burns of any extent. The clothing should be ripped open and removed. While the dressing should be thorough, speed is of importance. All blisters should be snipped and the raised epithelium removed. As a primary dressing, picric acid (picric acid 1½ dr., absolute alcohol 3 oz., distilled water 40 oz.) is the most satisfactory, as it relieves pain, prevents sepsis and promotes healing. Surgeon's lint or gauze is lightly wrung out of picric acid and applied over the whole area affected, then covered with a thick layer of antiseptic wool and retained in position by bandages. This dressing should not be disturbed for several days, and even then any portion of the original dressing that remains dry should be left in position. Much discomfort to the patient and unsatisfactory results proceed from non-observance of these practical points. We recently observed a case of extensive burns painted over with ordinary tincture of iodine, and the result created a very favourable impression.

Where a burn is already septic when first seen, picric acid is contra-indicated and the usual treatment for septic wounds should be adopted. Greasy dressings and dry powders should be avoided, the former because they are rarely sterile, the latter because they retain discharges. When a sepsis is obtained, skin grafting hastens healing, and much may be done thereby, as well as by attending to the position of the part, to obviate the deformities that so commonly ensue from cicatrization. More elaborate plastic operations, however, are frequently necessary.

Injuries Produced by Electricity resemble burns clinically and in treatment, but are very slow to heal.

Injuries to Joints include sprains and dislocations; **Injuries to Bones**, fractures of all varieties. They are all of the nature of severe contusions; are marked by much swelling due to extravasation of blood and serous effusion

into the soft parts, and by more or less interference with the local venous and lymphatic drainage. Injury to the soft tissues and joints accompanies every fracture, and should not be neglected. Hence immediate massage and early movement are as essential in treating fractures as in sprains and dislocations. Massage improves the local drainage and rapidly removes the effusions before organization can occur. Matting of the soft parts and adhesions within the joints are so prevented.

In fractures alignment of the bony fragments is essential, and may be obtained under an anæsthetic by manipulation and retained by external splints: or by open operation employing internal splints of metal plates and screws or silver wire. Radiograms are of the greatest value both as a means of diagnosis and of controlling treatment. They should be obtained whenever possible. Compound dislocations and fractures resemble lacerated wounds, and the treatment is similar.

Injuries to Viscera of the thorax and abdomen are serious and less apparent, partaking of the nature of contusions, subcutaneous rupture, incised and lacerated wounds. The signs and symptoms vary with the viscus, and with the nature of the lesion. Attention may be directed to the importance of interference with respiration in thoracic injuries, and of rigidity of the abdominal muscles in abdominal injuries. Immediate operation is often the only line of treatment.

A. P. W.

CONSTITUTIONAL EFFECTS OF INJURIES AND THEIR TREATMENT

The views upheld in this section are, to some extent, the outcome of the combined researches of Dr. Leonard Parsons and the writer; and it has been thought right to include these results, even when incomplete, inasmuch as they modify, to some extent, our outlook on the mechanism, and therefore on the prevention and treatment, of the physiological disturbances arising from injuries.

The constitutional effects of injuries may be divided primarily into two groups:—(a) *Immediate* and (b) *Remote*.

A.—Immediate Effects

These are associated with damage to three structures: I. Vascular; II. Lymphatic; III. Nervous.

I.—Vascular

The immediate effects of vascular injuries are hæmorrhage and thrombosis, according as the continuity of the vascular channels is interrupted or not. Thrombosis and its sequelæ are considered elsewhere.

The constitutional effects of hæmorrhage vary in rapidity of onset and progress with the size and importance of the injured structure,

while these may be complicated by the presence of shock, which will be discussed later.

The Symptoms and Signs of Hæmorrhage are pallor, low temperature, low tension pulse and rapid rhythm, thirst, sweating, restlessness, vomiting, sighing, shallow respirations, blindness, unconsciousness leading to death.

The whole symptom-complex constitutes the condition known as *collapse*, a condition which, however, is not peculiar to hæmorrhage but is a well-recognized sequel of the various forms of shock, toxæmia, cerebral anæmia from other causes, etc. The diagnosis of hæmorrhage often depends on the accurate recognition of these signs and symptoms, and a brief consideration of their physiology will often indicate the extent and severity of the lesion and the appropriate measures to be adopted. Let us therefore, briefly consider these separately—

Pallor. At an early stage this sign may be consequent on a general reflex vaso-constriction, resulting from the damage to peripheral nerves; if due to this cause the pallor is accompanied by a high tension pulse, though the peristaltic wave may be small from the contraction of the peripheral arteries. Later, however, pallor due to hæmorrhage is accompanied by a low tension pulse and is consequent, first, on the contraction of the vessels, which thus attempt to compensate the loss of intravascular fluid; finally, the vessels become flaccid and empty; a condition associated with a secondary heart failure. In this connection it should be remembered that the cutaneous surfaces are unreliable as an indication of the degree of pallor, and the mucous membranes should always be inspected.

Low Temperature in hæmorrhage depends on the diminished amount of blood flowing through the surface of the body; for the heat lost by radiation and evaporation is not compensated as in health.

Low Tension Pulse is an important sign of the extent of the constitutional disturbance. It is the direct evidence of the amount of fluid lost and the degree of compensation which exists.

Rapidity of the Pulse, combined with its force, indicates the compensation by frequency of the heart beats for the loss of work done at each beat, owing to the small amount of blood brought to the ventricles.

Thirst is a symptom of no great importance, and only indicates the necessity for the administration of fluids.

Sweating is probably a manifestation of the attempt to compensate the diminished blood pressure by a general vaso-constriction over the body. For this involves a general stimulation of the autonomic system, in which the sweat glands share. The same phenomenon is observed in some stages of shock (see § I.).

Vomiting may occur from the presence of blood in the stomach, and is of no great importance, except that the effort involved may induce a recurrence of hæmorrhage which has temporarily ceased. If, however, this cause is excluded, it is a symptom of grave import; for it is an indication that the anæmia of the centres is advancing to a dangerous degree. More fluids also lost.

The remaining symptoms are all dependent on the starvation of the higher centres from loss of blood. As usual, those centres which (phylogenetically) are the last to develop are the least hardy and are, therefore, the first to be affected.

This restlessness precedes loss of sight and consciousness, and these are the immediate precursors of failure of the respiratory centre. They are, therefore, symptoms of the gravest significance—calling for immediate treatment.

It should be mentioned that, in hæmorrhage in special regions, these symptoms may be modified. Thus, in hæmopericardium and cerebral hæmorrhage, cyanosis and dyspnoea may take the place of pallor and shallow sighing respirations, while in the latter the blood pressure is much raised. Special exceptions, however, will be dealt with under their appropriate sections.

Treatment. This should be considered under two headings: 1. Treatment of the lesion; 2. Relief of symptoms which, in themselves, are an additional source of danger.

1. Briefly the hæmorrhage must be stopped by the most suitable local measures, whenever this is possible. The choice of ligature, local or distal pressure, gauze packing, etc., must depend on the combined consideration of the accessibility of the site of the lesion and the condition of the patient. In all cases of hæmorrhage the motto should be *greatest speed and least disturbance*. Thus, if the constitutional symptoms are advanced and the hæmorrhage can be controlled by pressure, this course should be adopted, and suitable measures at once directed towards the relief of the former. If, however, operation is necessary to control the hæmorrhage, constitutional treatment must be adopted *before and during* its performance, and, of course be continued afterwards.

2. *Relief of Symptoms and Signs—*

Poor. This requires no treatment, since it is only a manifestation of the extent of the hæmorrhage, or of the degree of the success of the constitutional treatment.

Low Temperature. The patient should be clad in flannel; external warmth must be applied in the form of hot-water bottles, hot-waterbed if possible, and warm blankets (sheets should be removed). It should be remembered that patients in this condition are more liable to be burnt than those in ordinary health, and

that blankets should always intervene between such appliances and the skin.

Again, in order to prevent further loss of heat from the body, the air should be warm. This does not mean that the atmosphere should be rendered "stuffy"; fresh air should be ensured by opening windows, but the patient should be near a fire. The treatment of this symptom is most important, for, in addition, such patients are subsequently liable to pneumonia: the maintenance of the body temperature is further assisted by the treatment of the following symptoms.

The Fall in Pulse Tension must be mainly compensated by the free administration of fluids. These should reach the tissues of the subject at 100–110° F.

The Introduction of Fluids further diminishes the pulse-rate by increasing the blood pressure, and therefore the work of the heart, at each beat; also the *body temperature* is raised and thirst relieved.

Methods of Administering Fluids: 1. By the mouth; 2. Rectal; 3. Subcutaneous; 4. Intravenous.

1. *By the mouth.* A little fluid may be given to quench thirst, but it cannot usually be given in sufficient quantities without inducing vomiting. This is to be avoided at all costs.

2. *Rectal.* This is useful, rapid, and easy of performance, while asepsis is not necessary. It can be employed pending the preparation of the more elaborate methods. A catheter, rubber tubing and funnel are required. The buttocks should be raised and the funnel kept about one and a half feet above the level of the body. The amount which will be retained varies with the age of the subject and rapidity of administration. Roughly,

Adults usually retain about O i;			
12–15 years	„	„	$\frac{3}{4}$ viii–x
5–10 years	„	„	$\frac{3}{4}$ v–viii
Infants	„	„	$\frac{3}{4}$ ii

The administration may be continued at intervals of an hour or longer, according to necessity.

Composition of Fluids—

(a) *Saline Solution:* T. 105–110° F. The first essential is to raise the blood pressure as rapidly as possible; the solution therefore should at first be *hypotonic*, i.e. the salt dissolved should be less than .7 per cent. Rapidity of absorption of fluid from the bowel to the veins is thus favoured by *osmosis*.

(b) *Hot coffee* is a valuable stimulant, and may also be employed if obtainable.

(c) *Brandy* is useful as a diffusible stimulant, but *must only be given after the hæmorrhage has been stopped, and provided adrenalin has not been given intravenously.*

(d) *Later sugar* (dextrose or glucose), two

per cent., should be added to the infusions, as the carbohydrate metabolism is valuable in the maintenance of body heat.

3. *Subcutaneous.* Lax tissues should be selected, such as the inner side of the thigh, the abdomen, and (best of all) the axillæ. Funnel, rubber tubing and a large bore needle are required. Arbuthnot Lane's infusion bag is most useful. *Saline solution* T. 120° F. The solution should again be *hypotonic*, i. e. under .7 per cent. solids, to favour rapid absorption into the veins. *Asepsis is essential*; the after-effects of sepsis introduced by this method are *very severe* and, in small children, *not infrequently fatal*.

4. *Intravenous.* The most effective and rapid measure in dangerous collapse. Any superficial vein may be selected; usually the bend of the elbow is best. A bandage is placed round the arm to make the vein prominent.

Two Methods. If the veins are sufficiently prominent a needle may be introduced directly through the skin into the vein. A fairly wide bore needle, rubber tubing and funnel, or better, McDonagh's three-way-syringe (as used for the injection of salvarsan) are required. If McDonagh's apparatus is at hand it is the best method to employ. If the veins are too collapsed for this method, one must be exposed by dissection and a cannula inserted.

Saline Solution: T. 115° F. *Composition* should be *hypertonic*, i. e. over .7 per cent. solids. The fluid is here introduced directly into a vein, and the object is to keep it there as long as possible, in order to maintain the blood pressure and prevent too much fluid being taken up into the tissues by osmosis; the maintenance of the high percentage of solids in the veins favours the passage of fluids into the vascular system and of solids in the reverse direction. If, therefore, dextrose be added, this will be taken up by the tissues and assist in maintaining the body temperature. As much as four per cent. of dextrose may be safely employed. Dextrose two to three per cent. in the solution usually suffices.

If the hæmorrhage is arterial, *adrenalin* should be added to the infusion to the amount of $\frac{3}{1}$ in 1000 solution to the pint of saline. Thus the blood pressure is raised, and vaso-constriction helps to check the bleeding. Adrenalin should not be used intravenously in capillary or venous bleeding, or after the administration of brandy, and never into the subcutaneous tissues. More than two pints of saline solution should not be given at one time intravenously; and hypodermic injections of atropine sulphate should be given at regular intervals afterwards.

Firm bandaging of all four limbs is an efficient temporary measure in emergency. Blood is thus forced to the trunk and the blood

pressure rises. The limbs should be elevated and a flannel bandage firmly applied centripetally over a thin layer of warm cotton wool. These should be removed not later than four or five hours, and the pressure should be released *gradually*.

Firm bandaging of the abdomen also raises the blood pressure.

(c) When the pulse tension is dangerously low, small doses of strychnine (m ii-iii of the liquor) should be given hypodermically; these should be combined with small doses of morphia (see below). Pituitary extract should not be employed.

(d) *The head should be kept low* and the legs and body raised, in order to favour the blood supply to the centres.

Sweating. This should be checked, in order to prevent loss of fluid and heat, by the hypodermic administration of *atropine* in full doses (gr. $\frac{1}{50}$ for adults; $\frac{1}{100}$ for children). The atropine also tends to check the vomiting which sometimes accompanies injections of morphia.

Vomiting. When due to the presence of blood in the stomach, vomiting will cease with its natural removal, or by gastric lavage if the patient's condition admits of this procedure.

Mental Symptoms. Restlessness should be combated by *small doses of morphia* combined with the injections of strychnine and atropine, already referred to. It is most important to preserve quiet.

Blindness and loss of consciousness are ominous signs of damage to the higher centres, which is not infrequently to some degree permanent in those who recover. (The writer believes that direct transfusion of blood will some day be adopted for collapse of this degree, but the subject is in its infancy.)

II.—Lymphatic

For practical purposes the constitutional effects of injuries to lymphatics are mainly concerned with the asthenia following damage to the thoracic duct in the neck and to the consequent continuous loss of chyle. It should be remembered that the thoracic duct is rarely "single"; these cases, therefore, usually recover under appropriate constitutional treatment. This consists in withholding fats, and supplying the deficiency with copious administration of carbohydrates. Appropriate quantities of *isotonic* saline solution, to which two per cent. dextrose is added, should be given by the rectum four-hourly, as long as lymph is being lost at the site of injury; quin. sulph. and tr. ferri perchlor. should also be given in appropriate doses.

III.—Nervous

Injuries to the central or peripheral nervous system are responsible for the production of the

condition known as "shock" in its various aspects. By "injuries," in this connection, must be understood *any stimulus which exceeds or differs from the physiological normal*.

The correct treatment of shock is based upon an understanding of the mechanism of its onset, and it is therefore necessary to touch briefly on the physiology and pathology of the phenomena observed. For practical purposes it is simplest to regard the vasomotor, cardiac and respiratory centres as those essential to the life of the organism. To these centres is normally coming a continuous series of impulses, which are, on the one hand, the efferent stimuli of those reflexes which proceed from the outside world to the higher centres; and, on the other hand, the afferent stimuli direct to the medulla through the peripheral nervous system.

The passage of such impulses to the vasomotor and respiratory centres induces definite typical variations in blood pressure, which can be studied in tracings; if, therefore, such variations be attributed to the correct cause, the blood pressure forms a valuable sign of the nature and extent of the stimuli passing to the vital centres.

This mechanism constitutes the pathology of shock. The results vary, not only with the nature of the stimulus, but also with the situation, degree of violence, and extent of the injury originating these impulses.

Impulses from the outside world to the medullary centres may proceed by various routes—

1. From the centres of consciousness and the special senses.

2. From the central nervous system below the medulla.

3. From the peripheral nerves—

- (a) Through the centres of consciousness.

- (b) Through the centres for pain.

- (c) Direct to the medullary centres.

Now probably all afferent nerves to the medullary centres possess "pressor" and "depressor" fibres; stimulation of the former raising, of the latter depressing, the blood pressure. Prolonged or violent stimulation of afferent nerves fatigues the synapses of fibres, fatigue of the former being followed by a domination of the latter if the stimulus is continued.

Thus the shock-value of any region varies with the proportion of pressor to depressor fibres in its nerve supply, those with a high proportion of pressor fibres having a lower shock-value than those with a high proportion of depressor fibres. The treatment of the various forms and stages of shock depends on the recognition of the principles enunciated.

1. *Consciousness and Special Senses*—

Tracings taken in the same subject when asleep and awake, when compared, show that the stimuli to the vasomotor and respiratory centres arising from the higher centres during consciousness are responsible for a rise of blood-pressure of from 16–20 mm. mercury. *Mental effort* still further raises the blood pressure, and increases the range of individual variations; a feature which is still more marked when *mental anxiety* and *apprehension* are prominent features. In accordance with these observations it is found that the most marked variations of this type are observed in *fright*. Now a close study of tracings and charts shows that in the fibres from the higher to the medullary centres the depressor element is pronounced; therefore the pressor is easily fatigued under violent or prolonged stimulus; this fatigue of the pressor group is followed by a domination of the depressor group, with the consequent increasing fall of blood pressure under continued stimulation. It can be easily understood, therefore, how an exceedingly violent and sudden mental shock may completely paralyse the synapses of the pressor fibres, thus inducing sudden collapse or syncope.

Further, *sudden slight injuries* have on occasion been known to cause *death from shock* (e.g. a slight blow on the testicles): *Traumatic Shock*.

The explanation seems to be that the actual injury, though slight, is sudden; and is one which might be anticipated as serious and painful. So great is the stimulus to the higher centres that, through them, it is converted into a consciousness of serious injury, and the phenomenon comes into the group of *Mental Shock*.

Treatment of Mental Shock—

(a) *Preventive*. This applies only to the control of excessive mental disturbance in surgical operations. The control of the psychic element and the consciousness of painful sensations are effected by the various forms of inhalation anæsthetics, which are fully described elsewhere. Mention must, however, be made of the well-known fact that considerable mental shock is often induced by the administration of these. If severe operations are contemplated in excitable people, preliminary injections of morphia, or morphia and scopolamine, are advisable. In exophthalmic goitre mental shock is probably largely responsible for the operation fatalities, and the additional security of several preliminary sham anæsthetics has been recommended as tending to diminish the mortality (Crile). Omnipon has been also extolled (Gray), but its value yet remains to be proved. Hedonal is well spoken of, and is being tried in this country.

(b) *When Mental Shock has occurred*. If

serious, every fresh mental stimulus increases the collapse by stimulating the depressor fibres of the afferent tracts to the medullary centres (the pressor fibres being already fatigued). The first principle is to diminish mental activity. This is effected by mental quiet; complete rest to the special senses by darkening the room, eliminating noise, etc. The patient must be kept perfectly at rest and injections of morphia frequently administered. If collapse is profound strychnine should also be given in small doses, in order to reopen the paths of the pressor synapses, and so to raise the blood pressure until this can be effected by one of the methods of saline infusion. If the patient is conscious, strychnine and small doses of morphia are indicated—atropine is contra-indicated in mental shock. Cardiac stimulants, such as caffeine, camphor, ether, may be called for—alcohol is to be avoided. Any objects or persons likely to revive, in the consciousness of the patient, the cycle of events which led to the shock suffered from should be carefully excluded. This line of treatment must often be persisted in for a considerable time, and remote mental sequelæ are to be anticipated.

2. *Shock from injuries to the vertebral column and spinal cord* is usually profound, for both regions have a large proportion of depressor fibres in their nerve supply. The treatment of the immediate constitutional effects does not differ from that of the succeeding section, but the remote sequelæ of slight injuries are of importance in connection with insurance and the Employer's Liability Act (see *Injuries of the Spine*). Such injuries, during consciousness, are frequently associated with a considerable degree of mental shock.

3. *From the Peripheral Nervous System*. This involves shock arising from any injuries to the afferent nerves of the trunk or extremities. There are three sources of shock from such injuries—

(a) *Through the centres of consciousness*. This has already been briefly referred to above (*Mental Shock*).

(b) *Through the centres for pain*. Tracings in the human subject show that, of all nervous afferent impulses, those of pain possess, perhaps, the greater excess of depressor over pressor fibres; for the blood pressure, under painful stimuli, does not show a marked "mean" rise so much as enormous individual variations in a more or less steady "mean curve." The control of this factor by eliminating pain is, therefore, most important both in prophylaxis and actual treatment and must never be neglected. The depressing action of morphia need never be feared, even in collapsed subjects, for it can be readily counteracted. It is the prophylactic subjugation of pain, and the concurrent shock,

by inhalation anæsthesia which has rendered modern surgery a scientific possibility; but even these anæsthetics still leave open the "paths of shock" from the periphery direct to the medullary centres.

(c) *Shock arising from the injurious stimulus to afferent nerves*, and the resulting impulses passing direct to the medullary centres, is only amenable to one form of treatment, namely, *nerve blocking*.

All the other factors which tend to accentuate the grave constitutional sequelæ, may, under appropriate treatment, be so combated that the patient can withstand this third group of impulses, which constitutes *Surgical Shock*.

It is impossible to enter into detail, in the present writing, on such an immense subject, and the briefest outline of principles must suffice.

Surgical shock must be divided into three stages—

(a) *Pressor*, during which the blood pressure rises in response to the stimulus of the trauma to the pressor fibres of the afferent nerves in the injured area.

It is this stage in which preventive measures are to be adopted, if there is any likelihood of pressor fatigue. Spinal anæsthesia forms one most efficient means of obviating the second, or *depressor stage*, by blocking such impulses over a large area—not only does this treatment apply to prophylaxis in surgical operations, but also after severe accidents below the diaphragm. For it must be remembered that the stimulus of a trauma persists, in a lesser degree, for some time after the injurious agent is removed, and that pressor fatigue may lead to the second stage at a later period.

(b) *Depressor*. In this stage each stimulus is followed by a corresponding lowering of blood pressure which is associated with consequent secondary heart failure and starvation of the central nervous system.

Again the prevention of further damage lies in the blocking of all centripetal impulses on the lines already explained, and in the treatment of symptoms. The treatment of symptoms consists first in attacking the *progressive collapse*. The measures to be adopted are similar to those in hæmorrhage, viz. raising the blood pressure by infusion, the removal or suppression of the peripheral stimulus, tight bandaging of the extremities, and in this stage, if the collapse is profound, injections of strychnine. It must be realized that strychnine has the property of restoring the pressor paths and so raising the blood pressure by re-establishing the reflexes: this, *in emergency*, is a most important line of treatment to adopt until the further measures are taking effect. Strychnine, further, is a direct cardiac stimulant, and, contrary to some modern

teaching, possesses *no direct deleterious action on any centres*. The centres are not directly fatigued in shock, and there is no danger in stimulating them to activity. Consequently atropine is also valuable, especially when combined with morphia, as a guard against the additional complication of mental shock on recovering from narcosis and to subdue reflexes from the special senses, etc.

The best stimulants for a failing heart in shock are digitalis, caffeine and camphor in suitable doses—alcohol is not recommended. Further details in the treatment of collapse have already been discussed.

Finally, in intravenous infusion for shock the addition of two per cent. dextrose to the saline solution is better than giving adrenalin, since a similar object is served, while, in addition, dextrose is a valuable food.

(c) On cessation of the stimulus the depressor stage merges into an intermediate stage of higher blood pressure, which either leads to recovery, under the treatment adopted, or to death, if the damage to the central nervous system has progressed beyond recovery. (The future may, perhaps, see the adoption of direct transfusion of blood for the treatment of the central nervous system in this stage of shock.)

B.—Remote Effects

1. *Vascular*. These are associated with thrombosis, embolism, septicæmia, pyæmia, etc.; all of which are dealt with in their appropriate sections.

2. *Nervous*. These are mental derangement; impairment of the special senses; increased susceptibility to mildly painful stimuli (with consequent moderate ill-health); such diseases as traumatic neurasthenia, railway spine, etc. Though these ailments are considered elsewhere, it should be borne in mind that they may all arise as sequelæ of injuries, and are late constitutional manifestations which tend to decrease the value of the individual as a member of a community or as a bread-winner. These sequelæ are often extremely difficult to differentiate from malingering, are resistant to treatment, and of the greatest importance from a medico-legal point of view.

H. T. G.

SURGERY OF THE BLOOD-VESSELS

Great advances in the surgery of the blood-vessels have been made in recent years, mainly as the result of experimental research. Chief amongst the improvements may be mentioned the suture of large blood-vessels, arteriovenous anastomosis for the direct transfusion of blood or for the reversal of the circulation in incipient gangrene, and the restorative operations for aneurysm introduced by

Matas. The experience and elaborate technique necessary for such procedures, however, preclude their general use.

Accidental Hæmorrhage.—The lines of treatment in a case of severe hæmorrhage are (1) to arrest the bleeding; (2) to prevent its recurrence; (3) to treat the constitutional symptoms.

In the case of a wounded artery bleeding should be stopped by pressure over the bleeding point or on the artery above. To maintain hæmostasis a tourniquet should be placed around the limb. This is painful and cannot be borne for more than one or two hours. As soon as possible it is advisable to purify the wound and to prevent recurrence of the hæmorrhage by the application of ligatures. Hæmorrhage from veins, as in varicose ulcer, is easily controlled by pressure over the bleeding point and elevation of the limb.

Hæmorrhage at Operations.—Bleeding points must be ligated, preferably with catgut. If ligation over the point of the forceps is difficult, the safest method is to transfix the tissues containing the vessel with a suture before tying. When it is difficult to catch a bleeding point in a deep wound, as in the removal of glands from the neck, the best plan is to pull the deep tissues towards the surface with forceps, so that the vessel becomes more accessible. Packing is only required to stop oozing from the walls of a cavity or to arrest hæmorrhage from an inaccessible vein. Capillary bleeding can be arrested as a rule by firm application of the dressings, but if pressure is insufficient, hot water between 110° and 120° F., adrenalin 1 in 1000, and turpentine are the most useful styptics.

Reactionary Hæmorrhage is due to the slipping of a ligature, or to oozing from small vessels, following the improvement of the circulation after the shock of an operation or injury. If the bleeding is profuse, or not easily controlled by a fresh dressing firmly applied, the wound should be reopened and the vessels ligated.

Secondary Hæmorrhage is due to sepsis, and is always to be regarded as a serious symptom. The first indication is usually the occurrence of slight bleeding a few days after the operation or injury. Profuse and even fatal hæmorrhage is liable to follow when main vessels are involved. On account of the uncertainty of palliative treatment it is advisable, as a rule, to interfere at once. If the vessel is small it is sufficient to cleanse the wound and to pack it tightly, but when the artery is large it is necessary to ligate the vessel through a fresh incision above the infected area, or, according to the nature and position of the injury, to amputate the limb higher up.

In the case of a limb, as long as there is risk of serious bleeding a Petit's tourniquet should

be kept in position, ready for immediate tightening. In situations such as the neck and groin, the only means of treatment may be to plug the wound.

Internal Hæmorrhage.—Early recognition of internal hæmorrhage is important, as prompt operation is vital. It may be difficult to differentiate between collapse due to loss of blood and shock following visceral injury. Not uncommonly both conditions are combined. The physical signs of free fluid in the abdomen or thorax facilitate a diagnosis.

Constitutional Symptoms of Hæmorrhage.—The most striking features of severe hæmorrhage are (1) pallor of the skin and mucous membranes; (2) tendency to syncope; (3) air-hunger. A few hours after hæmorrhage, the blood count will show a diminution of red corpuscles and of hæmoglobin, but a leucocytosis of 15 to 30 thousand.

Treatment. The patient's head should be lowered to prevent syncope; he should have plenty of fresh air and if necessary oxygen to relieve dyspnoea. The most important step in the treatment is to increase the amount of fluids in the circulation. Temporary relief may be given by bandaging the limbs from below upwards, after emptying them of blood by elevation.

Intravenous infusion of normal saline should be performed in every urgent case. The solution can be made from common salt, one drachm to the pint of water. After boiling, it is introduced into the median basilic or other superficial vein at a temperature of 105° F.

The apparatus required is a small funnel or the barrel of a large syringe, four feet of rubber tubing and a metal or glass cannula. A temporary constricting bandage may be necessary around the upper arm to demonstrate the position of the vein. A short incision of half an inch made across the line of the vein is sufficient, unless the vein is obscure. Two catgut ligatures are passed around the vein and the lower one tied, whilst on the upper ligature the first two turns of a surgical knot are made but not tightened. The funnel, tubing and cannula are now filled with saline solution and kept in readiness, whilst the vein, put upon the stretch by pulling on the lower ligature, is opened by a small transverse incision placed between the ligatures. The cannula is pushed up the vein for an inch or more, and fixed by tightening the upper ligature. One to three pints of saline should be run in slowly, allowing ten minutes for each pint. On withdrawing the cannula the upper ligature is tied.

In less serious cases the saline may be given per rectum. By using a rubber catheter and only a low elevation of the reservoir large quantities of saline may be slowly absorbed.

With these two methods available there are few indications, except in the case of infants, for the subcutaneous method of saline infusion.

Direct transfusion of blood has been revived and perfected mainly by Crile, and is the ideal treatment for hæmorrhage, especially when combined with shock, or if it is essential to improve the patient's condition in order to withstand a serious operation.

The method commonly employed is to anastomose the radial artery of the donor to the median basilic vein of the patient. Glass tubes coated with paraffin to prevent coagulation have also been used to simplify the anastomosis, but the technique of the various methods is too complicated as yet to allow of their general adoption.

Varicose Veins.—The limbs should be examined whilst the patient is standing. Both saphenous veins may be affected, and irregular branches between the main veins should also be looked for.

Palliative Treatment may be used for early cases if there is little discomfort. It is indicated if there is any constitutional disease which precludes operation, or if the varix is associated with thrombosis of the deep veins of the leg.

The general health must be attended to, and the possibility of an intrapelvic tumour should not be forgotten. The patient must be warned against prolonged standing, excessive exercise and the wearing of tight garments, and should rest frequently with the feet up. A crêpe bandage is the best and most comfortable form of support for the veins. It is cheap, is not harmed by washing and retains its elasticity for a long time. Elastic webbing is also efficient but not so comfortable; rubber bandages should not be used as they keep the skin moist. The bandage should be applied before the patient rises and not removed till he is again in bed. It is important that the bandage be applied from the foot upwards, but it is rarely necessary above the level of the knee. Elastic stockings are not quite so satisfactory, as they are more expensive, and are apt soon to lose their elasticity.

Operative Treatment should be recommended in the great majority of cases if the varix is extensive or the symptoms severe, and particularly in young patients. Operation is also indicated if there is pouching of the vein or if there have been recurrent attacks of phlebitis. Cases of chronic ulcer which refuse to heal with ordinary measures should be treated by removal of the veins and excision of the ulcer with the immediate application of Thiersch-grafts (Mayo). The technique of the operation has been greatly modified in recent years by the use of vein-strippers, such as Mayo's or

Babcock's instruments, which enable long segments of the veins, unless very tortuous, adherent or thrombosed, to be removed through small incisions.

Simple Phlebitis in a Varicose Vein is common in the large saphenous, especially above the knee and in the calf, and is associated with thrombosis of the affected segment. The symptoms are pain, redness, cedema and induration over the vein, with possibly some swelling of the limb below.

The temperature is usually raised one or two degrees. The risk in such cases is the detachment of a portion of the clot, forming an embolus, or the spread of the thrombosis to the deep veins giving rise to phlegmasia alba dolens.

Treatment. The patient must be kept recumbent, with the foot of the bed raised and the limb steadied. The dressings should be kept in place by a many-tailed bandage to avoid unnecessary movement of the limb. At first the pain is most relieved by hot fomentations, but later ichthyol in glycerine (ten per cent.) is the best application. After three to four weeks, gentle massage may be employed if all signs of inflammation have disappeared. Later, when the patient gets up, he should wear a supporting bandage. Operation is indicated if the veins remain tender or if the phlebitis is recurrent.

Angiomata.—A nævus is a capillary angioma assuming the following forms:—(1) cutaneous; (2) mixed—affecting both skin and subcutaneous tissues; (3) subcutaneous. In mixed and subcutaneous varieties the capillary spaces may be dilated, forming a cavernous nævus.

Treatment is indicated (1) when the nævus is on the face, for æsthetic reasons, or if it be near the eyes or lips; (2) if the nævus is growing rapidly; (3) if there is a tendency to hæmorrhage.

Cutaneous Nævus.—The "port-wine stain" is the most troublesome nævus to treat. The best results are got by repeated exposures to a weak dose of radium, preferably applied in the form of a plaster. The skin should ultimately assume very nearly its normal appearance; but, if the exposures have been too strong, white atrophic spots may remain (Dawson Turner).

Mixed and Subcutaneous Nævus.—*Freezing by Carbon Dioxide Snow* is the method of choice in nævi of moderate size which project from the surface. The majority of cases can be cured by one application of the snow of not more than twenty to thirty seconds in adults, or of a shorter duration in children. Within an hour after freezing a blister forms at the site of application, but the pain is never excessive. If the freezing requires to be repeated, three weeks should elapse before the next treatment (Cranston Low).

Excision is the quickest method where the scar is immaterial. Hæmorrhage can easily be controlled by pressure. It is the usual treatment for subcutaneous nævi of the cavernous type.

Ignipuncture is suitable for small projecting nævi not larger than a florin. Several small punctures are made with the point of a cautery. This method requires a general anæsthetic, and the results, although often excellent, are not likely to be so good as those by freezing.

Electrolysis is reserved for large mixed or cavernous nævi, when excision is contraindicated on account of the scar, or when carbon dioxide snow has failed.

Cirsoid Aneurysm and Aneurysm by Anastomosis.—The risk in these rare conditions is hæmorrhage. Operation or electrolysis offer the only chance of effecting a cure, but the treatment is usually unsatisfactory.

Pathological Aneurysm (True Aneurysm).—The typical signs of a peripheral aneurysm are (1) expansile pulsation, (2) pulsation controllable by pressure on the proximal side of the artery, (3) compressibility of the swelling, (4) presence of a systolic bruit over the swelling or of a thrill on palpation, (5) diminution in volume or delay in time of the pulse beyond.

When the process of natural cure is going on pulsation may be very slight. By observing the effects of compression of the artery and of the swelling, and by noting the expansile character of the pulsation, aneurysm can usually be diagnosed from other conditions such as a tumour or an abscess over a main artery, a pulsating sarcoma or a normal vessel such as the subclavian displaced upwards by a cervical rib. When pain is the chief complaint, especially in aneurysms near a joint, the condition has to be differentiated from rheumatism or neuralgia.

The symptoms and signs which may be present vary with the situation of the aneurysm and with the effects of pressure on the neighbouring structures.

Treatment. In cases of thoracic and abdominal aneurysm the treatment as a rule must be confined to constitutional measures such as rest, low diet and iodide of potassium.

Should simpler measures fail in inoperable cases, a course of *gelatin injections* may be tried to favour coagulation in the sac. Seven ounces of a two per cent. solution of gelatin in normal saline are injected subcutaneously every five or six days till twenty injections have been given. The chief risk in the past has been the production of tetanus from incomplete sterilization of the gelatin preparation, but thrombosis and embolism have also occurred. The results are uncertain, but thirty-three per cent. of the cases have shown improvement

or actual cure (Jaeger). "The relief it furnishes in a considerable proportion of these unfortunate cases justifies its systematic use in all forms of inoperable aneurysm" (Matas).

The Moore-Corradi method of wiring and electrolysis of the sac is worth considering in inoperable cases of sacular aneurysm. If the aneurysm is superficial no anæsthetic is required. Although the treatment is uncertain, and not devoid of risk, it has been followed by relief of symptoms in a considerable proportion of cases, and by cure in a limited number. Out of thirty-eight cases of aortic aneurysm treated in this way Eshner reports five which were alive from one to eleven years after the operation.

Compression Methods of Treatment. Digital compression; flexion; elastic compression. These methods are rarely justifiable, as the results are uncertain, whilst they are associated with a considerable risk of gangrene, embolism or rupture of the aneurysm.

Operative treatment offers the best chance of effecting a cure in cases of peripheral aneurysm. The indications for surgical interference will depend on the general condition of the patient and on the situation and extent of the aneurysm. The immediate and subsequent risks of operation are immensely greater in aneurysms of the innominate, common carotid, subclavian or iliac arteries than in the case of more peripheral vessels.

In recent years the tendency has been to operate more upon the sac and less by methods of ligation. A great advance in the technique has followed the introduction by Matas of New Orleans, of the operation of endo-aneurysmorrhaphy, which enables the lumen of the artery to be retained in favourable cases, and therefore diminishes the risk of gangrene. Out of sixty-two cases of popliteal aneurysm treated in this way, it was possible to obliterate the sac without interrupting the continuity of the blood stream in thirty per cent. of the cases, and in only two of the cases, or 3.1 per cent., did gangrene occur (Matas).

Traumatic Aneurysm (False Aneurysm).—This form of aneurysm follows a small punctured wound of a blood-vessel. It is due to the gradual escape of blood from the puncture, or to the scar in the vessel-wall yielding. The symptoms and signs are similar to those of a pathological aneurysm. As the aneurysm is very liable to rupture and become diffused, operative treatment is indicated.

Varicose Aneurysm is usually due to a communication forming between a traumatic aneurysm and a neighbouring vein. Operative treatment is always indicated.

Aneurysmal Varix is a much less troublesome condition than the above. A firm supporting

bandage is usually sufficient to allay the symptoms, operation being rarely necessary.

J. M. G.

SURGERY OF THE LYMPHATICS

Injuries of Lymphatic Vessels.—The anastomoses of the lymphatic system are so free that wounds of even large lymphatic trunks usually give rise to no trouble and pass unrecognized.

The thoracic duct itself has not infrequently been wounded during operations at the base of the neck upon the left side. The accident is followed by free escape of milky chylous fluid for some days, but the discharge gradually ceases and no evil consequences follow as a rule, though in some recorded cases the discharge of chyle has been persistent and ultimately fatal.

Treatment. If the accident is recognized it may be possible to suture an incompletely divided duct. If the division is complete ligatures should be applied to the cut ends. If they cannot be found the wound should be closed and pressure applied.

Lymphangitis, or inflammation of the lymphatic vessels, may be acute or chronic.

Acute lymphangitis occurs when, owing to the presence of a septic focus, pyogenic bacteria gain access to the lymphatic vessels and inflame them. It may occur in the absence of any recognizable focus of infection within twenty-four hours of a puncture or abrasion of the skin so minute that it fails to attract the notice of the patient. The more prompt the appearance of symptoms, and the less obvious the point of entry of the virus, the more severe, as a rule, is the case.

Symptoms. An initial rigor frequently occurs, the temperature rises to 103° or 104° F., and upon the affected limb red lines can be seen, mapping out the course of the trunk lymphatics. The corresponding lymphatic glands are swollen and tender. The limb feels tense and heavy, and soon becomes the seat of a diffuse throbbing and burning pain, while cedema of the skin makes its appearance. Within a few days the affection may subside, or it may lead to cellulitis or to suppuration of the lymphatic glands, or in the worst cases to a general septicæmia or pyæmia. It is rare for suppuration to occur in the lymphatic vessels themselves.

Treatment. The milder cases may be effectually treated by rest and elevation of the limb and the application of lead lotion. Bier's passive hyperæmia by constriction is often useful. If the primary focus can be found it should be freely incised and fomented. If any discharge is coming from it an immediate microscopic examination should be made, without waiting

for a cultivation. If streptococci are seen 20 to 25 c.c. of antistreptococcal serum should be given immediately, and if staphylococci are detected 50 to 100 millions of a mixed staphylococcus vaccine should be injected subcutaneously. If no means of microscopic examination are available both these measures should nevertheless be adopted as a precaution if the general condition of the patient is in any way serious, and more especially if delirium or other signs indicate a profound toxæmia.

As a local application to the severer cases glycerine of belladonna may be used, especially if pain is acute.

The preparation of an autogenous vaccine should be undertaken, if the case does not yield to treatment by the time the results of the cultivation are known.

After an initial purge the general treatment must be of a supporting and sustaining character, and plenty of fluid nourishment should be administered in the shape of eggs, milk and beef tea.

The treatment of cases which merge into glandular suppuration or pyæmia is hardly within the scope of this article. Cellulitis needs free multiple incisions into the subcutaneous tissues, followed by hot fomentations.

Tuberculous Lymphangitis.—This affection is of course a chronic one. As the result of the inoculation of tubercle bacilli upon a wound or abrasion, usually upon the hand, multiple subcutaneous thickenings appear along the course of the lymphatics of the affected limb. Here and there these indurations may break down into abscesses. At the same time the corresponding lymphatic glands become enlarged. In the case of the upper arm the bicipital gland is the first to undergo enlargement, and should especially be sought for. Diagnosis is complicated by the fact that the original tuberculous sore may be healed by the time the patient comes under observation. Before suppuration takes place the subcutaneous deposits closely simulate gummata, but their linear distribution, their restriction to one limb, and the marked glandular enlargement, usually enable a distinction to be made.

Treatment. Bier's congestion and tuberculin may be tried, but usually it will be necessary to incise and scrape out the local deposits, applying zinc chloride (twenty grains to the ounce) to the cavity left. The glands should not be incised unless they show signs of breaking down.

Lymphangiectasis is a condition comparable to varicosity of the veins, but affecting the lymphatic vessels. It may occur in any form of lymphatic obstruction. When the superficial lymphatics are affected, little colourless vesicles, from which lymph frequently oozes,

may be present in large numbers upon the affected area of skin.

Elephantiasis Arabum is the name given to the extraordinary condition of hypertrophic lymphatic oedema of the skin and subcutaneous tissues which occurs in many hot countries. It is usually preceded by repeated attacks of acute lymphangitis in the affected limb, during which there are rigors, fever and cutaneous erythema. The parts most commonly affected are a lower limb or the scrotum.

On Manson's authority it has been believed that elephantiasis is due to obstruction of the lymphatics by multitudes of filariæ, embryos of a worm which may be found in the lymphatics. The recent careful work of Dr. P. H. Bahr,¹ under the auspices of the London School of Tropical Medicine, has produced fresh evidence in support of Manson's hypothesis. Nevertheless this view may be only partially correct, for I have convinced myself that a condition indistinguishable from an extreme degree of elephantiasis may occur, though rarely, in patients who have spent their whole life in England, and who on repeated examination show no sign of filarial infection. These patients, like tropical ones, often give a history of recurrent lymphangitis. In one such patient, Mr. A. G. R. Foulerton and I found a chronic infection of the subcutaneous tissues by a micrococcus indistinguishable from the staphylococcus pyogenes albus. A French observer, Dufougeré, has repeatedly found micrococci present in the tissues in cases of tropical lymphangitis, and these organisms too are probably the white staphylococcus. It is thus highly probable, in my opinion, that tropical elephantiasis depends upon a chronic infection of the subcutaneous tissues by this organism, which is a normal inhabitant of the skin, although the filaria may be important as a carrier of the bacterial infection.

Treatment. The treatment of elephantiasis may be considered under the headings of (1) methods aiming at cure; (2) methods aiming merely at control; (3) methods of prevention.

1. In scrotal elephantiasis amputation of the mass, which may be enormous, is a successful and in skilled hands a safe operation. In elephantiasis of the limbs amputation is likely to be followed by recurrence of the disease in the stump. Flaying the whole limb down to the deep fascia, followed by skin grafting, has been practised in India, but I believe this plan to be dangerous and unsatisfactory in its results. Excision of the most prominent masses and folds is a useful operation. I have tried to treat the disease by burying silk threads in the subcutaneous tissues to act as lymphatic conduits (lymphangioplasty). In my own hands this

¹ P. H. Bahr, *Filariasis and Elephantiasis in Fiji* (Witherby & Co., High Holborn, 1912).

plan has not been permanently successful, and I am unable to recommend it. In fairness to my method I may add that several surgeons have recorded successes with it.

The vaccine treatment of elephantiasis which I have introduced will be considered later. Its scope is mainly preventive, but in some early cases it appears to be actually curative.

2. *Methods of Control.* The constant use of a Martin's bandage, properly applied, will prevent any marked further increase of diameter in a limb the seat of elephantiasis. This effect of pressure is illustrated in cases where boots have been worn. In such cases the foot and ankle are only slightly increased in size, as compared with the enormous overgrowth of the limb above the limits of pressure.

The patient should sleep with the foot of the bed raised. Massage may be useful, but it should be combined with vaccine treatment.

3. *Methods of Prevention.* I desire to draw the particular attention of medical men practising in the tropics to a promising field of therapeutic investigation—the prevention of elephantiasis and its treatment in its earlier and active stage, by the use of vaccines. The first attempt to treat the disease by staphylococcus albus vaccine was made in a case under my care at the Middlesex Hospital in 1909. The recurrent attacks of lymphangitis from which this patient suffered remained in abeyance for over a year after the cessation of treatment, though they had previously been frequent.

Vaccine treatment is uniformly followed in my experience by marked softening of the hard subcutaneous tissue. The diameter of the limb is not diminished by this treatment alone, but if massage is combined with it, and the case is not too far advanced, an improvement verging on cure may be obtained. In a recent case of lymphatic oedema of the thigh in a girl of twenty, the swelling, though of ten years' standing, practically disappeared after three months of vaccine treatment combined with massage. The circumference of the thigh has diminished by more than six inches.

The vaccine should be given weekly by subcutaneous injection in the arm, in doses of 250 to 500 millions. A stock vaccine may be employed.

Owing to the rarity of the disease in England my opportunities for treating it are restricted, but if tropical experience confirms my observations a great step will have been taken towards the eradication of this intractable and common disease. It is to be observed, however, that vaccine treatment cannot be expected to benefit advanced cases where the bacterial cause may be no longer active, and where only its results remain in the shape of vast deposits of indurated and sluggish subcutaneous tissue.

The Lymph Vessels in Cancer.—In carcinoma and in melanotic sarcoma the lymph vessels are the principal channels for the diffusion of the disease.

Lymphatic Embolism.—In an early stage of many malignant growths particles of the growth are swept along by the lymph stream to lodge in the nearest glands. Enlargement of the infected glands soon becomes obvious.

Permeation.—Coincidentally with embolism along the trunk lymphatics, cancer cells spread along the finer vessels of the lymphatic plexuses by the actual growth of minute plugs of cancer cells along the vessels. To this process the writer has applied the name permeation. It must be sharply distinguished from infiltration. Permeation spreads like a ripple in the plane of the lymphatic plexus into which the cancerous organ drains. Its slow centrifugal spread conducts cancer cells ultimately to the serous cavities, whereupon death follows the rapid diffusion of the growth. A knowledge of the laws governing permeation is essential in the operative treatment of malignant disease.¹

Lymphatic Oedema of the Arm in Breast Cancer.—In the course of breast cancer permeation and subsequent fibrosis of the lymphatic vessels about the shoulder, together with obstruction of the axillary glands by growth, may completely obstruct the return of lymph from the arm, which thereupon falls into a condition of solid lymphatic oedema. The arm becomes paralysed and may be the seat of excruciating pain.

Treatment. In the early stage elevation of the arm in an extended position upon an inclined plane may give temporary relief. Later this position cannot be borne, and in suitable cases great relief follows the writer's operation of *lymphangioplasty* or subcutaneous internal drainage by buried lines of silk. The swelling rapidly subsides, pain ceases and power may return. These effects are usually permanent unless pleural effusion supervenes to interfere with drainage. Prior to the introduction of this method amputation of the arm was the only alternative to the habitual use of sedatives.

The Surgery of Ascites.—Since the serous cavities of the body may be regarded as lymphatic spaces, the surgery of ascites must receive a brief mention here.

It has been shown conclusively that when medical treatment and repeated tapping fail, certain cases of ascites, due to alcoholic cirrhosis or to visceral syphilis, may be actually cured, or relieved for a long period, by surgical measures. Those cases in which the ascites is dependent upon malignant disease, or where serious visceral disease is present, especially

¹ See Handley's *Cancer of the Breast and its Operative Treatment* (London, John Murray).

renal lesions, or where the ascitic fluid is being secreted with excessive rapidity, are unsuitable for surgical treatment. The methods which have been used fall into two classes:—

1. Methods which aim at diverting the obstructed portal blood stream into the systemic circulation.

(a) *The Talma-Morison Operation.* The method consists in the implantation of the omentum upon the parietal peritoneum of the anterior abdominal wall. New vessels form in the adhesions and blood is carried from the omental veins into the epigastric veins. Subsequently to the operation the latter veins may become enlarged and prominent. Though successful in a proportion of cases, the operation is somewhat severe and is not free from danger. Toxic symptoms may arise from the diversion of unfiltered portal blood into the general system.

2. Methods which act by helping the absorption of the ascitic fluid.

(a) *Femoral Drainage (Wynter's Operation).* In this method, first carried out by the writer, the femoral canal is exposed below Poupart's ligament and divided with scissors; the two halves of the canal are then sutured to Poupart's ligament, so as to maintain the patency of the opening. The ascitic fluid escapes into the cellular tissue of the thigh, and is reabsorbed by the lymphatics. The operation is simple and safe. It appears to be the operation of choice in ascites, but it is liable to fail, from blocking of the opening either by a piece of omentum, or, later, by the process of cicatrization. Several cases of permanent cure already stand to the credit of this method.

(b) The writer's operation of lymphangioplasty can be adapted to the treatment of ascites. It is to be recommended in cases where the simpler operation of femoral drainage has failed and where the fluid is being secreted with only moderate rapidity. Details of this method and also of the technique of femoral drainage will be found in my Hunterian lectures on lymphatic surgery.¹

Lymphangiomata are tumours mainly composed of lymphatic vessels. On account of their rarity they possess little importance. They are of two varieties: (a) the capillary lymphangioma or lymphatic nævus, a yellowish, slightly raised, congenital, sharply-defined area of skin, distinguished by its colour from the ordinary hæmic capillary nævus; (b) the cavernous lymphangioma (cystic hygroma) is a multi-locular, cystic, fluctuating swelling occurring in the subcutaneous tissues. Its spaces contain clear lymph and are dilated lymphatic vessels or spaces. It occurs most commonly in the neck or axilla, and in childhood.

Lymphangiomata are usually best treated by excision.

Septic Lymphadenitis.—When a local focus of pyogenic infection is present the corresponding lymphatic glands frequently become inflamed. Most commonly the septic focus is found in the naso-pharynx, and the cervical glands are accordingly affected—a common complication of the exanthems of childhood. Pediculosis or eczema of the scalp and alveolar abscess are also frequent causes of septic cervical glands. Often the glands in the groin or in the axilla are affected, usually as the result of a "poisoned wound" on the foot or hand. The healing of the primary focus of infection may precede, sometimes by months or years, the evolution of the secondary lymphadenitis. That is to say, bacteria may remain latent in lymphatic glands for long periods until circumstances favour their attack.

At first the glands are enlarged, firm, mobile and tender. If the affection then subsides the tenderness disappears and the glands slowly return to their normal size. But often suppuration takes place. It is preceded by fixation of the gland from periadenitis. The skin becomes adherent, thinned and erythematous, fluctuation is manifest, and the abscess bursts, leaving a sinus which is sometimes very persistent.

Treatment. The primary focus must be sought for and treated. Hot fomentations or glycerine of belladonna may be applied to the glands in the early stage. Suppuration requires incision, followed by treatment with Bier's suction glasses.

Bubo is a chronic suppurative inflammation of the glands in the groin, secondary to the presence of soft venereal sores upon the genitals. It is more common in men than in women. The skin over the tender and inflamed glands becomes reddened and gives way. An obstinate sinus is left which may continue to discharge for months.

Treatment. The soft sores must be treated by antiseptic lotions and dusting powder. In the early stage hot fomentations may be applied to the glands, or a mixture of ung. hydrarg. and ung. belladonnæ may be rubbed into the skin. As soon as pus forms it must be let out by a vertical incision. A horizontal incision gapes and heals badly. But the only method to secure a rapid cure is to completely excise the affected glands. If they have already broken down so that operative infection of the tissues is likely, the cavity left must be packed with sulphur and gauze for twenty-four hours. Subsequently the cavity is irrigated with boracic lotion and fomented until the sloughs caused by the sulphur have separated. If precautions are taken against reinfection the cavity remains an aseptic wound and heals rapidly.

¹ *Brit. Med. Journ.*, April 9 and 16, 1910.

Syphilitic Lymphadenitis.—In the early stage of syphilis the glands into which the primary sore pours its lymph become infected. They are enlarged and hard but remain discrete and painless. In the secondary stage, when the infection has become systemic and general, all the accessible glands of the body share to a less extent in the enlargement. Syphilitic glands never suppurate, and require no independent treatment.

Tuberculous Lymphadenitis.—Tuberculous glands of the neck are among the commonest affections of childhood, while in adults they are comparatively rare. It is probable that the infection is conveyed in nearly all cases by milk, although inhalation of tubercle bacilli floating in the inspired air may no doubt be a cause. The point of entry of the bacilli is in nearly all cases the ring of lymphoid tissues which surrounds the fauces, that is to say either through adenoid vegetation of the naso-pharynx or by way of the tonsils. Tubercle bacilli have frequently been found in excised tonsils and adenoids.

It is frequently stated that infection may occur through carious teeth, but I believe this is erroneous. Dental infection may, however, cause tuberculous glands to suppurate which would not otherwise have done so.

In nearly all cases tuberculous enlargement is first evident in a gland situated just at the angle of the jaw on either side. The enlargement is bilateral, but the gland on one side is larger than that on the other. This asymmetrically bilateral character is preserved as the disease advances. The glands along the carotid sheath are first affected. Thence the infection may spread into two side chains of glands, one situated in the submaxillary triangle, the other passing downwards and backwards across the posterior triangle, and ultimately reaching the axilla. The occipital glands also become infected in certain cases.

As the disease advances the glands first affected may soften and caseate. The skin over them becomes adherent and reddened and an abscess forms, which after bursting leaves an obstinate tuberculous sinus. The adjoining skin may show lupoid infection. Tuberculous glands are rarely dangerous to life, nor do they often lead to phthisis or to general tuberculosis. They usually disappear before adult life is reached. They may, however, first develop in adult life, and even in old age. In many instances rational non-operative treatment averts suppuration.

Lymphadenoma, or Hodgkin's disease, is variously regarded as an infection by an unknown organism, or with greater probability as a malignant neoplasm of lymphatic glands. It affects by preference young adult males,

though it may occur at any age. Sometimes the patient gives a history of a pyogenic infection in the area served by the diseased glands, a fact which has given colour to the infective theory of the origin of lymphadenoma. The disease is local in its origin, affecting at first a single group of glands, most often the cervical ones. It spreads gradually to the adjoining sets of glands and may finally involve the lymphoid tissue all over the body. The spleen is enlarged in the later stages and shows on section the characteristic appearance of almond toffee (hardbake spleen) from local deposits of lymphadenomatous tissue. The liver and kidneys may show similar deposits. The blood, at first unaffected, in a late stage shows merely the appearances of secondary anæmia. Death is usually due to circulatory disturbances produced by the pressure of enlarged deep glands upon the veins, or to respiratory difficulties of similar origin.

Lymphatic Leukæmia simulates Hodgkin's disease, but presents in addition the characteristic blood changes of leukæmia. It requires merely to be mentioned here, since it is a blood disease, and not primarily a disease of the glands.

Lympho-Sarcoma.—Primary sarcoma of the lymph glands is a rare and hopeless disease affecting the glands of the axilla, the neck, the mediastinum or the mesentery. Commencing in one gland or group of glands, it rapidly extends to the neighbouring groups. Meantime the glands first affected increase rapidly in size and become adherent to the skin and to their surroundings. The overlying skin ulcerates and a mass of sarcomatous tissue protrudes. The course of the disease is very rapid, and death usually occurs from pressure upon vital organs.

Diagnosis of Cervical Glandular Enlargements. It is sometimes very difficult to distinguish between glandular enlargement due to tuberculous infection and that which so frequently results from naso-pharyngeal sepsis occurring in the acute exanthems of childhood. Frequently the diagnosis can only be made by watching the case. If the enlargement is due to septic organisms, the glands are tender and they either usually break down rapidly and suppurate, or they disappear. If the glands remain enlarged after they have ceased to be tender, the probability is that tuberculous infection is present. It must also be recognized that swellings due to tuberculous infection of the glands at the angle of the jaw may be so sudden in their onset that the diagnosis of mumps may suggest itself, but of course the swelling in mumps extends upwards behind the ramus of the jaw, and there is difficulty and pain in mastication. The diagnosis of tuberculous glands from lymphadenoma also presents

difficulties. Lymphadenomatous glands are usually large, elastic and mobile, presenting no tendency to softening or suppuration, while tuberculous glands are often more fixed and of smaller size, and if they attain any considerable size softening or fluctuation can usually be detected. It must, however, be recognized that tuberculous glands may sometimes present all the characters described as typical of lymphadenomatous glands. In the writer's opinion the most trustworthy distinction between these two forms of enlargement is the distribution of the glands. It has already been stated that tuberculous glands are nearly always asymmetrically bilateral, that is to say, if glands are present on one side of the neck, a less marked degree of enlargement will also be found upon the opposite side. On the contrary, in the early stage of lymphadenoma the disease is strictly unilateral and confined to one set of glands. It is sometimes stated that enlargement of the glands in the axilla, coincident with enlargement of glands in the neck, points to lymphadenoma rather than to tubercle. This statement, however, is erroneous, for I have often observed tuberculous enlargement of the axillary glands coexistent with tuberculous enlargement of the cervical glands. From leukaemia tuberculous adenitis can easily be distinguished by an examination of the blood, which in the case of leukaemia will show an enormous increase in the number of white corpuscles. Lymphosarcoma, like lymphadenoma, is unilateral in its early stages. The enlargement of the glands is much more rapid than in the case of tubercle. The sarcomatous glands, unlike those of lymphadenoma, soon become adherent to their surroundings by infiltration. They adhere also to the skin, which may ulcerate, with the formation of a fungating mass of growth. The patient rapidly goes downhill, signs of thoracic metastases develop, and death comes quickly.

Enlarged cervical glands, while common in early life, are rarer in the adult. In those beyond middle life carcinoma is the commonest cause. It must not be forgotten that enlarged left supraclavicular glands may be an early sign of gastric carcinoma.

In all cases of glandular enlargement a thorough search for a primary infective focus should be made. The presence of eczema of the scalp, pediculi, carious teeth or otorrhœa, or in older patients of a malignant growth, may render the diagnosis obvious.

Treatment of Tuberculous Glands. The proper control of milk supplies and the exclusion by the tuberculin test of all tuberculous milk would probably bring about an enormous reduction in the frequency of tuberculous glands. If tuberculin-tested milk is not available the milk should be pasteurized or boiled, but both

of these methods impair its nutritive value for the child, and are therefore unsatisfactory.

The second important element in prevention is the maintenance of the naso-pharynx in an aseptic condition. While it is customary to clean a child's teeth daily, as a rule no attention is paid to the naso-pharynx, which, in cities at any rate, must be the receptacle for a large amount of dirt and many bacteria from the air.

In my opinion the naso-pharynx of all town-bred children should be washed out daily with a weak antiseptic. Probably the best preparation is an alkaline solution of thymol (e.g. glyco-thymolin). About ten drops of the solution should be instilled into each nostril night and morning by a nasal douche, or if this cannot be obtained, by a little flask-shaped bottle known as Schuster's alkalimeter (to be obtained from chemical glass merchants) or by an ordinary fountain-pen filler. Children do not object to this process, and indeed come to like it. If the tonsils are large they should be separately painted with glycerine and boracic acid daily. In my opinion these simple preventive methods, which are carried out daily in my own household, would not only decrease the frequency of tonsillar enlargements, adenoids, and tuberculous glands, but would also greatly diminish the incidence of the acute infections such as scarlet fever, measles and acute rheumatism.

Climatic Treatment. When tuberculous glands are present a child should, if possible, breathe air free from dust, pure and bracing. These conditions can be best fulfilled either at Margate or Ramsgate, or by a sea voyage.

Tuberculin treatment has its advocates, but personally I have never been able to convince myself of its value. It must be remembered that in many cases a secondary pyogenic infection is present. Medicinal treatment is of limited value, but a syrup of iodine of iron undoubtedly does good in many cases, while if the child is thin, cod-liver oil must be administered. Operative treatment should not be resorted to as a routine, nor, on the other hand, should it be too long deferred. If the glands show signs of breaking down it is probably best to excise the whole of the affected glands, and not merely to open and scrape those which are actually softened. The operation required is a delicate and somewhat difficult one and should only be undertaken by a practised surgeon, for it usually involves opening the carotid sheath, while the spinal accessory nerve frequently runs between two of the enlarged glands and may be firmly embedded in a mass of fibrous tissue.

Treatment of Lymphadenoma. In its early stage, when the disease is confined to one group of glands, there can be no doubt that complete

excision of these glands and of the adjoining apparently healthy ones is the right line of treatment. If, however, the enlargement affects more than one group of glands—if, for instance, the axillary glands also are enlarged—experience shows that operative treatment is useless, since the disease will certainly be already present in the inaccessible glands of the thorax. If it is decided not to operate, treatment by X-rays is the best resource. Its results are sometimes very striking, and large masses of cervical glands may rapidly atrophy and almost disappear. Unfortunately, however, the improvement is but a temporary one, and the extension of the disease to the thoracic and abdominal glands does not seem to be delayed nor is the fatal result postponed. The temporary relief from pressure in the neck is, however, a great boon to the patient. X-ray treatment should be combined with the administration of arsenic in fairly large doses. Arsenic alone, when freely given, may produce great temporary improvement.

The Treatment of Lympho-Sarcoma. Lympho-sarcoma is such a malignant form of neoplasm that a diagnosis can rarely be arrived at before the case has become inoperable.

If the disease is confined to one group of glands of the neck the whole of the lymphatic glands in the neck and axilla on the affected side should, as far as possible, be removed. This applies to apparently healthy glands as well as to those obviously diseased, for beyond the latter it is certain that there is a zone of glands microscopically infected. If, as nearly always happens, operation is impossible, treatment by Coley's fluid appears to be the best resource.

W. S. H.

THE NERVES

The Division of a Nerve.—In estimating the possibility of nerve division, a reasonably accurate knowledge is required of the anatomical distribution of the more important motor and mixed motor and sensory nerves. The importance of early recognition of the lesion cannot be overestimated, both from the point of view of practitioner and patient. The diagnosis should not be difficult, by reason of the immediate muscular paralysis and anaesthesia of the region supplied by the nerve in question.

It should also be noted that, even under the most favourable circumstances, the distal portion of the nerve trunk degenerates from the site of division to the terminal end-plates. Further stress might be laid on this point in view of a prevailing impression that a nerve cleanly divided in a clean wound heals spontaneously. This is a complete fallacy. Whether the evidence points to a complete or incomplete

division of the nerve trunk, it should be laid down as an absolute rule—one with no exception—that free exposure should be carried out and the ends united end-to-end. Natural “cures”—even under the most favourable conditions—are most incomplete in their ultimate results. Added to this is the fact that the practitioner runs serious risk of being accused of failure to recognize the conditions.

Due consideration must also be paid to the fact that the proximal end of the nerve retracts somewhat within its sheath of surrounding tissues, and that the blood-clot effused around the ends of the nerve interferes, by its later organization, with the downward growth of the axis cylinders from the upper segment to the lower.

There can also be no question that *primary* suture brings in its train results infinitely preferable to those obtained on *secondary* exposure and union; the process of repair is more rapid and the functional recovery more complete.

In the *primary* suture of nerves the following are the main essentials:—

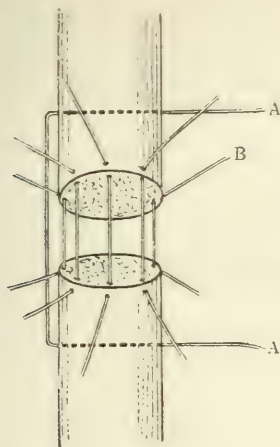
1. *Absolute cleanliness of operative field and media.* In the event of secondary suppuration the development of fibrous tissue not only impedes the passage of the down-growing axis cylinders but also strangulates them in their course. If the operator has to deal with a lacerated wound in which secondary suppuration might be expected to develop, the whole area of operation should be sponged with a two and a half per cent. solution of iodine in spirit. In the event of free suppuration when the patient is first seen—more especially when the infection is dependent on the streptococcus pyogenes—it is wise to obtain complete healing of the wound previous to carrying out any attempt at nerve suture.

2. *Complete exposure of both ends of the divided nerve*—by means of clean dissection with the knife.

3. *Removal of all blood-clot and a bloodless field of operation.* Tourniquets should never be used. The operator exposes the nerve with care, and all bleeding points are secured as encountered. The presence of blood-clot around the ends of the nerve and its subsequent organization strangulates the axis cylinders in their youth.

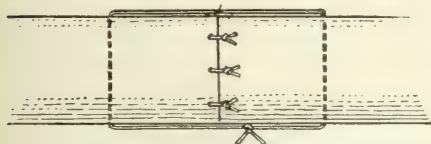
4. *End-to-end union of the divided nerve.* This method of union is greatly preferable to all others. It should always be carried out when the conditions permit of its adoption. In the illustration the ends of the nerve are united with fine catgut sutures, these being of two kinds:—(a) tension and (b) coaptation. With a fine rounded intestinal needle, tension sutures—one or two in number—are introduced into the nerve trunk a short distance above and below

the divided ends, whilst the coaptation sutures, in number according to requirements, are introduced through the sheath only. The tension



Stage I.

A = Tension Suture. B = Coaptation Suture.



Stage II.

FIG. 1.—The Two Stages in End-to-end Suture.

suture should, however, be omitted when the ends of the nerve can be maintained in accurate apposition by means of coaptation sutures only. The passage of the needle must destroy some few axis cylinders and, by reason of the later developing connective tissue, interfere with the downward passage of new nerve elements.

The nerve should, if possible, be buried in such a manner as to lie in the most favourable channel of non-contractile tissue, *e.g.* an intermuscular plane.

5. *Avoidance of all tension at the site of union.*

6. *Maintenance of the limb in such a position as to prevent tension on the sutures.* At the end of ten days or so the limb can be brought down to its natural position.

7. *Early massage of the limb and galvanism of the muscles.*

In the event of failure in bringing about end-to-end contact the next best results are obtained by the introduction of *silk* coaptation sutures which, picking up the sheath only, allow of the formation of a *trellis-work*, along which the axis cylinders will be guided to the lower segment and in the central channel of which the mass will be conducted in the same direction. In this case it is essential that the sutures should be passed with due regard to the tension which

will be existent after fixation of the part involved.

The results obtained by end-to-end suture. After the union of a mixed nerve some sensation may return within a few days—"recurrent sensibility." This is of a very rough nature and points of contact cannot be accurately localised. It usually disappears within a few days. The first signs of true regeneration seldom become apparent before four to eight weeks, sensation of touch developing first, that of pain and temperature later. Return of muscular power does not become evident till after two or three months and is seldom complete till after the lapse of a year or more. Delay in muscular recovery is directly proportional (1) to the healing of the wound and (2) to the capability of muscle fibre regeneration. The greater the degeneration of muscle fibres the more prolonged the period of recovery. If complete reaction of degeneration be obtained in the muscles supplied by the nerve, but little hope can be entertained of recovery.

If there is no improvement in tactile sensation within two months and no muscular recovery within six months, the operation may be regarded as a failure.

When *primary* suture has not been carried out or, if carried out, has not been successful, *secondary* suture should be adopted—the sooner the better.

The following are the main essentials in secondary suture—

1. Free exposure of the nerve and a clean bloodless field, as before.

2. Removal of bulbous ends and other fibrous tissue surrounding the nerve at the seat of division. A mere shave of the distal segment suffices; free removal—up to the upper termination of the bulbous enlargement—is required for the proximal end of the nerve.

The question of contact production now requires consideration. If possible, end-to-end union should be attempted, but, even after careful manipulation, *e.g.* full flexion of the hand when the median is involved, this method may not be practicable. Under such circumstances, the surgeon has at his command the following methods—



FIG. 2.—Nerve-bridging by means of a Silk Trellis-work.

1. The formation of a *silk trellis-work and channel* (as figured above) whereby the axis cylinders may be guided from the proximal to the distal end of the nerve.

2. *Transplantation* of a length of nerve sufficing to fill up the gap between the two ends.

3. Implantation of one nerve into another.

Transplantation may be carried out in three ways: (a) *Auto-transplantation*, in which the nerve material is derived from the patient himself. (b) *Homo-transplantation*, where the necessary segment is obtained from a willing friend. (c) *Hetero-transplantation*, where the nerve is obtained from an animal.

Homo-transplantation requires but few words. It is not altogether satisfactory, there is always the difficulty of obtaining a willing donor, and the nerve material, which obviously can only be such as possesses purely sensory function, can be obtained, with a prospect of better results, from the patient himself.

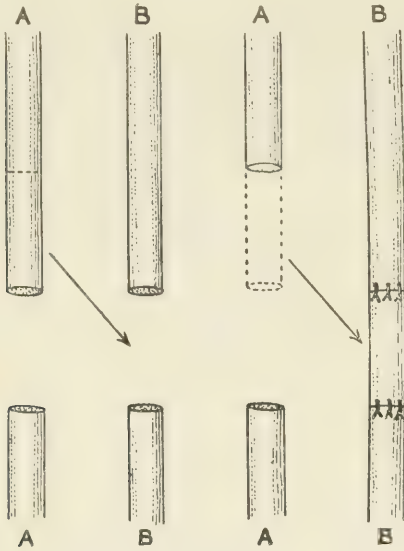


FIG. 3.—To illustrate the Repair of One Nerve with a Portion of Another.

In *auto-transplantation* a sufficient length of some sensory nerve (*e.g.* the long internal saphenous) is excised from the patient's leg, cut up into as many segments as will together equal the calibre of the nerve to be restored, and each segment sewn—by means of a few silk sutures—to the proximal and distal segments of the nerve involved. The nerve material merely acts as a bridge or connecting-link, undergoing atrophy in itself, but allowing in the meantime of the downward growth of the necessary axis cylinders.

In *hetero-transplantation*, the gap intervening between the two segments of the nerve trunk is filled in with a portion of nerve, of more or less corresponding calibre, derived from a living animal—*e.g.* the sciatic of a dog. The injured nerve is exposed and its ends refreshed whilst the assistant—with all aseptic precautions—dissects out the dog's nerve. The segment is then sewn into position with coaptation sutures,

the wound closed, and the limb fixed in such a position as will obviate all tension on the part.

Neither auto- nor hetero-transplantation yield very satisfactory results. Of the two, auto-transplantation is to be preferred. In all probability the connecting link of silk sutures (as described above) gives results equally satisfactory, besides presenting other obvious advantages.

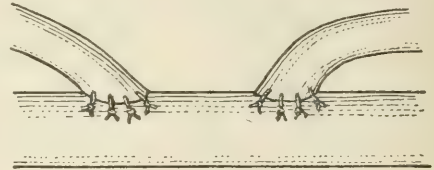


FIG. 4.—Lateral Implantation.

Implantation.—When the gap is too wide to bridge over by any of the methods enumerated above—more than two to three centimetres—implantation may be carried out. This method may be readily explained by two examples—

1. The ulnar nerve is severed at the wrist and considerable substance lost. Median and ulnar are both exposed and both proximal and distal ends of the ulnar—when refreshed—laterally implanted into the median, two small incisions being made into the sheath of the median and the sheath of the ulnar sewn to that of the median. (2) The facial nerve is destroyed in the region of the aqueduct. The distal end of the facial is found and implanted laterally into the spinal accessory or hypoglossal.

In both instances fairly satisfactory results may be anticipated.

Trigeminal Neuralgia.—No drug—other than that dangerous remedy, morphia—exercises more than a temporary effect in trigeminal neuralgia, whilst all the peripheral operations on the branches of the fifth nerve bring about at the best a very transient benefit. We have, however, at our disposal two measures, (1) intraneural injections of alcohol, and (2) operations on the Gasserian ganglion, its sensory root and its three divisions, all of which offer considerable hope of permanent cure.

Operations on the region of the Gasserian ganglion presented, in their earlier stages of development, a not inconsiderable mortality, but of recent years our technique has improved to such a degree that the operation, though necessarily a serious one, rarely terminates otherwise than in the most satisfactory manner. Still, alcoholic injections—as introduced by Schlösser—should always be tried first.

Alcohol Injections.—The needle should be provided with a blunt stylet, graduated in centimetres, about 10 cm. long and 1.5 cm. in diameter.

The *solution*. The following solution, as recommended by Purves Stewart, has been found most successful—

β -Eucaïne	grs. 2
Absolute alcohol . .	drs. 6
Distilled water . .	to the ounce.

The *injection* is preceded by the production of a local anæsthesia with a two and a half per cent. solution of eucaïne. The needle is then passed through the skin, the stylet inserted, and the combined instrument passed in the requisite direction to the required depth. The stylet is then withdrawn and the solution injected drop by drop. Two or three drops will suffice to tell whether the needle is correctly placed, a burning pain being experienced by the patient over the area supplied by the nerve involved. As far as one can tell it is not absolutely essential that the injection should be endoneural, though it would appear that perineural injections are less beneficial.

From 1 to 1.5 c.c. (minims 17–25) are introduced in all.

To reach the *foramen ovale* (third division of the fifth nerve) the needle is introduced through the cheek, behind the last molar tooth, at the lower border of the zygoma, at a point $2\frac{1}{2}$ cm. in front of the descending root of the zygoma, penetrating the masseter and the posterior part of the temporal muscle. Being directed backwards and slightly upwards, it impinges on the skull at the external pterygoid plate. It is then pushed upwards and backwards till it enters the foramen at a depth of usually 4 cm. from the zygoma.

To reach the *foramen rotundum* (second division) the needle is inserted as follows:—find the posterior border of the orbital process of the malar bone and from this carry a line down to the lower border of the zygoma. There introduce the needle $\frac{1}{2}$ cm. posterior to that point. Pass it horizontally inwards and slightly upwards, the foramen being reached, in the pterygo-maxillary fossa, at a depth of about 3 cm. from the surface.

To reach the *sphenoidal fissure* (first division) the needle is passed at the outer margin of the orbit, close within the fronto-malar suture, along the outer wall of the orbit, to a depth of $3\frac{1}{2}$ –4 cm.

The results obtained by alcohol injections. In successful cases relief from pain is almost immediate. The cure is, however, of a temporary nature, lasting a few months only, on an average about ten months. On recurrence of the pain the injection may be repeated, with, in many cases, equally satisfactory results.

Still, in some cases, even though correctly introduced, the injection fails to bring about a satisfactory result. In such cases and also

when, by reason of their position or residence, the patients cannot avail themselves of this mode of treatment, operative measures should be adopted.

Operative Treatment.—The following operations have been carried out—

1. Removal of the complete ganglion (the Hartley-Krause operation).

2. Removal of the lower two-thirds of the ganglion (the Jonathan Hutchinson operation).

3. Division of the sensory root of the ganglion (Frazier's operation).

4. Intracranial resection of the second and third divisions of the nerve (Abbé's operation).

In all these operations the approach is carried out through the temporal region. The temporal muscle is split or turned down, the bone trephined and a small opening made in the skull by means of the rongeur forceps. The dura mater is then stripped away from the floor of the middle fossa of the skull, and that membrane, together with the overlying temporo-sphenoidal lobe, retracted in such a manner as to allow of free exposure of the ganglion. Intracranial resection of the second and third divisions of the fifth nerve or other of the operations enumerated above can then be carried out. Of these procedures, some uncertainty exists as to which is the best. Probably it is wise to limit oneself to intracranial resection of the second and third divisions when the condition of the patient is unsatisfactory and, under other circumstances, to divide the sensory root.

The results obtained by operative treatment. Whatever operation be carried out, the results, both immediate and remote, are equally satisfactory provided that the operation be complete in every respect and carried out by one experienced in such operations. The mortality is exceedingly low, not more than five per cent., a small mortality when one considers the difficulties of the operation and the terrible nature of the disease from which the patient suffers.

There are, as far as one can say, but very few cases on record in which pain recurred after the complete operation.

L. B. R.

THE SKIN AND SUBCUTANEOUS TISSUE

Blisters.—These should be opened early, if possible, before the contents become turbid, by snipping (at a dependent part) with sterilized scissors, and the fluid gently pressed out, flattening the dome of the bulla on to the subjacent surface. The part is then dressed with several layers of sterilized gauze lightly strapped on or bandaged. In some bullous diseases of the skin the bullæ have to be followed up in this way, especially about the back and buttocks (pemphigus—acute pemphigus—pemphigus vegetans—pompholyx—leprosy—after

accidental or other burns). This is in order to prevent irritation by pus formation, and to relieve pressure on them and subsequent accidental bursting.

Corns.—Corn-cures are numerous, testifying to the difficulty of successful treatment. The usual course is to cut the corns with a sharp corn-knife or razor, preferably the flat to the hollow-ground. Instruments in any case must be clean and preferably sterilized by wiping the blade carefully with methylated spirits or alcohol before use, and the area to be dealt with should be disinfected. Every now and then streptococcal or other infection ensues, at times terminating fatally. Another way is to rub down the corn with pumice stone. These proceedings are best done after a warm foot or general bath, as some corns become extremely tough. Any bleeding should be dealt with by means of cyanide or sal-alembroth wool fixed by collodion or a strip of plaster. These are counsels of perfection and are seldom carried out.

In any radical attempt to cure a corn the core should be enucleated by means of a fine narrow spatula or a somewhat blunt-ended knife. In this way, after hot water and cutting down, the central cone can be dug out. In very tough corns soft soap and hot water may be employed as a preliminary. Again salicylic collodion (+ *Cannabis Indica*), painted on layer after layer, may be successful, but salicylic plaster (*emplastrum acidi salicylic*, Beiersdorf) is better. (The higher strengths should be selected.) In this way the thickened horny layers are softened and can be shelled off by the nail after being in contact for a few days.

Corn-shields with central perforations are to some extent useful in warding off recurrence, by preventing pressure in the central parts. Another method of prevention is to wear well-fitting comfortable boots. When pus forms under a corn the purulent focus must be reached by shaving off the thickened epidermic layer after layer in order to lay the small cavity bare for free drainage. The cavity should then be disinfected with an antiseptic solution applied on wool wound round a wooden match end and dressed with sterilized gauze.

A corn on a hammer-toe means that the latter must be surgically dealt with to get relief.

As to soft corns, between the toes, touching them with a little salicylic acid is very useful in most cases. The moist adjoining surfaces should be kept clean and separated with sterilized gauze.

Thickenings of the Epidermis on the sole of the foot (ball of the big toe) are sometimes met with and may cripple a patient. In ordinary thickenings of this sort, formalin, carefully

and repeatedly applied locally, but not going too far, of course, is useful (Dr. Starling of Norwich told me of this method). Another method, which is specially useful in relieving the pain, is electrolysis by means of a stout curved needle (connected with the negative pole) passed under the thickened epidermis.

Horns.—I will first deal with senile horns. Some of these may attain to a large size. They usually appear on and about the face, and on other parts, such as the scalp and glans penis. In the last situation they may follow circumcision. The only line of treatment which effects permanent cure is excision. One should be on the look-out for epitheliomatous complications in the aged, in the case of horns of long standing.

Another condition of interest in connection with this subject is one known as multiple juvenile horns. A number of these may be distributed about the cutaneous surface of puny subjects, the cornified excrescences being of various shapes. The only effective treatment is by excision, or scraping with a sharp spoon, followed by the application of pure carbolic acid to the base, in cases where the excrescences are small. Ordinary topical treatment by the application of various remedies is followed by regeneration of the excrescences and horny lesions.

Chilblains.—Here the value of internal medication by means of calcium lactate, trinitrin, etc., should not be overlooked. The dietary should include fats (see *Lichen Scrofulosorum*), as well as sugars to supply caloric. Exercise is important. The frequent association of chilblains with tuberculosis must be mentioned here. Local applications are many. Iodine-vasogen six per cent., or liniment. terebinth., ol. olivarum āā, etc., rubbed into unbroken chilblains are sometimes useful. When they are broken down and ulcerated they should be carefully dressed with mildly antiseptic soft ointments and sterilized gauze.

Moles.—See *New Growths of the Skin*.

Keloids.—See *New Growths of the Skin*.

Lupus Vulgaris.—It is very important to diagnose this condition in its earliest stages. Unfortunately the early lupomata are allowed to go on year after year without proper and adequate treatment. Administration of soothing ointments and telling young patients they will "grow out of it" are futile procedures. The earliest obvious phase of lupus vulgaris may be, for instance, a quite small nodule in the centre of the cheek of a child. A glass lens pressed down on the nodule will not drive all colour out of it as in an ordinary inflammation, but a fawn-tinted discoloration is left behind. That, with the usual history of increase in size of the "spot" in spite of treatment, should clinch the matter. The nodule should be destroyed

at once. A good way is to do this with acid nitrate of mercury carefully applied on a sharpened pointed wooden match and pushed into the nodule. Such lupus nodules offer no resistance. Larger lesions, which cannot be dealt with in this way, should be rather widely and deeply excised, for I have shown that histologically the nodular lupus growth may go down below the true skin into the subcutaneous parts. The edges can be brought together by strong sutures, also passed deeply. When this is not feasible then grafting should be resorted to, after the method of either Thiersch or Wolff, according to the depth of tissue removed. These measures answer on parts away from the face, but as lupus vulgaris usually affects the face, more modern modes of treatment, such as Finsen treatment and the X-rays, must be resorted to, especially if the areas of disease are large. The former is slow and tedious and takes up a lot of time, and as patients suffering from lupus are nearly always poor and dependent, this is a drawback. With X-rays many exposures are also required. Here a word of warning. —In the author's opinion malignant complications (epitheliomatous) are more common since the X-rays have been employed than they used to be. I have found that thoroughly scraping with a sharp spoon, under an anæsthetic, following up at once with the X-rays, gives good results. But cases must always be kept under observation for possible recurrences, which may spring up from the depths, as pointed out. Another valuable surgical method, which in my hands has answered well in circumscribed cases (end of nose, etc.), is multiple scarification, cross-hatching the part with a Vidal knife or multiple scarifier. If necessary, the parts can be *slightly* anæsthetized by means of ethyl spray, but the part must not be made too hard for the scarification. This can be done, from time to time, without interfering with the patient's work, a great consideration, for it is important that lupus patients should get as much food as possible, especially fats.

The so-called **Post-Mortem Wart or Lupus Verrucosus** is best dealt with by scraping with a sharp spoon, followed at the time by the application of pure carbolic acid. Or a strong salicylic plaster may be applied and the top layers got rid of, followed by carefully using acid nitrate of mercury. I have seen lupus verrucosus arise by direct infection from the sputum of the patient himself; in another case a woman contracted it whilst nursing her phthisical husband. The hands and fingers are the parts usually affected.

Scrofuloderma differs clinically from true lupus vulgaris in being more superficial, succulent and crusted. In such cases sharp curetting (with a good-sized fenestrated spoon), followed

up by the application of sulphuric acid, rapidly neutralized by an assistant by means of carbonate of soda, gives excellent results. Patients must be followed up and assisted by sea air or fresh air, plus plenty of good food, if possible.

Of course, in all these tuberculous conditions, the careful use of tuberculin vaccines may be of use, but in my experience I do not think much of vaccine treatment in lupus vulgaris, especially sclerosed chronic patches, except in cases where the mucous membranes are involved. For the affected mucous membranes in lupus vulgaris a twenty per cent. lactic acid solution is useful locally. For intranasal lupus, Pfannenstiel's method, which I saw applied in Stockholm, appears to give encouraging results. The method depends on the liberation of free iodine, the patient taking sodium iodide internally, the peroxide of hydrogen being locally applied by the medical man.

Sebaceous Cysts.—These may be treated by the ordinary method of transfixion, or by cutting down on and dissecting out the tumour. The point to bear in mind is to remove the cyst wall completely. The parts should, of course, be carefully cleaned and sterilized beforehand; and in the case of the scalp the parts thoroughly shaved.

Elephantiasis.—Elephantiasis or permanent swelling of the tissues may occur in various situations, as, for instance, about the orbits, after repeated attacks of erysipelas or even acute eczema. The underlying cause is blocking of the lymphatics or interference with the back-flow of lymph. The scrotum, the vulva, the leg are, however, the usual situations of the trouble. In tropical elephantiasis (elephantiasis arabum) the tumours and girth of the limb may become enormous. Apart from the filarial causation, an increase in size of the leg may occur in this country, but it is usually of a mild degree, as compared with the elephantiasis arabum. In the case of the enormous growths referred to, removal by surgical measures has been employed. Castellani of Colombo has employed with good results repeated injections of fibrolysin (thiosinamine and salicylic acid), either into the affected parts or deeply into the gluteal region. Bandaging is simultaneously employed. Handley has advocated lymphangioplasty preceded by vaccine injections of a diplococcus he found in the blood of his case until the latter was sterile.

In milder degrees of elephantiasis of the leg, such as one meets with in this country, systematic *careful* massage and bandaging from the toes upwards are useful. In addition, I recommend small doses of arsenic. This morbid condition may follow on abdominal conditions, which should be excluded, and I have seen it follow extensive abdominal suppuration with

subsequent multiple adhesions and interference with lymph flow.

Staphylococcal Infection.—See *Furunculosis*; *Carbuncles*; *Cellulitis*.

Scars.—When the shape and situation permit they may be excised if the edges can be readily brought together with fine sutures inserted at short intervals. Another method is to inject thiosinamine (see section on *Keloids* and *Hypertrophic Scars*).
G. P.

SURGERY OF THE MUSCLES, TENDONS AND TENDON SHEATHS

Injuries

Contusion of Muscle.—Gentle massage should be employed from the first. If the motor nerve to the muscle is bruised, recovery may be delayed and the muscle will show signs of wasting. When this occurs electrical treatment by the galvanic current should be given in addition to massage.

Rupture of Muscles and Tendons.—Slight degrees of rupture are common in muscular sprains. This is the cause of one form of lumbago, and of conditions such as sprains of the calf, in which a few fibres of the gastrocnemius or the plantaris may be torn. Such cases should be treated by massage and early passive and active movements. Prolonged rest, while suiting the inclination of the patient, is more likely to lead to stiffness or to relapse when the muscles are exposed to strain again.

The signs of complete rupture of muscle or of tendon are loss of power on attempted movement and the presence of a gap on palpation. If the muscle is made to contract the proximal part forms a swelling and the gap becomes wider.

Treatment. As soon as possible after the injury the limb should be steadied with the affected muscle relaxed, and supported by wool and a firm bandage to limit extravasation of blood. The choice of treatment lies between operation and the use of retentive apparatus. In complete ruptures, especially of important muscles such as the biceps, or of tendons, such as the tendo achillis or the supra- or infra-patellar tendons, operation should always be recommended, as otherwise a satisfactory union cannot be guaranteed.

Wounds of Muscles and Tendons.—Wounds both of muscles and of tendons must be stitched in order to get proper union. Exact apposition of the cut ends is specially important in the case of the flexor and extensor tendons of the hand and wrist. The amount of retraction varies, but it is more marked in the flexors than in the extensors, and in both cases it is greater if the tendons are divided at the wrist than in the

hand or fingers. When injury of the tendons is suspected the action of the corresponding muscle should be tested. Absence of the particular movement, whilst the muscle is felt to contract, indicates division of the tendon.

Treatment. The wound should be cleansed and the tendons stitched at the first opportunity.

In the case of the finger one per cent. novocaine may be injected at the root of the finger around the digital nerves. For divided tendons at the wrist a general anæsthetic is desirable.

To find the proximal cut end the muscles should be relaxed by flexion or extension, as the case may be. If retraction is marked an attempt should be made to catch the tendon with forceps pushed up the sheath. Compression of the muscles of the forearm by an elastic bandage applied from above downwards will sometimes bring the proximal end into view. Should these measures fail the incision must be carried upwards along the sheath till the tendon is reached. Fine round needles and chromic catgut should be used, and care must be taken to prevent the stitches cutting out.

It is important in the after-treatment to immobilize the hand and fingers on a splint, in a position of relaxation for the sutured tendons. Movements should not be commenced before the end of the third week.

For the first six weeks a controlling splint should be worn, except when the daily movements are practised, as, according to experiments by Tubby, there is a risk during that period of the junction stretching.

When the operation of tendon-suture is delayed till the wound is healed some form of tendon-lengthening or the use of silk threads may be necessary to bridge the gap; the prognosis is therefore less favourable.

Dislocation of Tendons.—The peroneus longus, or both peroneal tendons, may be displaced forwards over the external malleolus when the foot is dorsiflexed and everted. By extending the foot at the ankle and with a little manipulation the tendons can easily be replaced, but the displacement is liable to recur. The foot should be kept rigid for three to four weeks in a plaster case in the position of dorsiflexion and eversion (Tubby). For recurrent cases operation is indicated. Dislocation of the long tendon of the biceps or of the tendon of the tibialis anticus or posticus is very exceptional.

Hernia of Muscle.—In this rare condition a portion of the muscle protrudes through a gap in its fascial covering. The swelling is only present when the muscle is relaxed. This differentiates the condition from pseudo-hernia in a ruptured muscle where the swelling only appears during contraction. If treatment is necessary operation is indicated.

Diseases of Muscles and Tendons

Myositis Ossificans.—The circumscribed form, due to traumatism, affects in order of frequency the tendon of the brachialis anticus, the adductor longus and the quadriceps femoris. In the case of the brachialis anticus the bone forms in the tendon or on its under aspect, generally appearing a few weeks after a dislocation backwards at the elbow. The newly formed bone may limit flexion or press upon the median nerve. It can be recognized by the X-rays and is usually palpable in the antecubital fossa. If flexion is much restricted and the bony mass shows no signs of diminishing, as it usually does in the course of a few months, it should be removed by operation.

Volkmann's Ischæmic Contracture.—This is a condition of partial paralysis and contracture of muscles due to interference with the arterial blood supply. It affects most commonly the flexors in the forearm, especially in cases of fracture about the elbow which have been bandaged tightly in the flexed position.

Within a few hours the muscles become hard and contracted. In a typical case the wrist is slightly flexed, the hand pronated and the fingers are strongly clawed. Extension of the fingers is only possible if the wrist is fully flexed. Later the affected portions of the muscles become fibrous and the nerves also may be compressed by scar tissue.

Treatment. The arm should be massaged daily and the fingers gently stretched, beginning at the distal joints. A moulded metal splint should be applied to keep the fingers extended. This is more easily done if the wrist and metacarpo-phalangeal joints are first flexed. Gradually the amount of flexion at these joints is diminished, till finally the fingers are straight and the wrist can be hyper-extended (Robert Jones). Operation may be tried in cases which resist mechanical treatment, but the results have not been very favourable.

Tumours of Muscle.—Most of the primary tumours are sarcomata; simple tumours such as fibroma, myxoma and lipoma are rare; transition forms between fibroma and fibrosarcoma are not uncommon. Connective-tissue tumours, known as desmoids, are relatively common in the muscles and aponeuroses of the abdominal wall, especially growing forwards from the rectus sheath in women who have borne children. Some of these tumours are fibromata, but others are myxo- or fibro-sarcomata, which, although slow-growing, show great tendency to recur after removal. A desmoid may be differentiated from an intra-abdominal growth by observing that the former remains palpable during contraction of the abdominal muscles.

Treatment. Early operation and free removal is indicated in the case of sarcomatous tumours.

Diseases of the Tendon Sheaths

Teno-Synovitis Crepitans.—This is caused commonly by over-use, especially in those of the so-called rheumatic diathesis. It is not uncommon in labourers on resuming work after a period of idleness. The radial extensors at the wrist, the tendo achillis and the peronei are the tendons most frequently involved.

Although rest is essential in the treatment, complete immobilization by splints is undesirable, as relapse is more liable to occur when the tendon is again exposed to strain. Bier's passive congestion should be induced for twenty to twenty-two hours daily. The crepitations usually disappear in three to six days. In chronic cases hot-air treatment is useful in addition to massage.

Suppurative Teno-Synovitis.—This is typically seen in pyogenic infections of the flexor sheaths of the fingers. There is swelling, redness and pain along the line of the tendon. The tissues on the flexor aspect are tense and the whole finger, as a rule, is swollen. In doubtful cases it is helpful to test the movements of the finger. If the patient can flex the finger to any extent without great pain the pus is superficial to the sheath. When the sheath is involved movement is impossible on account of pain.

Early incision is essential, as the tendons are liable to slough, and the infection may spread upwards into the palm and wrist, especially in the case of the sheaths of the flexors of the little finger and of the flexor longus pollicis. A general anæsthetic is desirable.

In the fingers short incisions should be made in the middle line over the phalanges, sparing the flexor aspect of the sheath at the interphalangeal joints. In the palm incisions may be placed opposite the metacarpal bones, and below the superficial palmar arch, which is at the level of the web of the outstretched thumb. Above this level in the palm incisions should be placed between the median and ulnar nerves.

For pus in the flexor sheath at the wrist incise immediately to the ulnar side of the palmaris longus tendon, thus avoiding the median nerve.

Strips of dental rubber may be used for drainage. Wet boracic fomentations are applied and Bier's passive congestion induced for twenty to twenty-two hours daily.

An alternative to Bier's treatment is prolonged immersion of the hand in a warm saline or boracic bath. When the inflammation subsides passive and active movements must be commenced.

Gonorrhœal Teno-Synovitis.—This affects chiefly the tendons at the wrist and ankle. In the

subacute form there is pain and effusion in the tendon sheath.

In the acute cases there are the usual signs of a phlegmonous inflammation and pus may form within the sheath. Adhesions and stiffness are liable to follow, but necrosis of the tendon, even in the cases with pus, is exceptional. The neighbouring joint may also be the seat of an arthritis.

Treatment. Satisfactory results are obtained by Bier's passive congestion treatment. Any urethritis present must also be attended to.

In the phlegmonous forms the limb should be steadied by suitable splints, and if pus is present the sheath should be incised. Vaccine treatment also may be used with advantage in doses of five to twenty-five millions; the larger doses being given in the less acute cases (Struthers Stewart). When the inflammation has subsided active and passive movements should be employed, along with massage and hot air, to obviate stiffness.

Tuberculous Teno-Synovitis.—This may occur as hydrops, with fibrinous loose bodies, or as a diffuse tubercular thickening. The disease occurs most frequently in the common flexor sheath at the wrist.

Tuberculous Hydrops may be regarded as an attenuated form of the affection. The sheath is distended with fluid and forms a painless swelling which may be constricted by the annular ligament. Fluctuation and crepitation from the presence of melon-seed bodies can usually be felt. The tendency is for adhesions to form and for movements to be limited. Cold abscess formation is exceptional in this form.

Treatment. After evacuating the contents through a small incision the cavity should be filled with iodoform emulsion and the wound closed. Bier's passive congestion should be induced daily for two to four hours. If this treatment fails the sheath should be more freely opened and the diseased tissue curetted away, the wound being closed as before without drainage.

Diffuse Tuberculous Disease.—In this form there is more tendency to cold abscess formation and to involvement of adjacent joints; the tendons also may be infiltrated and stiffness is more marked.

Treatment. Passive congestion, rest by means of a splint and general hygienic treatment may be tried in the first instance. If there is softening, or if the condition fails to improve, the entire tuberculous synovial membrane should be dissected out; if any diseased tissue remains it is removed by the sharp spoon and the wound closed.

Tumours of Tendon Sheaths.—Myeloma is the commonest type of tumour. It occurs most frequently as a small, round, firm tumour in

the finger, attached to one of the flexor sheaths. Similar tumours occurring in the flexor sheath at the wrist or in the peroneal sheath at the ankle are liable to be mistaken for tuberculous disease. If the tumour is removed entirely there should be no recurrence. Other varieties of tumours, such as adipoma, myxoma, fibroma and sarcoma of the tendon sheaths, are occasionally met with.

J. M. G.

SURGICAL DISEASES OF BURSÆ

Acute Infective Bursitis.—The olecranon and prepatellar bursæ are most exposed to injury and to infection. The presence of suppuration is associated with marked redness and œdema in the overlying tissues. In the case of the olecranon bursa the whole forearm and elbow region may be swollen, but the primary seat of infection is easily recognized by the point of maximum tenderness over the bursa. If tension is not relieved by incision the pus is liable to infect the subcutaneous tissues, and a diffuse cellulitis is common in neglected cases. Treatment consists of an incision, drainage, moist dressings and passive congestion for twenty hours daily till the symptoms subside. Occasionally acute or subacute bursitis occurs from a rheumatic or gonococcal infection. The subdeltoid bursa and the bursa beneath the Tendo Achillis near its insertion are most often involved.

Acute Chronic Non-Infective Bursitis.—Under this heading come the various forms of trade or traumatic bursitis, typical examples of which are miner's elbow and housemaid's knee. In the acute form of simple bursitis the bursal sac becomes distended with fluid, painful to touch, and the overlying skin may be congested. In deep bursæ, such as the one beneath the psoas tendon, pain and restriction of movement may be the only symptoms. The pathological changes in chronic bursitis vary. Commonly there is hydrops of the bursa, with the deposit of fibrin on the inner surface, or melon-seed bodies may form the wall and become free in the fluid, giving a crepitating sensation on palpation. Organization of the fibrin may produce bands across the cavity or thickening of the wall, which renders obliteration of the cavity impossible on evacuation of the fluid, or the thickening may be so marked that the bursa becomes a solid fibrous tumour with merely a slit in the interior representing the cavity.

Treatment. Acute simple bursitis yields readily to rest and fomentations. In hydrops without thickening absorption may follow the application of a lister, but if this fails it is best to insert for a day or two a small drainage tube. Thick-walled bursal sacs and those with loose

bodies should be excised. Removal of the prepatellar bursa can as a rule be performed with local anæsthesia. A horseshoe-shaped incision is made above the tumour and the skin-flap turned down; in this way the subsequent scar is removed from the site of pressure.

Tuberculous Disease occasionally occurs, especially in the bursa about the great trochanter and in the prepatellar and subdeltoid bursa. The disease, which may be primary or secondary to joint or bone tuberculosis, occurs as a chronic hydrops, frequently with fibrinous loose bodies, or as a thickening with caseation of the bursal wall terminating in cold abscess and sinuses. The treatment should be excision of the bursa, entire if possible, or a free incision should be made and the disease thoroughly removed with the spoon and the cavity packed with iodoform gauze.

The adventitious bursa sometimes present in exostoses, hallux valgus, club-foot and over the projections in other deformities must be treated in conjunction with the removal or correction of the primary condition.

J. M. G.

THE INJURIES OF BONES

The only common result of a severe bone injury is some degree of fracture, but there are certain other rare sequences which deserve brief notice.

Simple local proctitis may result from a local contusion. **Tuberculous disease**, especially in children, is often traced to some slight injury in the neighbourhood of a growing epiphysis. **Sarcoma** of the long bones, in the same way, may be caused by trauma. **Myositis ossificans** is also a rare sequel of bone injuries, especially those near the knee and elbow joints. In both these cases the muscle which is attached to the joint capsule and the end of the bone (the quadriceps in the thigh and the brachialis in the arm) undergo ossific changes, which seriously interfere with the use of the joint.

Fracture of the Long Bones

Cause—

1. *Direct injury.* The bone is broken at the point of application of the force. The overlying soft tissues are contused, the bone is generally broken transversely or comminuted, and displacement is slight.

2. *Indirect injury.* The bone breaks at a distance from the point of application of the external force. The overlying skin is uninjured, unless by a projecting fragment of bone, the fracture is oblique or spiral and is accompanied by much overlapping and displacement.

3. *Muscular violence.* A bony process, e.g. the olecranon, which gives attachment to a strong

muscle, may be torn off by an excessive movement. It is in this way that the patella is usually broken.

4. *Spontaneous fractures.* In certain conditions the bones are so altered that a fracture may take place as the result of such slight violence that it is said to be spontaneous. In children this predisposing condition is termed *Fragilitas ossium*, but there is nothing by which its existence may be recognized except the frequency of fracture. In adult life *certain nerve diseases*—tabes, syringomyelia and general paralysis of the insane—are the common causes of spontaneous fracture. *New growths*, either primary sarcoma or secondary carcinoma, may so destroy the bone as to lead to its ready fracture. *Tuberculosis, syphilis and mollities ossium* are some of the rare causes of this condition, also mere *atrophy* of the bone from senility or paralysis.

Varieties—

Simple: the fracture is unconnected with the exterior by any wound.

Compound: the fracture is connected by a wound with the exterior.

Incomplete: a mere fissure or crack, or a "greenstick" in a child; in either case the continuity of the bone is not broken.

Complete: this may be according to the direction of the fracture—transverse, oblique or spiral.

Impacted: the broken ends of bone are driven into each other and fixed.

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Separation of the epiphyses: a fracture in the vicinity of a joint in a child or young adult, in which the line of fracture has separated the epiphysis from the shaft.

Signs.—There are six chief signs of fracture, which vary very much both in their prominence and importance in the different varieties. These are: contusion, pain, unnatural mobility, crepitus, deformity and the X-ray picture.

Contusion is conspicuous in fractures by direct injury, but usually absent in the other varieties.

Pain is generally severe and is popularly regarded as a necessary accompaniment of a fracture. But this is not the case, and it is of great importance carefully to remember those conditions in which it may be slight or absent. Spontaneous fractures due to nerve diseases are generally painless. In impacted and partial fractures the pain is often slight and transient. In alcoholism or coma the patient cannot make

subacute form there is pain and effusion in the tendon sheath.

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any intelligible complaint, and a systematic examination should always be made in such cases for the objective signs of fracture.

Unnatural mobility will be conspicuous in complete fractures of the shaft of femur or humerus, or of both bones of the forearm or leg; it will be difficult of detection if the fracture is near a joint, or if only one of the bones of the forearm or leg is affected, and it will be absent in the case of impacted or partial fractures.

Crepitus, caused by the rubbing together of the broken bone ends when the part is manipulated, is the most definite of all the signs of fracture. It is well marked in those cases that display great unnatural mobility. It is absent or doubtful in impacted or incomplete fractures, in separated epiphyses, and where the fragments are widely separated (*e.g.* fracture of the olecranon) or entangled in the soft parts. In the neighbourhood of a joint, crepitus may be simulated by the grating of osteo-arthritis or teno-synovitis.

Deformity may be so obvious as to be recognizable at a glance, but it is often so slight or so much obscured by swelling of the soft parts that it has to be most carefully looked for. In this examination by far the most useful guide is the relative position of the bony points, as compared with those of the sound side. This sign is almost the only available one in cases of impacted fracture, if an X-ray picture cannot be obtained. Measurement of the whole limb or of one segment between fixed bony points will indicate any shortening of the bones, whilst observation of the bony points around a joint will give information about the articular ends. For example, in fracture of the humerus the distance between the acromion and the external epicondyle is lessened; in the usual fracture of the lower end of the radius the styloid process of the radius is on the same level as that of the ulna instead of being half an inch below it; in fracture of the neck of the femur the trochanter is raised above Nélaton's line. The whole value of these observations of slight degrees of deformity depends on the accuracy with which they are made. It is of great importance in comparing the two sides to have the limbs in the same position and to mark those points of the bony prominences which are used for measurement at accurately corresponding spots.

Skiagraphy. There is no evidence of fracture so simple and satisfactory as that of a good X-ray picture. It may be perfectly true that in the majority of cases a diagnosis can be made by means of the older methods alone. But, on the other hand, there are very few cases in which something is not learned from the skiagrams which was not recognizable by other means. It must therefore be laid down as the

ideal rule of practice that every severe injury of bones or joints should be skiagraphed. In the more obscure and slighter forms of injury, *e.g.* a sprained joint, this should be done as soon as possible in order to see whether there is a fracture or not. Where the bones are obviously broken and the injuries are severe, it is better to put the limb up in splints in the best possible position, and have the X-ray picture taken after this has been accomplished. Then the diagnosis will be confirmed and it will be seen whether the treatment has brought about a reduction which is likely to give a good functional result. Skiagraphy not only has a most important bearing on the diagnosis and treatment of fractures, but it is absolutely essential from a legal point of view. It has been held by the law courts that, in the case of any injury of the bones and joints in which a bad functional condition results, the medical attendant has been guilty of negligence if he has not submitted the case to the X-rays. Of course in remote country districts this method is not always available, but nothing short of such prohibitive conditions will justify the failure to carry it out. In having a skiagram taken of a broken bone it is necessary in all cases to have two different views taken in lines at right angles to each other, in order to gain a true idea of the relative positions of the bony ends.

Constitutional Symptoms.—These are slight as a rule; where there is much extravasation of blood the temperature often rises to 100° or a little over, but this is only of transient duration. Shock will be in proportion to the general severity of the injury. Fat embolism, causing syncope and irregularity of the pulse, is so rare and doubtful an occurrence as to require no detailed discussion.

Complications.—For practical purposes the local complications of a fracture may be regarded as the concomitant injury of neighbouring joints, great vessels or nerves. When the end of a bone is broken the joint is often involved, and this is made evident by an effusion into the synovial cavity. It is in such a fracture that perfect functional condition will be most difficult to restore. The injury of large vessels by the accident or by the sharp fragments of bone is not very common; it will be made evident by a rapid effusion of blood under the skin and by a failure of the pulse in the parts below. Such a condition will require an immediate operation to secure the bleeding vessel. The injury of an important nerve trunk with a fracture is of much more common occurrence than the last-mentioned complication. Thus the brachial plexus may be torn when the shoulder bones are broken, the musculospiral nerve in fractures of the humerus, the ulnar in fractures of the elbow, and the

external popliteal in fractures of the upper end of the fibula. Nerve injury is the complication of fractures that is the most likely to be overlooked, because the symptoms are such as to remain unnoticed when the patient has his limb tied up in splints. A definite loss of sensation in the area of distribution of a given nerve is the cardinal sign, and if this does not diminish after a few days it is probable that the nerve has been severed and the question of an open operation for its suture will have to be considered.

Repair.—The natural repair of fractures involves the participation of two different kinds of tissue, viz. the soft tissues surrounding the bone and the hard tissues of the bone itself. The rôle of the former is active, whilst that of the latter is chiefly passive. From the deep surface of the torn periosteum granulation tissue is formed which is then calcified to form callus, later ossified to form bone.

The amount of this callus formation will depend chiefly on two factors, the fixation of the fragments and the accuracy of their apposition. If the bone is rigidly fixed and the ends accurately fitted there will be the minimum of callus formation; the opposite conditions will cause exuberant formation of callus. The hard parts of the bones are in the meantime softened by an invasion of their tissues by osteoclasts, until they present a spongy condition homogeneous with that of the surrounding callus, when union takes place and the whole region of the injury becomes denser than before. The time taken by these processes varies very much according to conditions. It will be rapid in children, small bones, bones containing much cancellous tissue, *e.g.* the ends of the long bones, and in bones accurately fixed in good position. It will be slow in persons above middle age, in the dense bones of shafts, and in those insecurely fixed in bad position so that a large gap has to be filled up. There are three points of great practical importance in this matter:—(1) The natural "setting" of the bone by the calcification of the granulation tissue to form callus takes from one to four weeks, and during this time it is possible to reset the bone without seriously delaying union. (2) After a long period, *e.g.* three months, has elapsed a mal-united fracture can never be properly reset, because by this time the architecture of the bone has been irretrievably altered. (3) The time occupied for firm enough union to have occurred to allow of use of the limb will depend upon the amount of strain that the part will have to undergo. In a Colles' fracture, for example, the hand can and ought to be moved at the end of two or three weeks, whilst in the case of the femur an equal number of months must elapse before

the weight of the body can be safely put upon it.

Treatment. There are four stages in the treatment of most fractures—

1. First Aid. The limb must be fixed by means of any improvised splint, *e.g.* that formed by an umbrella or rolled newspaper, before the patient is transported from the scene of the accident.

2. Setting. The fragments have to be placed in apposition with one another so that the normal form of the bone is restored.

3. Fixation of the fragments in the normal position in which they have been set until such time as firm consolidation has occurred.

4. Restoration to functional activity of the muscles and joints round the seat of fracture.

About the first stage it is hardly necessary to say anything, as it is merely the precaution of preventing the fracture becoming compound or complicated. But each of the other stages requires the most careful consideration in every case. Fractures will never be treated properly until it is realized what great difficulties they often present. It has unfortunately been a habit with the majority of surgeons to look upon fractures as cases of no special interest, which have only to be tied up to a splint and then got rid of as soon as possible. The fact that many men have been crippled for the rest of their lives has either been ignored or regarded as inevitable.

The routine use of the X-rays has, however, served to demonstrate the inefficiency of the methods of reduction and retention of fractures, and it has amply explained the bad functional results. We know now that it is no simple thing to "set" a broken bone or to keep it in correct position; that very often when a limb has been set and appears to be in good position the broken fragments are entirely misplaced. It will only be possible in this place to indicate the broad principles of treatment of fractures, the details being dealt with elsewhere. There are four chief methods or principles of treating fractures, and each method has its special merits which suit it for some cases rather than for others. There is too great a tendency to advocate one or other method for all cases, but the wise man will master the principles of each and know when to use it in preference to others.

The Splint Method.—This is the routine method by which ninety-nine per cent. of all broken bones are treated. The fracture is reduced by traction or manipulation, preferably under an anæsthetic, and the limb is then bandaged on to a padded splint of wood or metal in such a way as to immobilize the joints above and below the fracture. This arrangement is maintained for a period of time varying

or torn, and their sheaths filled with serous effusion. When the stronger ligaments and tendons are pulled away from their attachments portions of bone are not infrequently detached with them (sprain fracture), and the intra-articular cartilages may be torn or displaced, as in the knee and inferior radio-ulnar articulation. The clinical features of sprain are pain, swelling and disability. In the simplest form, that known as **strain**, which results from overstretching rather than tearing, there is no swelling, merely pain and stiffness.

Sprains may be simple or complicated. When simple, there is swelling in addition to pain and disability, and when complicated, paresis, palsy, extensive swelling or bone-injury may be superadded. The pain is often severe, described as sickening, persisting for a variable time, and made worse by movement. Local tenderness on pressure or during particular movements usually serves to establish the identity of the injured ligament or ligaments, and to exclude fracture.

Swelling and discoloration result from effusion of blood and serum into and around the joint, and a soft crepitation may be elicited from the presence of fluid effused into the tendon-sheaths. The bony points about a joint retain their normal relations, serving to distinguish sprains from dislocations and, as a rule, from fractures. In certain severe sprains with much swelling the Röntgen rays may be necessary to establish a precise diagnosis. With proper treatment the prognosis in simple sprain is good. Three weeks should be the limit of disability even for a large joint like the knee. A certain degree of stiffness lasting for a longer or shorter time follows all sprains, even the mildest.

There are, however, many sequelæ of sprains; some are preventable and result from faulty or careless management on the part of the surgeon, such as stiff and painful joints, muscle atrophy, relapsing synovitis, deformed joints and ankylosis; others, over which the surgeon has no control, are local pareses or paralyses, osteoarthritis and loose bodies. In the aged and rheumatic arthritis deformans is liable to supervene, leading to much crippling. Tubercular disease is a very rare, almost unknown, consequence of sprain in the writer's experience.

In the treatment of strains and sprains the relief of pain, reduction of swelling and restoration of movements are the special requirements. In *strains*, where there is no effusion, strapping the joint with firm adhesive perforated plaster to give support, and encouraging active voluntary movements from the first, is usually all that is required. Massage may or may not be necessary to remove stiffness. When there is swelling, no system is as convenient or

satisfactory as the employment of intermittent elastic pressure. It is applicable to all stages, early and late, suited to every condition, simple or complicated. Layers of cotton-wadding or Gamgee tissue of at least one inch in thickness are made to envelop the joint completely, passing well beyond the capsular limits. Over this a domette or flannel bandage is drawn tightly and fixed so as to keep up steady and equal pressure. Pressure should be applied as soon as possible after the injury, not only to check the immediate swelling (hæmorrhage), but to prevent, limit or remove secondary effusions (serous) likely to follow. It is advantageous in the early stages to remove the compress once or twice daily, partly to allow of re-examination, but chiefly to flush the joint with fresh newly oxygenated blood. When the effusion has disappeared, or nearly so, but not before, massage should be used. Massage, of the stroking kind, should be at first gentle and applied to the periphery of the swelling and gradually increased both in force and duration as it is better borne. Passive movements are seldom useful, and will be harmful if persevered with when they cause pain. Active voluntary movements should be encouraged from the earliest date, for besides preventing stiffness and atrophy they supply the natural and physiological stimulus to the tissues of and around the joint during the process of repair. All fixed appliances, even in fracture-sprains, are to be condemned, for complete rest and immobilization are only productive of atrophy and stiffness.

In joints stiff as the result of sprain specialized lines of treatment may be required; Bier's hyperæmic treatment (active and obstructive), mechano-therapy, injections of fibrolysin, and kataphoresis have each supplied a want. Kataphoresis as a therapeutic agency is important, and its application to the traumatic conditions of joints will probably prove of increasing service. For the relief of painful rheumatic complications the salicylates are more useful than the iodides. In the gouty and rheumatic cases intermitting or persisting pain often results from sprain, and is best overcome by exhibiting the remedies appropriate to these ailments, locally and constitutionally.

Dislocations (traumatic) present a persistent displacement of the bones entering into the formation of the joints. Indirect violence accounts for the greatest number. In the mechanism of displacement the lever is supplied by the more movable bone, the fulcrum by the check to normal movement, whether in the form of ligament, muscle or bone. In this way the important dislocations of the hip, shoulder or elbow are brought about. If the force is applied at a time when the sup-

porting muscles are relaxed or taken unawares, and is sufficient to overreach the physiological limits of movement, the head of the bone may tear asunder the fibres of the capsule and pass through them; the muscles then contracting reflexly pull the head of the bone into some unnatural position. The new position assumed depends upon such factors as the direction of the force, nature of the joint, position of the limb at the time of the accident, and the relative strength of the muscles acting on the displaced bone. Direct violence is a rarer cause, although the knee may be dislocated by a kick, and the acromio-clavicular joint by a direct blow.

Muscular contraction, though important in the mechanism of all dislocations, is seldom alone responsible, though the mandible, patella and humerus are sometimes displaced by muscular effort alone.

Dislocations may be complete or incomplete (subluxation), simple or compound, recent or old-standing and complicated. The characteristic features of a dislocation are unwonted rigidity and deformity. The bony landmarks lose their normal relationship and the deformity is distinctive and common to all examples of the same injury. Loss of function is complete; pain is often severe from pressure upon nerve trunks, accompanied or followed by tingling and numbness. Swelling varies, is often considerable, and may interfere with diagnosis. Shortening of the limb is a constant feature as well as increase in girth. In the majority of cases the bones retain their relations after reduction without external support, differing in this feature from fractures. The Röntgen rays are oftentimes needed to verify the condition. A joint is seldom as strong as before, even though the movements are completely restored. Some degree of weakness of muscles, and stiffness with liability to redislocation are frequent consequences.

Whilst prolonged immobilization may lead to stiffness, too early movement may tend to laxness of ligaments and favour redisplacement.

Reduction should be performed as soon as possible, delay increases the difficulty. Our main object should be to enable the displaced head of the bone to re-enter the socket through the rent in the capsule. This is attained by manipulations based upon the anatomical arrangements peculiar to each joint and each dislocation. Muscle spasm, entanglement of the head of the bone in the extracapsular tissues, as well as the difficulty of finding the opening in the capsule, are the difficulties in reduction.

A general anæsthetic will overcome the spasm, relax the muscles, and allow of painless and effective reduction by manipulation. In the mildest cases success will often follow gentle

manipulations while the patient's attention is temporarily diverted.

To disentangle and allow the head to retrace its course through the capsule successfully will depend upon the manipulator's skill and knowledge of the precise anatomy of the condition and joint. Pulleys, levers and other powerful mechanical devices are seldom needed; their use requires the greatest care to prevent irreparable damage to the surrounding tissues, and, in old people, fracture.

The after-treatment consists in early stroking massage and active voluntary movements, avoiding at first the movements directly concerned in the dislocation. In the rare instances in which anæsthesia and manipulations fail, an open operation under strict aseptic principles may be called for. Compound dislocations being generally the result of extreme violence, such as railway crushes, and being often complicated by fracture, have to be treated on the same principles as compound fractures, the main risk being sepsis and its consequences. Where amputation is not called for, often, at best, ankylosis and crippling results.

Old-standing dislocations afford many difficulties owing to the organic changes which take place in the bones and other tissues, and it often becomes a moot question whether it is best to attempt reduction or to aim at procuring increased movement by a false joint. Each case must be judged of according to the conditions found.

Fractures in the neighbourhood of Joints are many and of great importance, requiring the greatest skill and attention to avert disability and deformity or both. In some sprains and dislocations portions of bone become detached. One or other malleolus may be torn away in sprain of the ankle (sprain-fracture), whilst the edge of the acetabulum in dislocation of the hip, and the coronoid process of the ulna in backward dislocation at the elbow, are examples of fracture-dislocation. The patella frequently snaps as the result of violent muscular strain. In addition to these lesser detachments from strain, the various joints of the body are from time to time involved by fractures of the component bones or neighbouring epiphyses as the result of some external direct or indirect violence. Diagnosis, usually simple, may be difficult or almost impossible, when the fragment is small and the swelling great, without the aid of the Röntgen rays. It is a good rule to suspect an injury to bone whenever there is much bleeding into a joint. The importance of an early and reliable diagnosis cannot be overestimated, for prognosis and treatment are decidedly influenced by the complication. The general principles of treatment are in fracture-sprains the same as for simple sprains

and dislocations, though the cure will take longer. *Early* passive movements should not be practised, as they are productive of more harm than good, are painful, produce separation of joining ligaments, and lead to increased exudation and stiffness. Their use should be relegated to the latest stages. Every fracture entering a joint is a potential cause of disability, and certain lines of practice must be followed if we are to prevent it. Modern practice is based upon certain principles. Restoration of function is more important than cosmetic effects or absolute anatomical restitution, nevertheless, correct alignment should be attained whenever possible, and especially is this important in the lower extremity. Loss of movement is usually more distressing to a patient than deformity. The normal movements in a joint, as well as the lines of muscular strain to which it is subjected, and the common disabilities which accrue from fracture, either from neglect or mismanagement, must be kept steadfastly in mind. To each joint certain deformities and disabilities appear characteristic. In fractures at or near the hip adduction and internal rotation and sometimes extension are limited; at the knee a degree of genu valgum or flexion, with incomplete extension, is not uncommon; at the ankle some valgus and undue pointing of the toes, with painful stiffness; at the shoulder abduction and rotation become difficult and painful; at the elbow fixation at a somewhat obtuse angle (130°), with limitation of both flexion and extension, is very common; at the wrist limited extension with loss of grip. Each of these difficulties must be remembered and avoided. To prevent impairment of movement in a particular joint it is essential to know the precise movements necessary for its integrity and to make provision for them during treatment. Any deviation from correct alignment means erroneous deflection of body weight and straining, not only at the site of the fracture, but also stretching of certain structures in the joints above and below the fracture, all of which tend to produce effects similar to osteo-arthritis. (Robert Jones.)

Whilst restoration of movements in the treatment of joint-fractures is of primary importance, correct alignment, for the reasons stated, must be studiously sought and attained.

Correct alignment is more important than accurate re-position, of fragments. So long as these leading principles are adhered to, it matters little whether a fracture is treated by no fixation and massage, by splints and bandages, or by accurate fixation, with catgut, plate or wire. Each method is good and will yield good results, provided the practitioner possesses the necessary knowledge and skill. Without a definite comprehension of the con-

ditions pertaining and a due appreciation of the inherent difficulties to be met, success will not be attainable in the management of the fractures which involve the joints

R. H. A. W.

INJURIES IN THE REGION OF THE SHOULDER AND UPPER ARM

Fractures of the Clavicle.—The clavicle is one of the bones most commonly fractured. The fracture is usually the result of indirect violence applied to the shoulder or outstretched arm, though it is occasionally produced by direct violence or muscular contraction. The bone generally breaks a little to the outer side of its mid point, *i. e.* at its weakest spot and where it is least supported by muscles. The fracture is usually somewhat oblique, the direction being from the front inwards and backwards, or inwards and downwards. In children it is more often transverse and may be incomplete (green-stick). This fracture is very rarely compound, and mostly uncomplicated. In rare cases, particularly those with comminution due to direct violence, the vessels and nerves lying behind the bone may be injured or pressed upon.

Fractures near the extremities of the bone are much less common, though it is said that the outer extremity is more often injured than is generally thought to be the case, the fracture being overlooked.

In the common type of case the inner fragment overrides the outer, the latter being displaced inwards, downwards and forwards, together with the whole shoulder. This displacement is due largely to the weight of the limb, its buttress of support having collapsed, and to a less extent to retraction of muscles. The projection of the inner fragment can often be seen, and is easily felt on running the fingers along the bone. The arm is rendered useless.

Treatment. The displacement is easily overcome by supporting the arm and bracing back the shoulders, but it is not such a simple matter to retain the fragments in position. Four methods of fixation are worthy of consideration. As a temporary measure the shoulders may be braced back by a couple of folded handkerchiefs passed around the front of each and knotted together over the spine. A third handkerchief supports the shoulder of the injured side, raised to its proper position, passing under the point of the elbow and over the opposite shoulder.

As a permanent fixation apparatus nothing is so generally useful as Sayre's method, or some modification of it. Two long strips of adhesive plaster about three inches in width are cut. An end of one of these is passed around the arm, just below the axillary folds, with the sticky side

outwards, and the loop thus formed, which must not fit the arm tightly, is fixed by stitching or a safety pin. The shoulder and elbow are then pulled well backwards and the plaster is carried across the back, under the opposite arm, and continued right round the chest. It is as well to put a layer of cotton-wool, well dusted with boracic powder, in the axilla. The elbow is then drawn forwards and elevated, thus levering backwards and elevating the shoulder, the forearm and hand being placed across the chest in the direction of the opposite shoulder, some boracic powder and wool being placed between the hand and the chest. The second strip of plaster is now carried from the back over the point of the elbow, which is allowed to project through a slit in it, along the forearm and over the opposite shoulder to reach the opposite end on the back. It is often necessary, particularly in children, to make use of additional strips of plaster, or a bandage over all. In children, in whom the skin is delicate, some boracic lint should be placed beneath the loop of plaster around the upper arm, and also at the spot where the plaster crosses the opposite shoulder. In young women, in whom it is particularly desirable to prevent deformity, the best method of treatment to adopt is to keep the patient lying flat in bed with a firm pillow between the shoulders. This is also the best treatment when both clavicles are broken.

Lastly, in a limited number of cases, *e.g.* those complicated by pressure upon important structures in the neighbourhood, operation with a view to wiring or plating the fragments together is necessary. Whatever the method of treatment adopted, passive movement of the fingers, wrist, elbow and shoulder should be carried out at the end of a week, and then the limb fixed up as before for another week. Fixation for three weeks is usually sufficient, while the arm may be kept in a sling for a week or two longer. Massage, so far as fixation apparatus will allow, should be practised daily throughout, commencing a couple of days after the accident.

Dislocation of the Sterno-Clavicular Joint.—Dislocations of the sternal end of the clavicle are uncommon, and usually arise from violence applied to the shoulder in an oblique direction from the front, the back or above. The bone may be displaced forwards, upwards or backwards, the first being the most frequent.

In the last, and even in the upward dislocation the trachea, œsophagus, etc., may be pressed upon unduly. Reduction is usually easy, but is immediately followed by redislocation. The ligaments being torn, there is nothing in the shape of the bones to prevent displacement.

In the forward dislocation the arm should

be bound to the side with a pad in the axilla and the displaced bone held back in position by a pad and bandage.

The final result is almost invariably imperfect, so far as the position of the bone is concerned, but this does not interfere materially with the use of the arm. The other varieties are rare, particularly the upward displacement. If reduction is impossible removal of the sternal end of the clavicle may be necessary.

Dislocation of the Acromio-Clavicular Joint.—The outer end of the clavicle may be dislocated upwards or downwards from the acromion, the former being by far the more frequent of the two. Reduction is easy, though, again, retention of the bones in position is difficult. The elbow must be well supported, while pressure is made by a pad on the outer end of the clavicle. If the displacement persist and cause discomfort, the bones should be wired together.

Fractures of the Scapula.—Fractures of the body of the scapula are often associated with injuries of the thorax, and are difficult to diagnose on account of swelling of the soft parts, unless the fracture traverses the scapular spine. Treatment consists in bandaging the arm to the side and massage. Fractures of the neck of the scapula, in which the glenoid and the coracoid are broken away from the rest of the bone, may be mistaken for a dislocation of the humerus. There is flattening of the shoulder and lengthening of the arm; the diagnostic signs are the production of crepitus on elevating the arm and the great ease with which reduction is accomplished. Treatment consists in putting a pad in the axilla and binding the elevated arm to the side. Fractures of the *acromion* result from direct violence, and are usually diagnosed with ease. Flattening of the point of the shoulder and irregularity in the contour of the bone are present in most cases. Bony union rarely occurs, and, in the absence of special contra-indications operative treatment is indicated. Fractures of the *coracoid* process are exceedingly rare.

Fractures of the Upper End of the Humerus.—Fracture through the anatomical neck occurs most commonly in elderly people—the fragments may be impacted—while displacement of the head into the axilla may occur. Sufficient periosteal connections between the fragments may be preserved to maintain the nutrition of the head of the bone. In cases suspected to be of this class the utmost gentleness should be employed in examination or attempts at reduction, so that no further damage to the periosteum shall be done. The line of fracture may include a portion of one or both tuberosities. The clinical signs are slight flattening of the shoulder and slight shortening, with crepitus on rotation of the humerus. Fracture of the

greater tuberosity may occur either as the result of violence or muscular contraction. The fragment is displaced by the muscles attached to it, and it may be possible to feel the gap in the bone. Crepitus may or may not be obtainable; it depends upon the degree of displacement.

Separation of the Upper Epiphysis of the Humerus, *i. e.* of the head and both tuberosities, occurs as a result of traction on the arm, or direct or indirect violence, in children and adolescents. There may be little or no displacement, or there may be complete separation of the fragments, precisely as in fractures of the surgical neck of the bone, the only features suggestive of the former injury being the age of the patient and the nature of the crepitus.

Fracture of the Surgical Neck of the Humerus is usually transverse and caused by direct violence, but muscular contraction alone may produce it. When the result of indirect violence the line of the fracture may be oblique. The displacement is often insufficient to be detected through the swollen tissues around, though it may be marked. As a rule the upper fragment is abducted and rotated out, while the lower fragment is drawn upwards and inwards. Sometimes the upper fragment is adducted instead of being abducted. A diagnosis is made by the shape of the arm, the line of the lower two-thirds of the upper arm being directed to the inner side of the normal position of the upper end of the bone, as in a subcoracoid dislocation, by the absence of flattening of the shoulder, and by the upper end of the bone failing to rotate with the lower, while crepitus is thereby produced. Injury to the main vessels and nerves may be produced by the lower fragment, while the circumflex nerve may be implicated at the time of the injury or later in the callus. This fracture may be associated with a dislocation of the shoulder joint. It cannot be too forcibly stated that the assistance of a radiographer *must* be sought in every case of severe injury in the region of the shoulder joint unless a diagnosis of simple dislocation can be made with comparative certainty, and even in these cases a skiagram should be taken, if possible, after reduction.

Treatment. The thickness of the tissues surrounding the bone in these fractures renders retention of the fragments in accurate apposition a matter of the greatest difficulty in all cases in which more than the slightest degree of displacement has taken place. A moulded poroplastic shoulder-cap is useless, so far as fixation of the upper fragment is concerned. It seems to the author that the class of fractures just described is one in which operative treatment is not only justifiable in quite a large percentage of the cases, but is often absolutely imperative. Operative as opposed to bloodless

measures should be invariably adopted in (1) fracture of the great tuberosity, (2) fractures of the anatomical or surgical neck with dislocation of the head of the bone from the joint, and (3) separation of the epiphysis when *perfect* apposition is not obtained by other means. In addition to the above a large number of the cases of fracture of the surgical neck are best treated by plating and screwing. Each case must be treated on its own merits, after a good skiagram has been carefully examined.

Uncomplicated fractures of the anatomical neck may be treated by an axillary pad, a wrist-sling, and a bandage binding the arm to the side for a time. Massage should be commenced on the second day, and movements a few days later. Movements commenced too early usually defeat their own ends.

For fractures of the surgical neck and separation of the epiphysis Middelдорpf's triangle is the best thing to start with unless the upper fragments are in extreme abduction. If this is so, the lower fragments must be carried to the upper by fully abducting the arm and fixing it either in plaster of Paris for a short time, or with a weight-extension apparatus.

Massage is an important part of treatment and should be commenced early, but passive and active movements should not be begun too soon, not for a week at least, and then with caution so far as the shoulder is concerned. Movements of the fingers and wrist should be insisted upon from the very first day.

Dislocation of the Shoulder.—Dislocations of the shoulder result from violence applied usually to the elbow or hand, the arm being more or less abducted at the time, and either flexed or extended. The shoulder is dislocated with great frequency as compared with other joints, yet this accident is rare in children and adolescents. Usually, though not always, the head of the humerus leaves the joint at the weakest part of the capsule, *i. e.* below, and then slips up in front of or behind the glenoid, only rarely does it remain below the glenoid (subglenoid dislocation). The varieties are the subcoracoid, the subclavicular, the subspinous (or subacromial) and the subglenoid, the first-named being by far the commonest variety. The subclavicular is simply an exaggerated form of the preceding variety.

Subcoracoid Dislocation.—The head of the humerus lies in front and to the inner side of its normal position; the displacement can be both seen and felt.

The shoulder is flattened on its outer aspect, and the examining fingers can be tucked in under the acromion in a way that is impossible on the sound side. The elbow stands away from the chest wall, the forearm is usually flexed and lies across the chest. A straight-edged splint

can be made to touch the acromion and external epicondyle at the same time (Hamilton's test). The displaced head can be felt to rotate with the lower end of the humerus, and without crepitus. The vertical circumference of the shoulder and axilla is increased.

Subclavicular Dislocation.—The signs are similar to those of the preceding, except for the locality of the head of the humerus. The damage sustained by the muscles inserted into the upper end of the humerus is usually considerable in this variety, or the tuberosity may be fractured.

Subspinous Dislocation.—The upper arm is slightly flexed and abducted and internally rotated. The head of the bone can be seen and felt forming a swelling behind, while the front is flattened.

In all these varieties the measurements of the two arms do not differ enough to be of any service in diagnosis.

Subglenoid Dislocation.—This type is, as already stated, very rare. The head of the bone is felt in the axilla. Very rarely the head is displaced downwards, the arm being retained in the fully abducted or erect position (*luxatio erecta*).

Treatment. Reduction should be attempted at the earliest possible moment. If the first attempt has failed, or is to be made only after a lapse of a day or two, an anæsthetic should be given.

The subcoracoid dislocation is best reduced by Kocker's method. The surgeon grasps the elbow with one hand and the wrist with the other. The elbow is pressed to the side, the humerus being rotated out forcibly and fully, and is then raised forwards and gradually carried inwards till it lies over the mid line of the chest, the external rotation of the humerus being maintained throughout. Lastly, the humerus is rotated in, the forearm being carried right across the chest and the arm brought down to the side. These manipulations should be carried out smoothly.

If this manœuvre fails, traction downwards may be made on the arm, one foot of the operator being placed in the axilla. If an anæsthetic is being given, the surgeon should invariably have one foot unfastened, so that it can be removed easily should the "foot in axilla" method be found necessary. Sometimes traction outwards, or even directly upwards with a foot on the acromion, may be tried. In subspinous dislocations Smith's method of circumducting the arm outwards while pressure is made from behind on the displaced head is the best to employ. The arm is abducted to a right angle, externally rotated and then extended, *i. e.* the elbow is carried backwards. After reduction of the dislocation a layer

of cotton-wool, dusted with boracic powder, should be placed in the axilla, and the arm bandaged to the side, the hand being supported in a sling. Massage should be commenced on the second or third day, and passive movements of the shoulder after a week. Active movements can be cautiously indulged in after a fortnight, a sling being used for a week longer. The hand, wrist and elbow should be moved daily from the first.

These injuries are not uncommonly complicated by damage to nerves, particularly the circumflex. It is as well, therefore, to be guarded in one's prognosis as to the ultimate result. In cases of long standing the very greatest care must be taken in attempting reduction. It is wise to err on the side of reduction by "open operation" rather than by manipulation.

Fracture Dislocation of the Humerus.—A dislocation of the head of the humerus may be complicated by a fracture of the greater tuberosity, of the anatomical, or more commonly of the surgical, neck. The head is always displaced forwards into the axilla. These cases are often extremely difficult to diagnose, as the swelling of the soft parts is always considerable. In any doubtful case a skiagram should be taken at once if possible, or failing this a further careful examination made under an anæsthetic. Reduction will almost certainly be impossible, as the humeral lever is broken, and we have to rely entirely on extension and direct pressure on the head. Unless expert surgical help is not available, every case of this kind is a fit subject for a consultation, and, in most cases, for an operation. H. A. T. F.

INJURIES ABOUT THE ELBOW JOINT

Fractures about the Elbow.—Fractures of the humerus at or near its lower end are usually the result of violence applied to the hand with the elbow flexed, but they may be due to more or less direct violence applied to the elbow. Some are due to torsion or forcible angular movement of the forearm. These fractures are common in children, while the line of cleavage may take a variety of courses. In children a true separation of the lower epiphysis is probably much rarer than is generally supposed, the fracture usually taking place in the shaft a little above the epiphyseal line. Sometimes the fracture coincides in part with the epiphyseal line, a portion being in the shaft. The line of cleavage is often oblique, passing from behind downwards and forwards. This fact, coupled with the usual mode of production of the fracture, *i. e.* a fall on the hand with the elbow bent, accounts for the backward displacement of the lower fragment. The lower

fragment is tilted back as well as displaced bodily backwards with the forearm, while the lower end of the upper fragment projects in front. The forearm is usually in a position of slight flexion, about one hundred and twenty degrees. In separation of the epiphysis, which can only occur up to the age of about fifteen, and which, as already stated, is rare, the displacement is usually the same as in a low fracture of the shaft. Many have been compound. In older children the internal epicondyle may remain attached to the shaft, the epiphysis for this process having a separate centre, and by puberty having a separate epiphyseal line from the rest of the lower extremity of the bone. The crepitus lacks the crisp character of bony grating. The fracture may be T-shaped, or one or other condyle, or epicondyle, may be broken off separately. In all these fractures much difficulty may be experienced in making a diagnosis, particularly as the swelling of the soft parts is generally considerable, so that the bony points are often obscured unless the patient is seen immediately after the accident. In the common supracondylar fracture a diagnosis has to be made from backward dislocation of both bones of the forearm.

Examination of the seat of the injury must always include a careful search for the usual bony landmarks about the joint, namely the two epicondyles, the olecranon and the head of the radius, the relative positions of which should be compared with those on the sound limb. In supracondylar fractures the relations of these prominences are unaltered, whereas in a dislocation backwards the relations are disturbed. In every case a skiagram should be taken either before or after setting the fracture.

Treatment. Each case must be treated on its own merits, but it may be said at once that in the majority of cases the best method of treatment is to fix the limb with the elbow fully flexed and the forearm supinated by means of a figure-of-eight bandage encircling the arm and forearm. In cases with much swelling this may have to be reduced somewhat by massage for a few days before flexion quite to the required amount can be obtained without endangering the circulation in the limb. A piece of lint or thin layer of wool, powdered with boracic acid, should be placed in the fold of the elbow. In the usual type of fracture, just above the epiphyseal line, the lower fragment must be disengaged from the upper and brought forward before the elbow can be fully flexed. This is best done under an anæsthetic by extension of the elbow, traction on the forearm with digital pressure on the lower extremity of the humerus, and then flexion of the elbow. The position of the parts must be ascertained

by means of the X-rays. Sometimes the fragments cannot be got into position except through an open wound. In such a case, after the lower fragment has been levered into place, full flexion of the elbow will retain the bones in position.

As a rule a plate and screws are unnecessary. In all the younger children there is not sufficient bone in the lower fragment to hold a screw. Care must be taken to prevent lateral displacement, or the "carrying angle" will be increased, diminished, or even reversed (cubitus valgus, cubitus varus). These deformities may develop gradually as a late result of injury of the epiphyseal line. Massage should be employed early in all cases, but passive movements, in children at any rate, are best delayed till the end of ten or fourteen days.

Dislocation of the Elbow is not uncommon in young people. The violence that produces it may be applied directly to the elbow or indirectly to the hand. One or both bones of the forearm may be dislocated. The commonest variety is dislocation of both bones backwards; less commonly the bones are dislocated forwards, inwards or outwards. The dislocation may be complete or incomplete, while many cases are complicated by fracture of one or more of the bones entering into the formation of the joint. With backward dislocation the coracoid process may be broken off, while in forward dislocations the olecranon is often fractured. The ulnar and median nerves may suffer damage. A skiagram is essential in complicated or difficult cases. In the common variety of dorsal displacement of both bones the elbow is held flexed to an angle of one hundred and twenty degrees, and the forearm lies in the mid-position between pronation and supination. A diagnosis is made from supracondylar fracture of the humerus by the altered relative position of the bony points about the joint. The forearm is shortened.

Treatment. Reduction of a recently dislocated elbow is usually accomplished without much trouble if the patient is anæsthetized. The surgeon places his knee in the bend of the elbow and uses it as a fulcrum, pressing against the lower end of the humerus. The forearm is first extended and then slowly flexed while strong traction is made upon it.

Traction and direct pressure on the displaced bones usually suffices to reduce the other varieties. After reduction the arm should be kept in a sling with the elbow bent a little above the right angle, and should be massaged daily; movements may be commenced with care after forty-eight hours. In cases only seen some weeks after the accident the very greatest care must be taken in attempting reduction. An open operation is often necessary.

Dislocation of the Radius alone is much more common than displacement of the ulna alone. Dislocation of the radius forwards and the ulna backwards has been seen. The head of the radius may be displaced forwards, outwards or backwards, the former being the most frequent. In this injury limitation of flexion of the joint, with the presence of a lump over the displaced head, are the outstanding features. *Reduction* is accomplished by traction with the elbow flexed, and by direct pressure on the displaced head of the radius. The arm should be fixed in full flexion, and movements of the elbow should only be commenced with great caution after two to three weeks. Sometimes reduction is impossible except by operation; in recurrent cases, and in those in which nerves are pressed upon, excision of the radial head may be necessary and is followed by excellent results.

"Pulled Elbow" is an accident produced in the youngest children by traction on the forearm. The head of the radius slips partially from the embrace of the orbicular ligament, the edge of which is nipped between the radius and humerus. The forearm is held in slight flexion and pronation; supination is painful. *Reduction* either occurs spontaneously or is easily produced by flexion and rotatory movements.

It is to be remembered that dislocation and sprains of the elbow, without apparent fracture, are sometimes followed by the formation of masses of bone in or beneath the muscles, particularly the brachialis anticus. The bone is either formed from pieces of torn periosteum or is the result of traumatic myositis ossificans. Removal of the mass by operation is not always necessary, as absorption not uncommonly occurs after a time.

Fracture of the Upper End of the Radius and Ulna.—Fractures of the *olecranon* process are common, and result from direct violence or muscular action. The amount of displacement varies, but the gap in the bone can usually be felt.

Treatment. The arm should be fixed on a splint with the elbow extended till arrangements can be made for operative treatment. A Lane's plate and screws are the best means of fixing the fragments in accurate apposition. If silver wire is used it must not traverse the cartilage-covered surfaces of the fragments. Only occasionally, and this usually in aged people, is operation unnecessary or inadvisable. In all cases massage is essential from the first, and passive movements may be commenced early.

Fracture of the Coronoid occurs as a complication of backward dislocation of the elbow, and may allow re-dislocation to occur. After reduction the elbow should be fixed in full flexion. Except in children movement must not be long

delayed, as mobility is of more importance than good union.

Fracture of the Upper End of the Radius.—Fracture of the head of the radius is uncommon except in conjunction with other injuries to the elbow. A piece may be chipped off, the head may be split into several pieces, or the epiphysis may be separated. Diagnosis is often impossible except by X-rays. Fixation at a right angle, with the forearm midway between pronation and supination, and massage are all that can be done.

Fracture of the Neck of the Radius is rare. The head does not rotate with the shaft, while the upper end of the lower fragment is made prominent in front by contraction of the biceps.

Treatment. The forearm should be fixed in full flexion and supination, with a pad over the prominent lower fragment.

Fracture of the Shafts of the Radius and Ulna.—These bones may be fractured together or singly. Greenstick fracture of both bones of the forearm is a common accident in children. The bones most commonly break at or below the middle. The ulna, as might be expected from its exposed position, is a frequent site of fracture; this injury may be combined with a dislocation of the radial head. Diagnosis is easy if a finger is run along the subcutaneous posterior border. The lower fragment is usually drawn a little towards the ulna, but the longitudinal displacement is negligible if the radius is intact.

An important point in fractures of the radius, whether alone or combined with fracture of the ulna, is to determine whether the fracture has occurred above or below the insertion of the pronator radii teres muscle. If above, the upper fragment is fully supinated by the biceps and supinator brevis; if below, the upper fragment lies midway between pronation and supination. The lower fragment is tilted towards the ulna and pronated in either case.

When both bones are broken the deformity and abnormal mobility make the diagnosis obvious.

Treatment. In all the varieties mentioned, with one exception, the best position during treatment is right-angle flexion of the elbow, with the forearm midway between pronation and supination. This position is best preserved by a right-angle splint applied to the inner side of the arm and forearm, and a dorsal splint on the back of the forearm. Massage should be commenced at once, and also movements, active and passive, of the fingers and thumb. Flexion and extension of the elbow can also be commenced early, particularly if the internal splint is jointed at the elbow. Pronation and supination should be prohibited for at least two weeks, and then commenced very carefully.

The exception mentioned above is fracture above the middle of the radius. These cases must be put up with the forearm fully supinated, as it is impossible to control the supinated, upper fragment. An anterior right-angle splint and posterior splint are the best. It is essential that all splints should be a trifle wider than the forearm, so that no lateral pressure can be exerted on the bones, which occasionally become united by a bridge of callus. A skiagraph should invariably be taken when the fracture has been set. This can be done without removing the splints. When the position of the fragments does not approach perfection, particularly when both bones are broken, operative treatment is indicated. The movements of the forearm are of such importance, and the bones are so readily reached through longitudinal incisions, that plating of these fractures should be made use of to a much greater extent than has hitherto been the case.

A word of warning is necessary about the application of bandages in fixation of splints to the forearm. The bandages should be looked to a few hours after their first application, to make sure they are not too tight; the swelling of the forearm may have increased since the fracture was set. Ischæmic contracture (Volkman's contracture) occurs more often in the muscles of the forearm than anywhere else, and is, of course, due to undue compression of the limb by splints and bandages. H. A. T. F.

INJURIES IN THE REGION OF THE WRIST AND HAND

Fractures of the Lower End of the Radius.—A transverse fracture in the last inch of the radius—**Colles's Fracture**—is one of the commonest fractures met with. Elderly women are peculiarly liable to this injury. While the fracture is usually transverse, it may be oblique from behind downwards and forwards, and from without downwards and inwards. It is produced by falls on the hand in most cases; back-fires during the starting of a motor have been responsible in some recent cases. Forcible over-flexion of the wrist may also produce a fracture at the same situation (R. W. Smith).

Either the internal lateral ligament or the styloid process of the ulna gives way. The displacement is somewhat complicated. The lower fragment is displaced bodily backwards, and its lower or articular part is tilted backwards, while the fragment is also rotated outwards, so that the styloid process lies at a much higher level than it should. Impaction is common, while comminution of the lower fragment may occur. The deformity produced is usually characteristic. The lower fragment forms a swelling on the dorsum, just above the level of

the wrist joint, and above it there is a sudden drop to the level of the posterior surface of the forearm. On the palmar aspect the lower end of the upper fragment forms a projection below which is a depression. The wrist and fingers are slightly flexed. The styloid process of the ulna is below the level of the styloid process of the radius. In addition there is local tenderness, and only occasionally crepitus. The hand is deviated to the radial side.

Very rarely is the lower fragment displaced forwards instead of backwards.

Separation of the lower epiphysis may occur up to the age of eighteen or twenty. Not uncommonly the fracture is compound. This is probably due to a feature which distinguishes these cases from an ordinary "Colles's," namely, the marked projection and sharpness of the anterior edge of the end of the shaft.

Treatment. Every effort should be made to get perfect apposition of the fragments. This is by no means always an easy matter, and may be impossible, even under an anæsthetic. The hand is grasped as in shaking hands and traction is made on the lower fragment, counter-extension being made by an assistant on the elbow. The surgeon's spare hand is used to manipulate the fragments. The patient's hand should be adducted during extension, *i. e.* carried towards the ulnar side. No splint is so good as the well-known Carr's splint, as it keeps the hand adducted while allowing the thumb and fingers free play. It should be padded with a couple of layers of lint only, and no dorsal splint is necessary.

The fingers and thumb should be exercised actively and passively from the very first, and massage can be carried out within twenty-four hours. At first the massage can be done while the arm rests on the splint, the bandage having been removed. Passive movements of the wrist and pronation and supination should be commenced with great caution after a few days. It is a mistake to try and hasten movements of the wrist and forearm. The splint may be discarded in a fortnight.

Separation of the epiphysis is treated in a precisely similar manner.

Injury to the epiphyseal line, with or without displacement of the epiphysis, is sometimes followed by deficient or irregular growth, while the ulna grows normally and, being longer than the radius, projects on the dorsum of the wrist (Madelung's deformity).

Fractures of the Lower End of the Ulna are uncommon except in conjunction with a Colles's fracture, with which, as already stated, the ulnar styloid process is often broken.

Dislocation of the Wrist is a rare accident. The carpus may pass backwards or forwards. The relative positions of the two styloid pro-

cesses should aid in distinguishing this injury from a Colles's fracture. Reduction is not difficult, and should be followed by rest on a Carr's splint for a week or two, while massage and exercises are carried out as for fracture of the radius.

Sometimes the head of the ulna is dislocated backwards from the radius and carpus. Reduction is easy.

Sprained Wrist. Fractures and Dislocations of the Carpal Bones.—The extended use of X-rays in recent years has revealed the fact that fractures of the carpus, from falls on the hand, are of much more frequent occurrence than was formerly supposed. The scaphoid is the bone most often fractured. It may be the only bone broken, or it may be associated with fracture of the radius and ulna. It is, therefore, advisable to have a skiagram taken in cases of severe sprain of the wrist, as the presence of a fracture will call for some modification of the treatment. In an uncomplicated sprain massage and exercises are proceeded with vigorously from the first. When the scaphoid or other bone is fractured, a period of rest extending over a couple of weeks should be insisted upon, while the massage is carried out with the greatest care. Movements of the fingers are encouraged from the first, but movements of the hand on the forearm should not be commenced for a couple of weeks, except in elderly patients.

Dislocation of one of the Carpal Bones is a rare accident. The os magnum and semilunar are the commonest bones to be displaced. Reduction of the former is easy, but retention of the bone in its proper position is difficult. If the bone remains partially dislocated on the dorsum of the wrist it may give rise to discomfort and weakness of the hand. If the discomfort produced is sufficient to demand relief, the bone should be excised. The semilunar is displaced forwards, not backwards like the os magnum, and lies beneath the flexor tendons. The best treatment is removal of the bone.

Fractures of the Metacarpals and Phalanges.—Fractures of the metacarpal bones are not uncommon and usually result from indirect violence. The fracture may be transverse, but is more commonly oblique.

Treatment. Nothing is better than the old method of making the patient grasp a roller bandage, and then covering the fist with turns of another bandage. The outer bandage must be removed daily for exercise of the fingers and massage. The fixation should be continued for ten days.

The first metacarpal may be fractured in the centre of the shaft, just like the other metacarpal bones, but there is also a special fracture

of this bone (**Bennett's fracture**). This fracture is oblique and usually traverses the articular surface at the base, passing from this obliquely forwards and downwards to the palmar surface. The small proximal or palmar fragment remains stationary, while the shaft of the bone passes upwards on to the carpus. A skiagram is often necessary to decide the diagnosis.

Treatment. A tin or poroplastic splint is moulded to the palmar aspect of the thumb and wrist, reaching a little above the latter. The splint is first fixed to the thumb with strips of adhesive plaster, extension is then made upon the thumb, and the splint fixed to the wrist.

Fractures of the phalanges are often compound. Tin splints will be found useful.

Only occasionally is it necessary to operate upon a fracture of one of the metacarpals or phalanges.

Dislocation of the Metacarpo-Phalangeal Joints.—This joint of the thumb is the only one dislocated with any frequency. Almost invariably the phalanx is displaced backwards as a result of hyper-extension of the joint. The position of the joint is characteristic and the diagnosis easy. The metacarpal is adducted and flexed to a slight extent, the head of the bone making an obvious prominence; the proximal phalanx is hyper-extended, while the terminal is flexed.

Great difficulty is often experienced in reducing this dislocation. The head of the metacarpal projects between the sesamoid bones, the neck being embraced by the short flexor tendons, while the long flexor tendon curls round the ulnar side of the neck. The glenoid or palmar ligament of the joint is torn away from the metacarpal, but remains attached to the base of the phalanx, and it comes to lie behind the head of the former bone; this ligament probably forms the main bar to reduction.

Treatment. The phalanges should be grasped firmly and the dislocated joint still further hyper-extended so as to enlarge, as it were, the hole between the sesamoid bones through which it passed, and to disengage the glenoid ligament from behind the head. The base of the proximal phalanx is then forced down towards the level of the joint, and then flexed round the head of the metacarpal. Only too often this manœuvre fails, even under an anæsthetic. Under these circumstances a fine tenotome should be inserted on the dorsum immediately above the base of the first phalanx, and the point thrust in till the glenoid ligament is reached and divided longitudinally. Gentle movements should be insisted upon after twenty-four hours.

Similar dislocations take place, only with less frequency, in the other metacarpo-

phalangeal joints, and the same difficulty may be met with in the treatment thereof.

H. A. T. F.

INJURIES IN THE REGION OF THE PELVIS, HIP AND THIGH

Fractures of the Pelvis.—These fractures are usually the result of direct violence, particularly when force is applied simultaneously from two directions, as in crushes, buffer accidents and so on.

The pelvic girdle may be broken in one or many places, while the fracture may involve either the true or false pelvis alone, or both together.

Fracture of the False Pelvis.—The line of fracture may be anywhere in the ala of the ilium. These fractures are of less gravity than those of the true pelvis, with which they are often combined. The signs are local pain, increased on any muscular effort involving the muscles attached to the bone, abnormal mobility of a portion of the bone, irregularity of the iliac crest, and sometimes crepitus. One of the iliac spines may be torn away from the rest of the bone; the displacement is slight except in the case of the anterior superior spine, to which the sartorius is attached.

Treatment. If present, an attempt should be made to overcome displacement, but this is not always possible. The patient must be kept in bed for six to eight weeks with a firm flannel bandage around the pelvis. Fracture of the anterior superior spine should be dealt with by an open operation.

Fracture of the True Pelvis.—Fracture of the true pelvis is a more serious injury than the preceding, principally because of the frequency with which it is accompanied by grave damage to the pelvic viscera. Crushes naturally cause the pelvic girdle to give way at its weakest parts. These are the horizontal ramus of the pubis, the conjoined rami of pubis and ischium, and the region of the sacro-iliac synchondroses. The bodies of the pubes and the symphysis may be completely separated from the bone on either side. A not uncommon combination is a fracture of the pubic and conjoined rami on one side, and fracture partially through the sacro-iliac synchondrosis on the other.

Diagnosis. The patient is usually unable to walk, and if just able to stand feels as if he were falling to pieces. There may be local effusion and tenderness over the pubis, and movements of the legs, coughing, etc., cause pain. Compression of the pelvis or attempts at moving one part upon another produce pain at the site or sites of fracture, and may produce crepitus. Deformity is uncommon. The examination should be carried out with the greatest

care, for fear of displacing fragments and doing damage to viscera.

In a doubtful case treatment should be carried out as for fractured pelvis until a skiagram has settled the diagnosis. It is of the utmost importance that any complication, such as rupture of the urethra, bladder, etc.—which complications are unfortunately common—should be accurately diagnosed. A catheter should *invariably* be passed, except when extravasation of urine has already occurred through a ruptured urethra.

Treatment. Except that the patient is moved with the utmost care, the treatment of a serious complication must precede the treatment of the fracture. For the latter the use of a firm mattress is necessary. Any displacement of fragments that can be made out may be corrected if possible. In most cases a broad flannel bandage is all that is necessary to support and hold the pelvis together. Occasionally a moulded splint of poroplastic may be of use. The thighs should be slightly flexed and immobilized either by tying the knees together or fixing each leg between sand-bags.

The patient must be confined to bed for eight weeks, and may then begin to get about on crutches.

Fracture of the Acetabulum.—This may occur as a result of the head of the femur being driven forcibly inwards towards the interior of the pelvis. The damage may vary from a mere fissured fracture to a complete perforation of the floor of the fossa, the head of the femur being driven right through this floor, so that it can be felt in the pelvis per rectum. The upper lip of the acetabulum may be broken off by the head of the femur, as it is dislocated directly towards the dorsum ilii. In such a case, though reduction of the dislocation can be accomplished without difficulty, redislocation occurs very readily. This injury can be diagnosed by feeling crepitus on attempting reduction, and by finding that redislocation occurs readily, but can only be recognized with certainty by means of a skiagram.

Treatment. When the head of the femur is driven through the floor of the acetabulum the bones must be disengaged, if possible, and the limb extended either by the ordinary weight-extension apparatus, or by means of a Hodgen splint. This injury is always complicated by grave damage to viscera.

Fracture of the upper lip of the acetabulum must be treated by extension of the limb in a position of full abduction. In some cases an operation may be necessary.

Fractures of the Sacrum.—The line of cleavage may be vertical or transverse; in the latter case the lower fragment is displaced forwards and presses upon and may damage the rectum.

These fractures are often comminuted and compound, while they may be complicated by injury to the sacral nerves. The vertical fracture is treated as a fracture of the pelvis. With a transverse fracture the lower fragment must be pushed back into place, and the patient made to lie upon the face or in the semiprone position.

Fracture of the Coccyx may occur during parturition, or may result from a kick or blow. The loose fragment should be removed if it cannot be prevented from projecting towards the rectum, or if it has united in this position and gives rise to pain.

Fractures of the Upper Extremity of the Femur—

Fractures of the Neck of the Femur.—The neck may give way near the head or near the great trochanter.

Intra-capsular Fracture (so-called), or fracture near the head of the bone, occurs particularly in elderly females as a result of comparatively slight violence, such as tripping up, or slipping off the edge of the curb on to the roadway. There is little or no bruising in the region of the trochanter unless the patient has fallen heavily when the bone has given way. The signs are: entire loss of function of the limb, except in rare cases, marked eversion of the leg, and shortening, the latter usually not being very great. There is no thickening of the trochanter, though this process is raised, and lies nearer the mid-line and farther back than normal.

Crepitus may be present, but should not be sought for, as the diagnosis is usually easy without this sign, and manipulation of the limb may disimpact the fragments. However, impaction is uncommon. In the elderly union often fails to occur, the neck being absorbed to a greater or less extent, and a false joint is formed, so that walking is impossible without the aid of a stick or crutch.

The age of these cases often makes the fracture a very serious matter, and hypostatic pneumonia or other complication may prove fatal.

Extra-capsular Fracture (so-called), or fracture near the trochanter, usually occurs in adult life, and is caused by heavy falls upon the trochanter. The line of fracture is always within the capsule in front, and extra-capsular behind. Impaction is not uncommon, though often the trochanters are split into two or three fragments by the neck being forced into the outer fragment. The signs are similar to those of the fracture near the head, but a diagnosis between the two can generally be made. The limb is useless, and lies everted fully, as in the fracture previously described, but the shortening is much greater, about two inches or more; there is marked bruising about the trochanter, while the latter is distinctly thickened from before back. Crepitus is readily detected in the non-

impacted cases, while the trochanter is displaced as in the other variety. Osseous union always occurs, but only too often with the fragments in a faulty position.

Treatment. In both varieties the utmost gentleness must be preserved, so that impaction, if present, may not be disturbed.

In the intra-capsular variety, when it is thought that impaction has occurred, the limb may just be kept at rest between sand-bags, with or without weight extension. In the elderly patients it is of the first importance to avoid lung complications, and many cases are best out of bed and sitting in a chair after a few days. In others extension, either by the ordinary weight-extension apparatus or preferably by Hodgen's splint, may be maintained for two or three weeks and then the patient allowed up. Massage should be employed from the first. A single Thomas hip-splint and crutches may be used with advantage. If the patient be a healthy adult, a skiagram should be taken as the patient lies in bed with extension, and if the position of the fragments is bad, the question of operation should be seriously considered. A long screw or two may be passed from the trochanteric surface along the neck and into the head. In the extra-capsular variety care should likewise be taken to avoid disimpaction. Prolonged extension, *i. e.* for six weeks, is necessary, and this may either be done by means of a weight and pulley, or better by means of Hodgen's splint. More or less shortening is certain to remain, however great the weight employed, and in all cases a skiagram should be taken with a view to the consideration of operative treatment.

The femur is the bone in the body, perhaps more than any other, the fractures of which call for treatment by open operation. Without it coxa vara and shortening are certain to occur. If deformity is moderate impaction of the fragments may be of great service, but where the shortening is considerable the fragments must be separated, whatever the method of treatment adopted later.

Separation of the Epiphysis of the head is an uncommon accident, but it does occasionally occur and gives rise to one form of traumatic coxa vara. It must be treated by extension in the fully abducted position. Partial separation of the epiphysis resulting from slight falls on the hips probably plays an important part in the etiology of many cases of adolescent coxa vara.

Fractures of the Upper Part of the Shaft of the Femur, either through or just below the trochanters, may occur. The lower fragment tilts outwards the upper as the limb shortens, thus making the neck of the bone horizontal. The upper fragment is usually also tilted for-

wards, while the lower is rotated out by the weight of the limb. These cases undoubtedly call for fixation by a plate and screws. The diagnosis from a fracture of the neck may be difficult without the aid of a skiagram.

Dislocation of the Hip Joint.—This is a somewhat rare accident, but does occur in adolescents and adults; in elderly people the neck is usually fractured, and not the head displaced. The head leaves the acetabulum at the weakest spot in the capsule, namely the lower and back part. Having emerged from the socket the head usually slips up behind as the violence that displaced it ceases to act or is altered in direction; less commonly the head moves to the front. Besides irregular types there are four main varieties of dislocation; these are, in the order of their frequency: *dorsal*, *sciatic*, *obturator* and *pubic*. In all the strong anterior Y-ligament is undamaged.

Further details of the anatomical peculiarities of each type are of no practical importance. In the dorsal variety the head is on the dorsum ilii, in the sciatic it lies in, or upon, the margin of the sciatic notch, *i. e.* the head has not passed up as high as in the dorsal. Similarly in the obturator or thyroid the head lies in the foramen known by these names, while in the pubic it has passed higher on to the pubic ramus. These dislocations may be produced in many ways, but the commonest cause is violent abduction of the thigh, which forces the head down upon the lower part of the capsule.

Signs. In the *dorsal* dislocation the thigh is semiflexed, adducted and internally rotated, so that it crosses the lower third of the other thigh. The trochanter is raised, is not thickened as in fracture of the outer part of the neck, while, most important of all, the displaced head can be felt behind the trochanter. In the *sciatic* variety the deformity is precisely similar, but less marked, the thigh crossing the opposite knee and not the thigh above it. The trochanter is much less displaced, while the head is somewhat more difficult to feel. In the *obturator* dislocation the thigh is flexed, abducted and externally rotated, *i. e.* the first position of hip disease. The leg is lengthened; the trochanter is less prominent than it should be; the head can be felt beneath the adductor muscles. The patient may be able to walk, but does so with the pelvis tilted forwards.

In the *pubic* variety the thigh is slightly flexed, but distinctly more everted and abducted than in the previous variety. The head can be felt on the ramus. The trochanter is less prominent than normal and raised about an inch.

As already mentioned while discussing fractures of the acetabulum, a *direct* dorsal dislocation may occur, and in some of these cases

the posterior-superior lip of the acetabulum is fractured.

The sciatic nerve may be bruised in the posterior dislocations, the obturator or anterior crural nerves in the anterior.

Treatment. A general anæsthetic is necessary for reduction. In attempting to reduce the dislocation, of whatever variety it may be, it is necessary to remember the course which the head has taken in reaching its abnormal position, and that it must be made to retrace its steps to the rent in the capsule, and so re-enter the acetabulum. The patient should be placed on a mattress on the floor.

Posterior Dislocations.—The knee is flexed and brought right up over the abdomen, and inclined towards the opposite side, the adduction and inversion thus being maintained or even increased. This manœuvre brings the head down to the rent in the capsule. The thigh is now circumducted outwards, and extended down parallel to the other. It is while the knee is being carried outwards, *i. e.* abduction, that the head is slipping into the acetabulum, and it is here that resistance is felt. Sometimes this manipulation only results in the production of an anterior dislocation, which in its turn gives place to the original dorsal displacement. When this happens the outward circumduction must be done with great steadiness, the rotation of the femur and of its head being controlled by grasping the ankle with one hand, the knee being flexed to a right angle. In this way the head can be kept applied to the acetabular margin till the abduction forces it over the lip into the joint. If the above manipulations fail an attempt may be made to lift the bone into place. The pelvis is held down by assistants or by a towel nailed to the floor. The hip and knee are each flexed to a right angle, and the thigh is pulled vertically upwards by the surgeon hooking his arms beneath the knee, the patient's foot being in the surgeon's perineum. A jack towel around the patient's thigh and surgeon's shoulders may also be used to make vertical traction.

The *anterior* dislocations are attacked by similar methods, it being remembered that the head has to travel downwards and backwards, or only backwards, to reach the hole in the capsule. The thigh is fully flexed as before, but in a position of abduction and external rotation, and is then circumducted inwards and brought down parallel to the other leg. Resistance is encountered as the lowering of the leg is commenced, and it is at that point that care is needed to ensure that the head enters the joint.

The direct dorsal dislocation is easily reduced, but requires extension for six weeks. After reduction of a dislocated hip the patient should

rest in bed for two to three weeks, having massage daily, and may then begin to get about on crutches. H. A. T. F.

INJURIES IN THE REGION OF THE KNEE AND LEG

These injuries include wounds, contusions, sprains, dislocations and fractures.

Wounds of the Knee, whether penetrating or lacerated and contused, are very serious if sepsis occurs, because the complicated nature of the joint renders disinfection and effective drainage so difficult, that complete disorganisation leading to amputation or permanent stiffness is not unlikely.

Therefore the first object in treatment should be directed towards preventing and combating septic infection, while the later efforts are concerned with promoting healing, restoring movement, and preventing stiffness.

Contusions of the Knee, when severe, produce a transient synovitis readily removed by temporary rest, elastic compression, and gentle massage. Contusions from blows and kicks on the shin are often very painful, the pain being out of proportion to the size of the swelling; these occasionally suppurate when accompanied by even a superficial abrasion. The skin wound should always be disinfected carefully and the bruise supported by a pad and bandage.

Sprains of the Knee afford every degree of severity according as the ligaments are simply overstretched or torn. Portions of bone are sometimes detached with the stronger ligaments and tendons, the internal lateral and the patellar ligaments being chiefly concerned. One or other semilunar cartilage, more frequently the inner, becomes loosened, detached or torn across, constituting the commonest variety of "internal derangement."

The extensor apparatus of the knee is frequently injured, especially in adult males, as the result of forcible muscular contraction. The powerful quadriceps extensor muscle may be torn by its own efforts in trying to avoid a fall backwards. The tear may be only partial, and confined to its central tendinous attachment to the base of the patella, but not infrequently the lateral expansions also give way, making the rupture complete.

The patella itself often snaps transversely, usually just below its middle, though the precise situation of the cleavage varies according to the degree of flexion at the time of the accident. Following the snapping of the patella the lateral tendinous expansions on each side are torn asunder more or less transversely, the degree varying with the amount of movement permitted and the efforts made after the cleavage of the bone. The ligamentum

patellæ may tear at any part, but usually gives way near to one of its bony attachments; lastly, the tubercle of the tibia may be avulsed and torn with the ligament from its socket, partially or completely. It is convenient to classify transverse fractures of the patella with fracture-sprains rather than with ordinary fractures as is the rule, because the bone is a sesamoid developed for the mechanical purpose of leverage within the tendon which serves as a ligament. This grouping has the advantage of directing attention to the causation (muscle-strain), and establishes the rationale of the customary non-operative treatment by means of muscular relaxation, strapping, massage and movements; virtually the same as for simple sprains.

Ordinary sprains with effusion (synovitis) are treated with elastic compression and early voluntary movements with or without massage (*v. Injuries of Joints*). Early passive movements should not be practised in sprain-fractures, for they are painful and liable to produce separation of bony fragments and other torn tissues, leading to increased callus formation and effusion, followed later by more stiffness and limited movements.

The internal lateral ligament, from its position, is the one most liable to overstretching in an ordinary sprain. It is usually torn from its femoral and not its tibial attachment. This may be demonstrated by the almost constant presence of a point of exquisite tenderness located at this spot in nearly all severe sprains.

The clinical features of rupture of the extensor apparatus, whether of the muscle, its tendon, the patella, or patellar ligament, are mainly the same, and consist of loss of active extension and inability to straighten the flexed knee at will, and of a distinctly globular or rounded swelling of the whole joint. *This globular swelling is present whenever the capsule is torn, allowing its contents to escape, and is in marked contrast to the appearance of a joint with effusion into an intact capsule*, when the outlines are characteristic, being strictly limited to the synovial extensions. In fractures of the patella the fragments are palpable and mobile, with an interval between them. In rupture of the quadriceps tendon, instead of an interval between the fragments we find an abnormal gap just above the patella. In rupture of the ligamentum patellæ there is a gap below the patella, and there may or may not be obvious luxation of the patella upwards, depending largely upon the presence or absence of tearing of the lateral expansions in addition.

Avulsion of the tubercle of the tibia is recognized by the presence of a loose chip of bone attached to the patellar ligament, and

results from a single sudden and severe strain, and corresponds to a rupture of the tendon.

In adolescents (12-16) the equivalent of this accident is not uncommon, and results not from a single strain, but from repeated strains, as in athletic exercises.

In childhood the tibial tubercle is mainly cartilaginous; sometimes it is developed from the tongue-like prolongation downwards of the main epiphysis, at other times there is a separate epiphysis. The tubercle sustains part of the insertion of the ligamentum patellæ, but not all, consequently it is not so likely to be torn off completely, though it may be loosened from its bed by violent contractions of the quadriceps. The diagnosis depends on lameness, thickening, local tenderness, and a slightly movable small fragment. In all cases of doubt the Röntgen rays should be used.

The treatment of tears in the extensor apparatus, including transverse fractures of the patella, by posture, splints and bandages, is not as a rule wholly satisfactory. More or less weakness and insecurity in walking results from a lengthening of the tendon and improper and insufficiently close union of the patella fragments. In recent transverse fractures the open operation with an accurate suture of all the torn parts with an *absorbable* material (catgut or kangaroo tendon) is the only really satisfactory proceeding. The suturing process must be accurate and complete, tendons stitched to tendons or to the periosteum. In fractures of the patella good bony union will invariably result, providing there be no sepsis, that the joint be emptied of its clots, the fragments bared of the intervening fibrous capsule which curls in between them, and held together with catgut or kangaroo-tendon sutures. The writer encircles the bone antero-posteriorly with three or four strands of catgut passed with a handled needle from below through the patellar ligament beneath the fragments and out through the extensor tendon immediately above the upper fragment. The sutures are then tied in front after accurate and close approximation of the fragments.

The lateral tendinous expansions, which are always more or less torn, must also be accurately sutured. In thirty-three consecutive cases treated during the last ten years by this plan, bony union with a perfectly movable joint has resulted in every case.

The use of wire sutures, unless placed circumferentially—as may be needed in fractures of the bone from direct violence to approximate the widely separated fragments—is uncertain, tends to refracture both of the wire and the bone, and is quite unnecessary. Bony union will result if after an open operation the fragments be closely approximated and held together by

suturing the lateral expansions alone, even without suturing the bone, though it is obviously safer to secure the fragments as well. The method is suitable whatever the size of the fragments, and there is no need to drill the bone.

Rupture of the patellar ligament is best treated by suture.

Avulsions of the tubercle usually do well after rest from active exercises and wearing a firm pad and bandage for three or four weeks. The symptoms of lameness and intermittent pain may last for months if left untreated, whilst some permanent thickening usually remains.

The internal semilunar cartilage of the knee, for anatomical reasons, is more frequently loosened or torn than its neighbour. This occurs oftener in adult males than females, and is rare at the extremes of life. The injury is the result of a violent twist or wrench while the joint is partially flexed and is being rotated.

The clinical features are pain, often severe, described as sickening, and locking of the joint in slight flexion, complete extension being impossible. Very soon the capsule becomes distended with effusion, the swelling gradually increasing for some hours after. The locking may be undone spontaneously or may require manipulative assistance. A very successful and generally applicable manœuvre to effect this is that of placing the patient on his back and completely flexing the leg upon the thigh and the thigh upon the trunk, and adducting the flexed knee across the middle line, so as to relax all the ligaments and tendons completely. The operator with one hand grasps the flexed knee to steady it, while with the other he seizes the ankle, and with the leg used as a lever and with a rocking movement he alternately separates the head of the tibia from each condyle, according as the injury is internal or external, to dislodge the displaced cartilage. As soon as the cartilage is dislodged, and not before, the limb may be brought into complete extension. If the plan fails, or there is pain, a general anæsthetic may be required for its repetition.

Semilunar displacements are liable to recurrence. Treatment for a first attack is the same as for a severe sprain, viz. rest, elastic pressure, massage, and voluntary movements other than rotation. No fixed apparatus is necessary; most cases will recover in from three to five weeks. Recurrent attacks are followed by the same symptoms, though less severe. In chronic cases synovitis may be slight or even absent. Relapsing cases, in the young and vigorous, and in those to whom a cure is essential, are best treated by the removal of the damaged cartilage if there be no definite contra-indication. In operating every precaution must be

taken before, at the time, and after, to prevent sepsis. No operation should ever be undertaken without proper technique and suitable surroundings.

The essentials of a curative operation are absolute asepsis, a *vertical* or *oblique incision* close to the patella, with separation of the parallel fibres of the internal lateral ligament, and removal only of the damaged portion of the cartilage. *Transverse* division of the internal lateral ligament and extensive removal of cartilage are faulty proceedings, and invariably lead to weakness in the joint. Fine catgut is the best material for the deep sutures, silk-worm-gut for the skin. A small interval at the centre of the incision may be left unstitched to allow of free escape of the oozing, which is usually copious during the first twenty-four hours, and if retained leads to tension and discomfort or pain. No splint is necessary, sandbags are sufficient to steady the joint, which naturally assumes the posture of semiflexion. If the wound is healed, as it ought to be, walking may be permitted about the tenth day, and recovery should be complete in a month. No other means are really curative. When operation is contra-indicated a hinged apparatus to prevent rotation, but allowing flexion and extension, may be worn. In neglected and long-continued relapsing cases there is a tendency in young people to roughening and hypertrophy of the synovial membrane, followed by the development of fringes and loose bodies, and in the old to arthritis deformans.

These consequences of themselves afford ample reasons for advising operation in all suitable cases, the operation in capable hands being neither difficult nor serious.

Dislocations of the tibia from the femur are rare, result from extreme violence, are nearly always complicated with fracture and complete rupture of the crucial ligaments, and take place in any direction. Diagnosis is simple, prognosis uncertain, while treatment consists in reduction and fixation for about a fortnight, followed by massage and movements until recovery is complete.

Dislocations at the superior tibio-fibular joint are rare and require no special mention.

Dislocations of the patella are outward or rotatory, partial or complete, and may result from direct violence or muscular action. They are usually associated with a congenital deficiency in the external condylar ridge.

Reduction is effected by manipulation, and the treatment is by posture and strapping. Recurrence is not infrequent. Operative measures may be required, though rarely, and are not always satisfactory.

Fractures in the region of the knee are many and important. Those involving the femur

are the supra-condylar, T- or V-shaped, and separations of the epiphysis, and of one or other condyle.

Fractures of the upper end of the tibia may be of the tuberosities, separation of the epiphysis, avulsion of the tubercle.

The essentials of successful treatment consist in securing not only bony apposition, but correct alignment and free natural movements in the joint. Care must be taken that the hip, knee and ankle fall into line, remembering Wolff's law as to the changes in structure which follow upon variations in strain and function. The likely disabilities are traumatic genu valgum and semiflexion with painful stiffness; these must be guarded against. Most knee fractures are best treated in the extended position; the necessity for a double inclined plane is a modern fetish, the worship of which is founded upon an improper appreciation of the exact anatomy of fractures in the lower third of the femur. Careful study of the usual displacements with the aid of the Röntgen rays has already taught much as to the erroneous views held until lately as to these and other bone injuries. A Macewen's osteotomy (half-box) splint with a footpiece, supplemented by Gooch splinting for the thigh or leg, or a Thomas's knee-splint, are the most convenient, comfortable and trustworthy, and may be adapted to all requirements.

Early passive movements are always to be avoided; atrophy and stiffness may be prevented by massage and systematic voluntary movements. The successful management of fractures in the neighbourhood of the knee will depend more upon the clinician's appreciation of the principles necessary for attaining proper alignment and early movements than upon any definite system of splintage or fixation.

R. H. A. W.

INJURIES ABOUT THE ANKLE AND FOOT

These are perhaps the most important of the injuries that come before the practitioner in his daily work, owing both to their extreme frequency as well as to the difficulties in treatment and diagnosis which accompany them, and not the least to the very serious disability which may result in after-life. Here, above all, the practitioner should be warned at the very outset *that in all cases of injury to the ankle and foot, skiagrams should be taken at the first possible opportunity by a competent person, and that these should, if possible, be stereoscopic skiagrams which should be interpreted by a competent observer.* It is to be insisted on that in all such cases not only is the difficulty of obtaining a satisfactory X-ray picture very great, but also that of interpreting the picture when obtained is no less difficult. Having in view the present proclivity

of the public to have recourse to the gentle art of the Law, it would be well also to insist that in all cases where a skiagram is objected to by the patient, the patient should give his reasons in writing to the practitioner for not having a skiagram before any treatment is undertaken.

Injuries about the Ankle.—These resolve themselves into *strains* and *sprains*. The term *strain* is loosely used for those cases where there has been a twist or wrench of the ankle which has not been followed by swelling of any magnitude but only by continued pain.

Treatment in such cases (after a satisfactory X-ray photo) should be by strapping the whole joint from the balls of the toes to about three and a half inches above the ankle with interlacing layers of plaster—preferably Seabury's X-O Plaster or "leucoplast." The patient should be kept at rest, but slight voluntary movements should be encouraged from the very first (as distinguished from "passive" movements). Before applying the plaster the foot and ankle should be carefully shaved. Attempts may be made to put the foot to the ground as soon as voluntary movements are free and without pain.

Sprains.—The term sprain is used for an injury which involves definite damage to various structures and is followed by the results of injury to blood-vessels or other tissues. They may be divided into: (1) *simple*—where the injury involves only the soft parts, *i. e.* ligaments, synovial membrane, etc., or (2) *complicated*—where it may involve bones, muscles, nerves, etc. It must be insisted on that a diagnosis between these two forms is often impossible and should never be attempted without recourse to X-ray examination. Over and over again it has been the experience of every surgeon to find cases of "sprained ankle" which really consist of fractures of part of the tibia and fibula, more especially the latter, oblique fractures of the tibia and fractures of the astragalus, or associated with fractures of the bones of the foot, especially of the navicular and the spur of the fifth metatarsal.

Having thus assured ourselves that the sprain is not a complicated one, we can consider its treatment in general, and it is first well to remember that when swelling is universal after sprain it may be due to two causes, being (1) immediate and due to rupture of blood-vessels; or, (2) later or "deferred," where it is due to synovial infusion into the joint.

In both forms the *treatment* is the same. In the author's opinion, neither hot nor cold applications are the best, but he would rather recommend the treatment so well advocated by Whitelocke—that of firm elastic pressure from the first. Soft layers of gamgee tissue are put over the joint, taking care to pack the tissue

well in behind and in front of the bony prominences of the ankle. Pressure is then applied by a strong domette bandage (elastic bandages are not nearly so useful); the foot should then be elevated and the patient kept in bed. This careful pressure would be found to rapidly remove the pain. The whole should be removed in twelve hours' time and the joint again examined and the pressure reapplied. Active voluntary movements of the foot should be encouraged at a very early date—almost from the first—but massage and passive movements are not to be advised until the swelling is at an end. It is difficult to lay down the law as to when the patient may put weight on his foot, but as a general rule he may make an attempt in about ten days; but before putting his full weight on the foot, he may try the support of a go-cart or other methods. When the swelling is entirely removed the usual elastic bandages and anklets may be applied, but it must be recognized that these are merely of the nature of a placebo and not of real assistance.

The main questions now before the practitioner should be: (1) Is there recurrence of the swelling on putting the foot to the ground? (2) Is there localised pain rather than general ache? In both cases he may be well advised to reconsider the position, having in mind that sprain-fractures of the ankle joint are very common.

Results of Sprains.—*Relapsing Cases of Sprain and Swelling.* These may be due to the direct result of the original injury, *i. e.* fracture-sprain or damage to the synovial membrane. On the other hand, constitutional causes should not be forgotten, amongst the foremost of these are gonococcal infection, rheumatism and traumatic arthritis, gout and, more especially in children, tubercle; even hæmophilia is to be taken into consideration.

In the treatment of such cases recognition of the cause, whether local or constitutional, is most important, and treatment will depend mainly on this. As a local application and counter-irritant, iodine, or more especially that preparation known as "Iodex," is to be strongly recommended.

Tension in Joints after Sprains. Here the tension is due to a prolonged synovitis, which may depend upon the same causes as the above. Treatment should be undertaken in order of merit as follows—

(1) Aspiration of a small quantity of fluid (two or more ounces of fluid will be adequate), followed by pressure by bandages. It must be insisted on that such treatment is by no means devoid of risk and should be undertaken most carefully and deliberately. Failing this (2) Dry heat and radiant heat. (3) Hot fomentations. (4) Arthrotomy and drainage, and here, again, it must be pointed out that

the risks are very great and, indeed, the operation should not be performed except by experienced hands and in suitable surroundings.

The whole treatment of these cases may be summed up as follows:—Avoid movements, whether voluntary or passive, until the whole tension is gone, and employ elastic pressure as soon as, and as long as, the tension shows signs of diminishing.

Fracture-Sprains.—Where a sprain is found to be complicated by a fracture the line of treatment of the fractured part must be modified by the fact that movement, both voluntary and passive, must be avoided until there is a reasonable chance of the fracture being united. The union or non-union will be best recognized by remembering that localised pain is a sign of non-union or of light fibrous union, while its absence is a sign of union. Thus, in the case of a fracture-sprain, light, voluntary movement on the part of the patient may be advised under supervision within two weeks. If such movements cause local pain they must be abandoned. It is important to remember that in such sprains the principles of elastic pressure should be adhered to and splints, where possible, not employed. On the other hand, it is not to be forgotten that a common result of a fracture-sprain is a painful and stiff joint, as the result of not moving the joint for a long period. It may be insisted on that early and slight movement under careful supervision will never be regretted, while, on the other hand, active and vigorous movements which give pain are always to be deprecated.

Amongst the cases of fracture-sprain that have to be dealt with we may mention injury or partial displacement of the epiphyses of the tibia and fibula. This has been shown to be not infrequent, it occurs between ten and seventeen and can usually only be diagnosed by X-ray examination. It may possibly produce deformity of the foot, but it is to be remembered that such a deformity is by no means common.

Fractures about the Ankle.—These may be divided into—

1. Supra-malleolar fracture of both bones or Malgaigne's fracture. This is usually caused by direct violence; it is often compound and comminuted.
2. The various forms of Pott's fracture, where the foot has been violently forced outwards.
3. Fractures of the astragalus and os calcis.
4. Separation of the epiphyses.

Pott's Fracture.—It is unnecessary here to detail the considerable number of varieties of Pott's fracture. It is of the utmost importance to realize that simple fracture of the fibula is the injury in the majority of cases of Pott's fracture, and this frequently is unaccompanied by displacement and, indeed, is very frequently

only recognized by the X-rays. Here, again, the importance of an early X-ray examination should be apparent, otherwise in such cases a "sprained ankle joint" only is treated and continued local tenderness in the end reveals the fracture of the fibula, and condemns the practitioner.

Another variety of fracture which can only be shown by X-rays is the not infrequent **Oblique Fracture of the Tibia** without separation, and without any fracture of the astragalus or fibula.

Treatment of Supra-Malleolar Fracture. It is important to realize the seriousness of such a fracture. It may be treated by extension and splints in the usual way, but very frequently it will require operative interference to unite the fractured bones by screws or plates.

Recovery is, as a rule, slow after this fracture, and it is quite common to find a patient incapacitated from work for six months or even longer.

Treatment of Pott's Fracture. Here the deformity can usually be reduced under an anæsthetic, but in the more serious varieties it is important to remember that the foot as a whole may be pushed backwards. As a rule, back and side splints will be sufficient, but in a case of backward displacement Symes's horse-shoe splint (see Fig. 1) may well be applied.

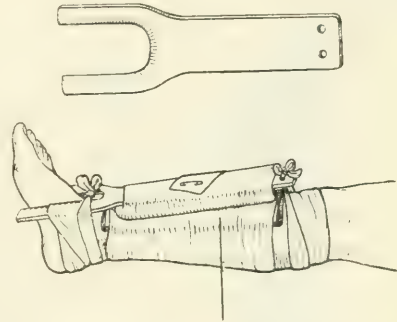


FIG. 1.—Symes's Horseshoe Splint.

It is important to be perfectly certain that sufficient padding is put on the anterior surface of the leg and ankle before the splint is applied. Again, a double system of extension, to give both extension and a forward pull, may be applied to the foot, as here figured. In such cases the weights should be kept on the foot for a period varying from seven days to three weeks.

If it is important for the patient to put his foot to the ground at an early date, Hoefftke's ingenious splint may be used. Here the entire weight is taken off the foot and put on the pelvis. In all cases of Pott's fracture voluntary movement should be encouraged at a very early date and the splints taken off for this purpose. On

the other hand, passive movements and massage should be delayed for between two and three weeks. The old treatment of leaving such fractures in plaster for some weeks after the

the leg and the entire ankle joint torn open, the astragalus being directed downwards. This was readily reduced under an anæsthetic, and the ankle joint was washed out and sewn up,

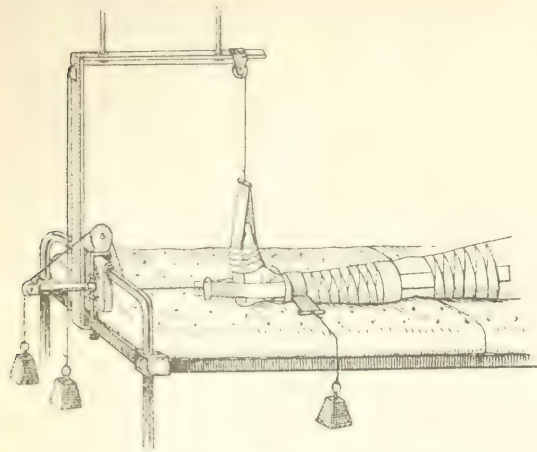


FIG. 2.—Double Extension in Pott's Fracture.

first swelling is over is entirely to be condemned. It cannot be said that the prognosis in Pott's fracture is good as far as the perfect use of the foot is concerned, for between twenty-five and thirty per cent. of all cases have

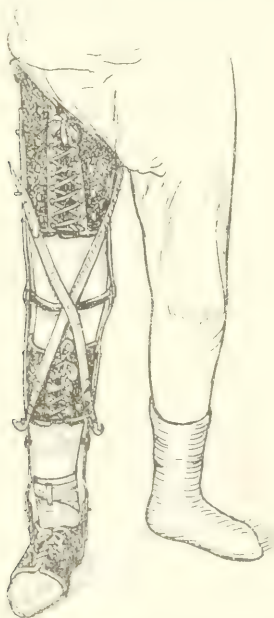


FIG. 3a.—Hoefftke's Extension Splint.

some permanent limitation with regard to the function of the ankle joint. On the other hand, gratifying results may be obtained after even the most serious injuries. For example, I have seen a case of compound Pott's fracture where the foot was displaced on to the outer side of

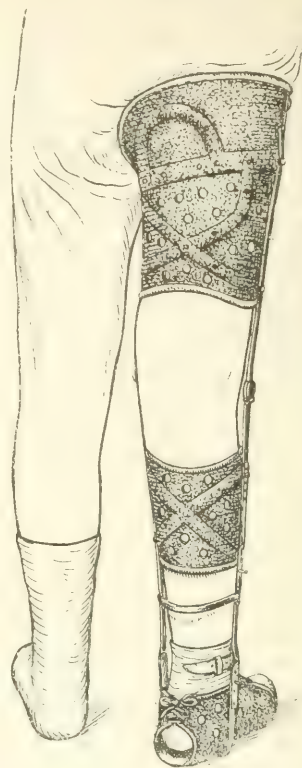


FIG. 3b.—Same from behind.

the result being a perfectly useful joint. Primary amputation is probably never admissible in any case of Pott's fracture, however severe, always provided that the fracture is not complicated by crushing or mutilation of the foot.

The influence of the Workmen's Compensation Act on the after-results of Pott's fracture is not a little remarkable.

Deformity due to old-standing Pott's Fracture.—Treatment in such cases is usually very unsatisfactory and should be entrusted to an experienced surgeon. In some cases division and removal of a wedge-shaped piece of the fibula will improve the position of the foot, but in the majority orthopædic apparatus adapted to each special case is probably the best treatment.

Dislocation of the Ankle Joint is rare. Backward displacement is the usual form, accompanied by fracture of the tibia and fibula. It is extremely difficult to reduce even under an anæsthetic, and an attempt will probably be necessary to get the bones together in order to keep the astragalus in position.

Fracture of the Astragalus is rare, with the exception of the detachment of its posterior margin or tubercle. In all cases it is usually recognized only by X-rays. If occurring in compound cases any comminuted portions of it may be removed. Early passive movements of the ankle joint, and especially of the great toe, owing to the close relation of its tendon to the astragalus, should not be forgotten.

Fracture of the Os Calcis.—The posterior portion of the os calcis may sometimes be dragged off by over-action of the tendo Achillis. It is most important that this condition be recognized, as it demands early operative interference by pegging or plating the fragments together.

Other Fractures of the Foot.—Two deserve a special mention, they are the fracture of the spur of the fifth metatarsal and fractures of the navicular and internal cuneiform. They are both very uncommon and are met with in ordinary sprains of the ankle as the result of a comparatively trivial injury. They are usually undiagnosed (except by the patient) unless a routine X-ray examination has been made.

Pringle (*Fractures and their Treatment*) has made a useful collection of the amount of compensation in cases of fractures of the foot from continental authorities. These take the utmost amount of compensation as two-thirds of the patient's income, and the amounts arrived at are as follows:—Persistent swelling of the leg and foot, 50 per cent. Loss of foot, 60 to 70 per cent. Ankylosis of ankle in good position, 30 to 40 per cent.; in equinus position, 50 per cent. Deformity of ankle, 70 per cent. Loss of great toe, 10 to 15 per cent. Loss of all toes, 20 to 25 per cent.

Injuries of the Foot in General.—The practitioner need not be reminded that every attempt should be made to save any part, however small, of the foot; that the old set amputations are now a thing of the past, and surgical treatment should rather consist in removing fragments and attempting to suture skin together without tension, in order to save as much as possible for the patient. In subsequent septic inflammation we have a very great aid in Bier's treatment, as well as the use of autogenous vaccines; and a cultivation may well be taken for that purpose from any infected foot when first seen.

Tubercle of the Ankle and Foot in Children.—A most dangerous disease so far as the foot is concerned. In the ankle joint it is usually mistaken for a sprain, which it closely resembles at first. The rapid wasting of the calf muscles in tubercle should never be forgotten. In the foot, again, its symptoms are usually mistaken for the pain of flat-foot with which it is often associated. In both cases early X-ray examination will show the difference. In the author's experience, the best results are obtained by a

radical treatment from the very first, that is, exposing the ankle joint freely by a horseshoe incision, dividing, and afterwards reuniting all the structures in front of the joint, removing the upper part of the body of the astragalus and clearing out every particle of tubercle from the ankle joint. It must be admitted that it is a serious and difficult operation, but, on the other hand, the results obtained from it are excellent. In the same way many tarsal bones, and, indeed, all, have been removed successfully, for tubercle, and it is found that they have been replaced by bone. J. K. M.

DEFORMITIES

Deformities of the Upper Extremities

Congenital Deformities. Syndactylism.—Fusion of two or more digits in the hand is by no means rare, is often roughly symmetrical, is not uncommonly associated with a similar deformity of the feet, and, lastly, shows signs of being hereditary. The extent of the fusion may vary between a slight prolongation of the web to union throughout the whole length of the digits, the union including to some extent the bones. Most cases call for operative treatment, but the position of the patient, the work he will probably be called upon to perform, and the fusion of the phalanges may decide us against operation in a particular case. A skiagram may be of service when there is bony union. For the details of the operative treatment the reader is referred to works on operative surgery. Here it will suffice to insist on the importance of covering in with healthy skin the bottom of the cleft made by separating the digits. This is best done by raising a triangular flap on the dorsum between the fingers, and turning this down through the cleft and suturing its apex to the palmar skin edge.

Polydactylism.—This deformity is often inherited. The extra digit may be a useless, imperfect appendage or it may be perfect in every detail. Amputation a few weeks after birth is the best treatment in most cases. In some no treatment is necessary, while in others careful consideration of the usefulness of the various digits, coupled with inspection of a skiagram, will be necessary before a decision is come to as to which digit or digits should be removed and in what manner.

Macroductyly or overgrowth of a digit usually calls for amputation.

In **Club-Hand** the hand is deviated at birth to one or other side, or is in a position of flexion or extension at the wrist joint. Mal-development of the forearm is often present in addition, the condition most often seen being abduction of the hand with partial or complete absence of

the radius and suppression of the thumb. Treatment is often extremely difficult. Daily attempts at correction of the deformity, with the use of a malleable iron or tin splint should be commenced at birth and continued till, after a few weeks, a skiagram may be taken and the future conduct of the case submitted to a surgeon.

Congenital Contraction of the Fingers.—The little finger is the special seat of this deformity, in contra-distinction to Dupuytren's contraction in which the ring finger is chiefly affected. Manipulations and the use of a little palmar splint, which must be worn night and day, will effect a cure if continued for a sufficient time.

Congenital Elevation of the Scapula.—This deformity is not so very rare, but is often overlooked, the case being taken for one of simple scoliosis. As a rule the deformity is unilateral, but it may be bilateral. In the simplest cases the scapula of one side lies higher than that of the other, and there is absence of the lower fibres of the trapezius and serratus anterior. In others the errors of development are widespread. The scapula is small, particularly in its vertical measurement, it lies higher and nearer the mid-line than its fellow, it is more or less fixed, while the muscles around it are malformed. A triangular bridge of bone or fibrous tissue hold its vertebral border to a lower cervical vertebra. There is an abrupt curvature of the spine, convex towards the deformed side, this curve sometimes being due to the presence of a half- or wedge-shaped vertebra, while the ribs show unexpected irregularities in ossification and fusion. A skiagram should always be taken when the deformity of the spine does not seem sufficient to explain the elevation of the shoulder, since the finding of unsuspected rib deformities will settle the diagnosis in a mild case. Treatment should be directed towards preventing any increase in the spinal deformity. When the scapula is anchored to the spine by bone or ligament, definite, though not very great, improvement in position and mobility of the shoulder can be brought about by excision of the abnormal structure.

Subluxation of the Shoulder, Obstetric Paralysis, etc.—While the occasional occurrence of true congenital dislocation must be admitted, this is an excessively rare deformity. Not so rare is a subluxation backwards of the head of the humerus which occurs as a late result of obstetric paralysis. In a typical case of obstetric paralysis due to stretching or tearing of the fifth or fifth and sixth cervical nerves during labour, the arm hangs limp by the side, the arm being rotated in fully at the shoulder joint and the forearm pronated, so that the palm of the hand looks outwards. Beyond the wasting of the deltoid and spinati there is nothing

abnormal to be made out at the shoulder joint on palpation, and the movements are free with the exception of external rotation. In a case of subspinous subluxation of the shoulder joint the head of the humerus is found lying too far back, the normal hollow beneath the angle of the acromion being replaced by a convexity caused by the displaced head. The arm is held in slight abduction and flexion and marked internal rotation, the forearm passing downwards and inwards from the elbow in full pronation. Attempts at rolling out the humerus are checked when or even before the internal rotation is entirely obliterated. By voluntary effort the patient cannot achieve even this. In addition there may be some limitation of supination. As a result the hand cannot be advanced palm upwards, and is used but little by the child. The importance of distinguishing these cases from those of uncomplicated obstetric paralysis lies in the fact that in the former an operation upon the shoulder joint can alone make the arm of service, the use of supporting apparatus and massage, excellent treatment for the latter affection, being practically useless. The operation consists in exposing the shoulder joint from the front, dividing the subscapularis and the anterior part of the capsule, often coupled by division of similar structures at the upper part of the joint, and reduction of the displacement by external rotation of the humerus. Fixation in full external rotation for three months, followed by massage and exercises for a prolonged period will improve the usefulness of the limb to an enormous extent.

Acquired Deformities—

Dupuytren's Contraction.—This is an affection of middle life and may attack one or both hands. It consists in a chronic inflammatory contraction of portions of the palmar fascia and superjacent subcutaneous tissue, which leads to permanent flexion of one or more fingers at the metacarpo-phalangeal and first interphalangeal joints. The terminal joint is usually seen in extension. The ring finger is the first to be affected, and next to this comes the little finger, while the others and even the thumb may become involved in rare cases. The contracted tissues form hard bands which can be seen and felt, and the skin is not uncommonly thickened over them. The cause is doubtful, but the deformity is commonly met with in patients whose hands are subjected to excessive pressure or friction. *Diagnosis* is easy, the presence of the thickened tissues in the palm serving to distinguish it from congenital contraction—which, by the way, affects the little rather than the ring finger—and from flexion due to shortening of muscles. In the latter the

tendons can be felt to stand out at the wrist on attempts to straighten the fingers.

Treatment. Occasionally the thickenings in the palm become obvious before any contraction has taken place. In such a case contraction must be prevented by seeing daily that full extension is possible. When the deformity is slight, daily manipulations to stretch the contracting tissues, coupled with the use of a specially made splint at night, may suffice to prevent any increase in the deformity. In the majority of cases operative treatment is necessary. This should consist in excision of the whole of the contracted fibrous tissues through longitudinal or V-shaped incisions. The V-incisions should be sutured in the form of a Y. A splint is worn day and night, with intervals for active and passive exercises for a couple of months, and then at night only for at least a year. In this way only can a relapse be avoided with certainty.

Trigger Finger is a condition in which a finger, usually the middle or ring, remains flexed when attempts are made to extend it from the fully flexed position. Force, either active or passive, is necessary to overcome the difficulty, when the finger flies into full extension with a jerk. More rarely is there difficulty in flexion as well as extension. The condition is due to the presence of a swelling of one of the long flexor tendons which interferes with free gliding of the tendon in its sheath. Removal of the redundant tissue is necessary to effect a cure.

Mallet Finger is the name given to a finger in which the terminal phalanx is always in a position of flexion, and is due to damage to the dorsal tendon. If the application of a splint and rest immediately after the accident is not followed by a cure, the damaged insertion of the tendon should be repaired by operation.

Ischæmic Paralysis (Volkmann's Contracture).—This deformity is caused by a fibrosis and contracture of the flexor muscles leading to flexion of all the fingers and thumb. Extension, active and passive, of the wrist and fingers at the same time is impossible, while in the more severe cases it may be impossible to fully extend either wrist or fingers alone. The changes in the muscles are the result of prolonged anæmia caused by undue pressure of the forearm by splints or bandages. The skin usually shows the scars of pressure-sores, while it is quite common to find trophic and sensory evidence of damage to the nerves in addition. The diagnosis from the history, the scarred skin, and the position of the fingers is usually easy when trophic and sensory signs are absent. The muscles affected react normally to electrical stimulation. Treatment should consist of massage, active and passive stretching of the contracted tissues, and the use of an adjustable malleable iron

splint. The splint, which has a separate process for each finger, is bent every day or two as the flexion is reduced. It is as well to let the wrist be flexed fully at first and to gradually extend the fingers to the full, and then begin to lessen the flexion at the wrist, keeping the fingers extended, till eventually full extension of wrist and fingers is achieved.

In obstinate cases operation may be called for. The procedures adopted are either lengthening of the flexor tendons or shortening of the radius and ulnar by excising a portion of each.

Deformities of the Lower Extremities—

Congenital Talipes.—Club-foot is as a rule a distortion pure and simple, without any paralysis. It should therefore be capable of complete cure if corrective appliances are made use of for a sufficient length of time. All the structures comprising the foot are involved in the distortion—bones, ligaments, tendons, muscles, and even the skin. The muscles on the side towards which the foot is deviated act at greater mechanical advantage than do their opponents, so that in the aimless movements of the infant it is the shortened muscles which usually contract and thus retain their vigour, while their lengthened opponents are over-stretched and weakened. The distortion is thus complicated by a want of equilibrium between the opposing groups of muscles, and this loss of balance increases the longer the case is left untreated.

The same holds good for the distortion of the bones, which becomes increasingly difficult to correct as the child grows with the feet uncorrected. In nearly half the cases the deformity is bilateral. As to the variety of the deformity about three-fourths of all cases fall under the heading—*equino-varus*. In this variety, the ordinary *club-foot*, the foot is inverted, adducted and plantar-flexed, while the arch is contracted (*cavus*). In addition the whole foot is twisted inwards to a greater or less extent, this rotation usually taking place below the knee by a spiral twist of the tibia and fibula. Next most common in frequency is *calcaneo-valgus*, the exact opposite of the previous type, while *calcaneus valgus* and *varus* may occur alone.

Severe types of *varus* and *valgus* are occasionally associated with absence of the tibia and of the fibula respectively. In these cases there is some deficiency of the foot on the same side as the missing leg bone.

Treatment. Treatment must be commenced early, *i.e.* in the first week of life. Nothing is to be gained by waiting, and the longer the delay the more difficult does correction become. The commonest variety, *equino-varus*, may be dealt with first, the principles of treatment

being the same for all varieties. We must first over-correct the deformity. In the mildest cases this may be accomplished by daily manipulations, further over-correction being obtained each day, while the foot is retained in the intervals in as good a position as possible by the tin shoe to be described later. Such cases are usually cured before the child begins to walk. It is not uncommon to meet with cases in which the varus can be corrected by manipulation, whereas the equinus calls for tenotomy of the tendo Achillis. In such cases the varus should be fully over-corrected first, a malleable iron splint being used to hold the foot in the everted and abducted position. This splint consists of a strip of soft tinned iron, an inch or more in width and $\frac{1}{4}$ in. in thickness, padded on one side. This is fixed to the outer side of the leg and foot with a calico bandage: it can be bent opposite the ankle so as to hold the foot everted, and its shape can be altered as the

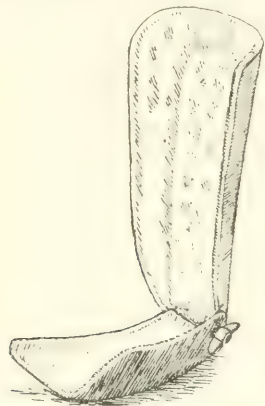


FIG. 1.—Tin Shoe (author's pattern for equino-varus).

foot improves. After three weeks or so, or as soon as the foot can be fully everted with the gentlest pressure of the fingers, the tendo Achillis is divided and the foot put up at a right angle on the "tin shoe." The "tin shoe" I use is a modification of Little's shoe (*vide* Fig. 1). Its particular features are the eversion of the foot-plate, which is also shaped so that its inner border and the flange are convex while the outer border is concave. The foot when carefully bandaged to this must be in a position of eversion and abduction. A quadrant and screw allow of the foot-plate being fixed at any required angle with the leg-piece.

The cases of average severity require tenotomy for correction of the varus as well as for the equinus. My rule is to operate for the varus in all cases in which the foot cannot even be carried outwards by light pressure so as to lie in the line of the leg. It is usually necessary to divide the tibialis anterior tendon, the inner

part or whole of the plantar fascia, and the internal lateral ligament. The foot may now be wrenched into full abduction, but the tension of the parts, particularly the skin, makes it advisable not to fix the foot at once in full abduction. The malleable iron splint is applied with the foot in a line with the leg or only very slightly everted. In being content with partial correction to begin with one avoids the chance of causing a pressure-sore where the splint rests on the external malleolus. After a few days, during which the small wounds heal completely, the splint is removed and thrice daily manipulations towards full over-correction of the varus are practised, the splint being bent out more and more. When the pressure of one finger is sufficient to carry the foot right out to full abduction, *i.e.* after three or four weeks, tenotomy of the tendo Achillis should be performed, and the foot put at a right angle with the leg on the tin shoe as described above. The bandages are left alone, as before, for a few days to allow the wound to heal and the gap in the tendon to be filled by firm blood clot which rapidly begins to organize, and the bandage and dressings are removed and manipulation recommenced. While the foot is held in full abduction and eversion it is slowly and firmly dorsiflexed, the tissues at the back of the ankle being gradually stretched. Each day some further advance is made till the foot can be put into a position of full calcaneo-valgus with the greatest ease. In a difficult case it may be necessary to wrench the foot forcibly under general anæsthesia once or twice. This is often necessary when treatment has not been commenced till the child is several months or a year old or the foot has relapsed, or when the parents are wanting in sense and perseverance. Sometimes the tibialis posterior may require division, but this is rarely necessary when treatment has been commenced in early infancy.

Tenotomy is an easy operation in a thin foot, but may be somewhat difficult when the tendons, etc., are obscured by a thick layer of fat. In dividing all the structures mentioned above the tenotome should be entered on the inner side of the tendon or other band to be severed; it is then passed on the flat close to the superficial or deep aspect of the tendon, the edge is turned towards the tendon and the latter is divided as it is put on the stretch by manipulation of the foot. The blade should be carried through the tendon gradually by a see-saw movement of the handle. The tendo Achillis is best divided from its deep aspect, the other structures from their superficial aspects. The tibialis posterior is best divided under the eye through a short vertical incision along the inner border of the tibia about one and a half inches above the tip

of the malleolus. A small sterilized dry dressing of gauze and wool must be applied and kept on for three or four days.

To return to our typical case, the equinus should be fully corrected in a couple of weeks, but the tendency to relapse, it must be remembered, is by no means overcome in this time. Daily manipulations and the use, day and night, of a tin shoe or other appliance is necessary for many months, usually till nearly two years of age, when walking may be allowed provided proper boots and irons are worn.

The accompanying deformity of inward rotation of the leg must be dealt with from the first by twisting the ankle and foot outwards with one hand while the upper end of the tibia is held with the other. When the child is a

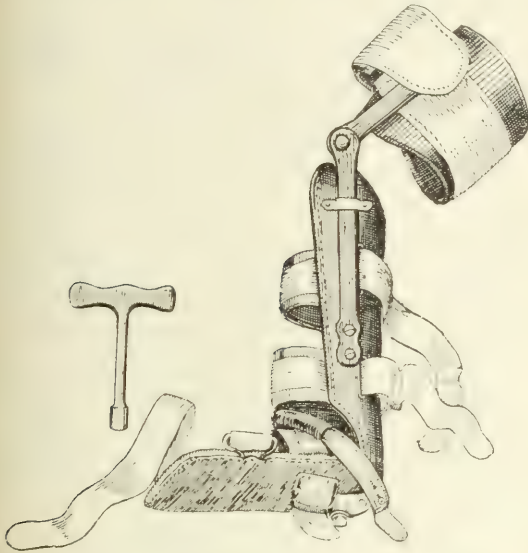


FIG. 2.—Adams's Varus Splint (for left leg).

year old or even sooner Adams's varus splint, (*vide* Fig. 2), which reaches above the knee, and thus controls rotation, may with advantage be substituted for the tin shoe. The splint must, however, be properly made, so that the foot is turned out fully whenever the knee is bent and the thigh-piece thus brought into use. As regards the walking apparatus, the boots are fitted with a varus T-strap to prevent the ankle from going out, and a light toe elevating spring (at first) to prevent foot-drop. Over-action of this spring may be prevented by having a "stop" at the ankle joint to check dorsiflexion at five degrees above the right angle. The pelvic band is made in two pieces with a strap and buckle fore and aft. By means of these straps the position of the leg as regards rotation can be controlled.

The treatment of the other varieties of congenital talipes is based upon similar lines.

Calcaneo-valgus or calcaneus, the next most common variety, very rarely calls for tenotomy. Daily manipulations with the use of the malleable iron splint applied to the antero-external aspect of the leg and foot so as to hold the foot down and in, usually effect a cure in a month or two. The valgus portion of the deformity may only become obvious when walking is commenced: in such a case the shoes must be thickened on the inner side.

Rarely congenital valgus calls for tenotomy of the peronei and the use of a tin shoe similar to that used for equino-varus but so shaped that the foot is held in an exactly opposite direction. The sole-plate may be fixed at right angles to the leg-piece, and the adjustable quadrant and screw dispensed with.

Metatarsalgia, or Morton's Disease, is a painful affection of the foot due to flattening of the transverse arch formed by the metatarsal bones. The feature of the disease is neuralgic pain localised to or starting from the region of the head of one of the metatarsal bones, usually the fourth. The longitudinal arch of the foot is often flattened also, but it may, on the other hand, be contracted. Corns develop about the centre of the ball of the foot, a site naturally free from special thickenings of the epidermis. Walking and standing start the pain, which may be severe enough to cripple the patient. Usually one foot only is affected, and the affection occurs in early adult life. The actual pain is set up in one of two ways, either by the undue pressure of the depressed heads of the metatarsal bones on the sole of the foot, or by pressure on the digital nerves by wedging the broadened foot into a shoe too narrow for it.

Treatment. The anterior arch, and particularly the painful articulation, should be elevated by a thickening inside the boot just behind the heads of the metatarsal bones. Elephant plaster is an excellent material to use for experimental purposes, till the best size, shape and position of the pad has been determined. The plaster should be a quarter of an inch in thickness, and a portion should be cut out so as to fit just under the necks of the second, third and fourth metatarsals, skirting the balls of the big and little toes, and the edges of the piece should be bevelled. The patient can try different sizes and shapes for himself. In the case of a lady who refuses to give up her high-heeled shoes, the piece of elephant plaster should extend around the front of the central callosity in the ball of the foot, if such is present, just like a corn plaster. If this is not done the foot tends to skid forwards over the plaster, which soon fails to preserve the tender corn from pressure. When relief is obtained by a suitable pad, the latter may be reproduced in leather and fixed

in the boot, or better still a German silver insole may be made. Exercises of the toes, particularly in the direction of plantar flexion, are useful in restoring the arch. If the longitudinal arch is decreased or increased it must receive appropriate treatment.

Removal of the head of a metatarsal bone is rarely necessary, and should be reserved for cases in which other treatment fails to give relief.

Hallux Rigidus. Hallux Flexus.—This is a condition in which dorsiflexion of the metatarso-phalangeal joint of the big toe is limited and painful. In hallux flexus this joint is flexed, *i. e.* plantar-flexed, extension being impossible. It is, therefore, a later stage of hallux rigidus. The affection is due to a chronic osteo-arthritis of the joint, and this is brought about by various causes, traumatism probably being the determining factor. The foot is often flat and in this way the big toe is forced against the end of the boot or subjected to lateral pressure.

Treatment consists in correction of the accompanying flat-foot, and if necessary stiffening of the sole of the boot to prevent or limit dorsiflexion of the toes in walking. A thin strip of steel inserted in the sole will accomplish this, or the sole may simply be thickened along the inner side as for flat-foot. In bad cases excision of the joint should be performed.

Hallux Valgus. Bunion.—In this condition the big toe is bent outwards at the metatarso-phalangeal joint, leaving the inner side of the head of the first metatarsal projecting under the skin, and exposed to the pressure of the boot. As a result of this pressure and friction the bone is thickened by chronic periostitis, while a bursa and a corn develop over it. It is the projection formed by these three, the bone, the bursa, and the corn, which constitutes the bunion. The cause is invariably the wearing of badly shaped boots. The bursa is often inflamed and may suppurate, while sometimes the suppuration extends to the joint. The deformity is found at all ages, but rarely causes symptoms before thirty. If left untreated, rheumatoid arthritis sooner or later supervenes with the development of "lipping" and increase in the discomfort caused by the affection. This deformity is often associated with hammer-toe.

Treatment. Properly shaped, broad-toed boots, absolutely straight along the inner side from heel to toe, are imperative. This, coupled with daily manual correction of the deformity and exercises in the same direction, is all that is necessary in early cases. In some a toe-post in the boot, worn over a digitated sock, may hold the toe in good position, but it is often uncomfortable and may lead to so-called ingrowing toe-nail. A light metal splint

covered with kid and fitting along the inner side of the foot and toe with a hole cut out opposite the bunion, and a loop to hold the big toe to the splint will be necessary in most cases, whether the case be operated upon or not. This may be worn inside the boot, but at any rate it must be worn at night for a prolonged period. When the deformity is beyond correction by other means and the pain and disability produced is sufficient to induce the patient to consent, an operation should be performed. The operation is best done through a curved incision arching over the callosity. The bursa and the inward projecting part of the head should be excised, the external lateral ligament divided and the toe brought into the line of the metatarsal bone. Slight over-correction is advisable to begin with.

In the worst cases excision of the whole of the head of the first metatarsal gives excellent results. Prolonged after-treatment is essential as in almost every case of deformity.

Hammer-Toe.—This usually affects the second toe, and is often associated with, and in part caused by hallux valgus, while it may occasionally be congenital. When all the toes are affected, the deformity forms part of an extensive acquired condition of the foot in which the longitudinal arch is contracted. In these cases correction of the distortion of the rest of the foot is often alone necessary, but all the extensor tendons may require division.

In ordinary hammer-toe affecting the second digit the metatarso-phalangeal joint is hyper-extended, the first inter-phalangeal joint is fully flexed, while the terminal joint is slightly extended. A corn and a bursa form over the prominent head of the first phalanx.

The causation of the deformity, when not congenital, is the wearing of too short boots and the crowding out of this toe by a hallux valgus.

Treatment. If congenital the toe may be held in a flat position by narrow strips of adhesive plaster, one passing *over* it and *beneath* the adjacent toes, the other, nearer the end of the toe, passing *under* it and *over* the adjacent toes. In the acquired form in childhood, when it is often met with in a mild form, similar treatment may effect a cure if broad boots or shoes are worn. If of long standing the deformity can only be corrected by operation, and then the best proceeding is excision of the head of the first phalanx through a longitudinal curved incision just skirting the corn. The toe should be held flat by a metal plantar splint, and when all dressings are dispensed with an inner sole of leather stiffened beneath the toes by a thin sheet of metal and with a loop of elastic or tape to hold the toe flat should be worn for a year. If hallux valgus is also

present this, of course, *must* be dealt with at the same time.

Paralytic Deformities of the Foot, Knee and Hip

The causes of acquired deformities of the feet are numerous, but by far the commonest is infantile paralysis. Talipes accompanying the rarer diseases of the nervous system and muscles is of much less practical importance, and it need not be dealt with here. Talipes resulting from injury to a nerve of the leg, from fracture, and from irregular growth at an epiphyseal line following injury need only be mentioned.

Paralytic talipes is the result of the action of gravity, *i. e.* the weight of the foot or the weight of the patient on the foot, and of the pull of the unparalysed muscles. The varieties are exactly similar to those found at birth, though their relative frequency is entirely different. Simple equinus is by far the commonest paralytic deformity, while it is the rarest of all forms of congenital distortion. A paralytic deformity may be a true fixed deformity which cannot be corrected by ordinary pressure or it may only amount to a tendency to deformity in that the faulty position is invariably assumed when the patient contracts his leg muscles or when he stands on the foot. The diagnosis between the two is easily made by attempting to over-correct the deformity: if this cannot be done real shortening or contracture must have taken place in the unparalysed muscles, and in a case of long standing accommodative changes in the bones and ligaments in addition.

In every case of infantile paralysis it is the duty (a duty by no means fully realized) of the medical attendant to take steps to prevent deformity, for if a foot is allowed to remain in any extreme position recovery of the paralysed muscles cannot take place, and sooner or later contracture of the opposing muscles will supervene. It is here only possible to give the general plan of treatment, and for this purpose we may take the commonest paralytic deformity—equinus or drop-foot. In this there is a want of equilibrium between the anterior and posterior groups of muscles of the leg. The anterior are either paralysed or weak. So long as a weak or apparently paralysed muscle is over-stretched it cannot recover. This is the foundation of all treatment.

We must, therefore, dorsiflex the foot and relax the anterior muscles and allow them to recover. The balance between the two opposing groups is most rapidly restored by placing the foot in a position exactly opposite to that to which it tends to fall, *viz.* in the case of equinus we raise the front of the foot till it is slightly above the level of the heel, *i. e.* a position of calcaneus. The foot is supported in this

position by a simple tin shoe similar to that used for congenital talipes. There is no need for a joint at the heel; the sole-plate may be fixed at rather less than a right angle with the calf-piece. If there is a tendency to varus the sole-plate is slightly everted, if to valgus it is inverted. The splint is worn day and night, being removed twice or thrice a day for exercises, massage, etc.

If the hip and knee are sufficiently stable for walking to be possible, with or without instrumental support to these joints, a boot with an outside iron, with a "right angle back-stop" at the ankle joint of the iron to prevent the foot dropping below the right angle, is supplied. The boot should have a strip of thick leather across the tread, something like a bar on a football boot only wider, and the heel should be low: these features ensure relaxation of the weak or paralysed anterior group of muscles in walking.

If the foot cannot be brought up above the right angle there is shortening of the calf muscles, and the tendo Achillis should be lengthened. This is best done through a curved incision to the inner side of the tendon, which is then carefully lengthened to the required amount by the Z method. This gives better results than simple tenotomy. The anterior muscles should not be adjudged to be hopeless or incapable of further recovery till some months of careful massage have followed the relaxation of these muscles. Recovery may take place in a feeble muscle years after the onset of the paralysis if it be given a fair chance, but if no improvement takes place, in, say, six months following the complete removal of all stretching of the muscle, recovery must not be expected. When it is certain that no more improvement can take place, further advice should be sought with a view to an operation being performed.

The operation decided upon will be that which makes the best use possible of the healthy muscles, etc., so as to restore as far as possible the weight-bearing function of the foot and to render unnecessary cumbersome instruments. Such an operation will be one of the following, arthrodesis, tendon-transplantation, formation of artificial ligaments, etc., or a judicious combination of these.

The paralytic deformities that are met with at the hip and knee are usually in the direction of flexion, while genu valgum resulting from paralysis is by no means rare. When the biceps cruris is the only healthy muscle above the knee, a triple deformity is usually seen, in which the tibia is flexed, abducted (genu valgum) and rotated outwards.

Treatment is on the lines already given. Division of contracted muscles, and the use

of apparatus to prevent over-stretching of their weak opponents should be followed by a long period of massage and exercises. When no further improvement can be looked for from this treatment some further operation, viz. arthrodesis or tendon-transplantation, must be performed.

Flat-foot.—Flat-foot may be a congenital deformity, when it is not uncommonly overlooked till walking is commenced, and it may occasionally be the result of tubercular disease of the ankle joint or tarsus. It is a fairly common result of infantile paralysis, but in the greater number of cases it is the result of loss of muscular tone, *i. e.* it is a *deformity of weakness* like scoliosis. The inability of the calf muscles to hold up the longitudinal arch of the foot may be the result of general loss of muscular tone, or may be due to the tiring out of those muscles by excessive standing. In either case there is often present a definite cause for muscular weakness, and also other deformities of weakness, viz. round shoulders, scoliosis and genu valgum.

Rickets is a common cause in children, but in a very large number of cases in older children and adults some infective cause is to be found to explain the loss of tone and the anæmia which is so often associated with it. Oral sepsis in its broadest meaning will be found only too often, if looked for, and the presence of enlarged glands in the neck on either side is a confirmation that the carious teeth or septic tonsils and adenoids are really infecting the system.

The primary defect is a failure of certain calf muscles to support the arch; this leaves the strain to be borne by the ligaments, particularly the inferior calcaneo-navicular ligament upon which rests the head of the astralagus. The ligaments stretch and the arch gradually flattens out. Pain is due largely to the stretching of the ligaments and the tension at their points of attachment: pain is therefore an indication that the deformity is advancing, except in the inveterate cases. Knock-knee may be present and be the cause of the deformity of the feet.

The deformity needs no special description, but it may be remembered that flattening of the arch is always accompanied by eversion and abduction of the foot, and that the latter cannot exist for long without the development of a definite lowering of the arch. In the mildest type of case the patient can voluntarily correct the deformity while standing when directed how to do so, and the foot can be fully inverted by the surgeon. In a slightly more advanced case there is present some spasm of the peronei muscles and over-correction of the deformity is impossible, either voluntarily

or by the surgeon's hands. Absolute rest for a time, the duration varying with the severity of the case, is followed by absolute restoration of the mobility of the foot, so that full over-correction is possible. Beyond this type all degrees of severity are met with up to what is called inveterate flat-foot, in which contracture of the peronei is present, gross bony changes have occurred, and general osteo-arthritis of the tarsal joints has supervened.

Treatment. The treatment of ordinary acquired flat-foot will alone be dealt with here. This must depend to some extent upon the severity of the deformity. If the case is a mild one, and voluntary correction possible the following routine treatment should be carried out.

All sources of infection must be dealt with and the general health improved by fresh air in abundance, tonics, etc. Rickets, if present, must receive appropriate treatment. Standing about indoors should be avoided if possible: exercise as well as rest in the open air should be insisted on.

Special exercises to strengthen the calf muscles and restore the arch should be practised assiduously.

In the case of waiters and shop-assistants who, as a class, are martyrs to this complaint, exercises are usually worse than useless. Their occupation gives them but little spare time and this is best spent in resting the feet. The boots should be properly shaped, *i. e.* straight along the inner side and broad toed. The inner edge of the heel and tread should be thicker than the outer, so that the inner side of the foot is raised and the ankle thrown out. The heel may be carried forwards on the inner side to support the waist of the boot, and the leather passing up the inner side of the foot should be hardened. When it is found that one or both of the feet cannot be inverted, it is not always easy to tell whether this is due to spasm of the peronei only which will entirely disappear with rest, or whether it is due to real shortening of the peronei and other changes in the bones and articulations which will not be overcome by simple means. It is a good rule to order absolute rest in such a case for a few days, the feet being forcibly manipulated inwards every day. If rest does away with spasm the special boots described above may be ordered. If the patient is obliged to get about while the boots are being made, the wearing of the latter must be preceded by a day or two's rest to overcome the spasm, which will not return if the boots are efficient. If rest is insufficient to cure the spasm the feet may be forcibly inverted under an anæsthetic, and occasionally even the peronei tendons divided, after which the feet are fixed in plaster

of Paris in a fully inverted position, with the ankle at a right angle. The patient should wear the cast for three months, being encouraged to walk in it, and should then be given boots built on the principles already indicated, but with the addition of a "concealed spring" on the outer side to assist in preventing a relapse. Treatment in inveterate cases is always disappointing and it need not be discussed here. It may be noted that in the older children and adolescents, when other methods fail, fixation in an inverted position in plaster of Paris for three months will be found of the greatest benefit.

Coxa Vara.—This is usually described as a condition in which the angle formed by the neck and shaft of the femur is decreased. Although this is fairly accurate it is not absolutely so, as the essential of the deformity lies in the alteration of the relative positions of the head of the femur and the great trochanter, and this can occur without the "angle" of the femur being altered, *e. g.* in slipping of the epiphysis of the head off the neck.

The varieties are (1) congenital, (2) rachitic, (3) infantile, (4) adolescent, (5) traumatic. Of (1) nothing need be said. The rachitic type is not so very common considering the frequency of rickets. The longer the rickets is continued the more likely is the child to suffer from coxa vara. In this type the neck of the femur is actually bent downwards and the "angle of the femur" decreased.

In infantile coxa vara there is slipping downwards of the epiphysis of the head, together with a fragment of the lower part of the neck close to the epiphyseal line, off the rest of the neck. In adolescent coxa vara the slipping takes place at the epiphyseal line itself, the head moving backwards as well as downwards in relation to the neck of the femur. In the two latter cases traumatism, often slight and recurrent, probably plays an important part in the causation.

In traumatic coxa vara the condition may resemble the adolescent type in skiagraphic appearances, differing from it in the sudden displacement of the epiphysis as compared with gradual displacement in adolescent coxa vara. Fractures of the neck of the femur through the trochanters and through the junction of the shaft and trochanters often result in this deformity.

In the infantile, adolescent and traumatic types although the "angle of the femur" may not be at first decreased, abnormal development of the neck or the formation of new bone to repair a fracture eventually leads to distinct alteration in the direction of the neck of the bone.

The signs common more or less to all types of

coxa vara are limping or a rolling gait, elevation of the trochanters with corresponding shortening of the limb, and limitation of abduction, extension and internal rotation of the hip. Lordosis is commonly present but not invariably.

In the infantile type, flexion of the hip and lordosis are usually considerable, and there is adduction of the limb.

The adolescent type is characterized by great rigidity of the joint and eversion of the limb. The rigidity is due to spasm and disappears under anæsthesia. The period of rigidity varies in length, but eventually passes off, leaving a deformed hip with limitation of movement in the directions of abduction and inversion. It is this type which is so often mistaken for tubercular disease of the joint. The marked eversion without flexion of the limb should distinguish it at once from the flexed and slightly abducted and everted limb in tubercle, while the elevation of the trochanter in coxa vara is often of such a degree as is only seen in advanced tubercular disease with sinuses or scars and marked adduction.

The infantile and rickety types of the deformity have to be diagnosed from congenital dislocation. While various signs, which will be found described under congenital dislocation, may assist us in making a diagnosis, the latter must depend upon the position in which the head of the femur can be felt. If the head is in the acetabulum the case is one of coxa vara, whereas if the head has moved up with the trochanter and can be felt in front of it, below and to the outer side of the anterior superior iliac spine, dislocation is present. In all cases a good skiagram is essential to confirm or correct the diagnosis.

It may be noted that all the rachitic cases are bilateral, while a considerable proportion of the infantile and adolescent cases are also bilateral, but the deformity is usually more marked on one side than on the other.

Treatment. In all cases rest is the essential, at any rate for a time. This is best assured by placing the patient on an abduction frame (Jones), *i. e.* a modified double Thomas's splint with the legs widely abducted. The splint should have foot-pieces to which the limbs are attached by the ordinary strapping extension apparatus. If the foot of the couch on which the patient lies is raised, and the splint is anchored to the foot of the couch, the weight of the patient's head and trunk will exert gentle traction on the hip joints and so prevent increase of the deformity. Abduction is essential and if necessary an anæsthetic must be administered to obtain it. This treatment should be continued for from three to six months, after which time the patient may be allowed

to get about on a caliper splint. This splint is really a Thomas's knee splint in which the lower end of the lateral bars end in the heel of a boot instead of being prolonged and ending in an iron ring.

When consolidation of the neck of the femur has taken place and increase of the deformity is at an end, operation may be advisable but only in selected cases. The operation most commonly applicable is a sub- or trans-trochanteric osteotomy.

Genu Valgum (Knock-Knee).—This is a condition in which, the knees being in contact with one another and the patellæ directed forwards, there is an interval between the malleoli. The deformity may be congenital and associated with talipes, but much more commonly it is due to rickets or is due to a general loss of tone in adolescents.

In these cases it results from deficiency in muscular tone and the assumption of faulty attitudes. It is, in other words, a *deformity of weakness*, and is therefore often associated with flat-foot, round shoulders and scoliosis, the cause of the weakness being rickets, oral sepsis, tonsillitis, adenoids, etc.

The deformity is really an exaggeration of the normal angle formed by the femur and tibia, which is a particular feature of women. The initial changes consist in a stretching of the internal lateral ligament and the surrounding muscles. As a result of the bending inwards of the knee almost the whole of the weight is transmitted through the external and very little if any through the internal condyle. The rate of growth at an epiphyseal line varies inversely with the pressure borne by the line, therefore in genu valgum excessive bone formation takes place on the inner side and diminished growth on the outer. In this way the lower epiphyseal line of the femur comes to lie obliquely and the inner condyle to project below the level of the outer. Similar changes may take place in the tibia, but it is most common to find practically the whole of the deformity in the femur.

Genu valgum may also result from excessive or diminished growth of part of the epiphyseal line due to tubercular deposit in the epiphysis of the femur or tibia, it may follow a fracture, excessive riding, or the use of a double Thomas's splint with abducted leg-pieces, unless special means are adopted to prevent it, or, lastly, it may be caused by paralysis. The diagnosis is easy, but the share taken by the femur and tibia respectively should always be determined by feeling for the line of the joint, particularly if operative treatment is decided upon. A skiagram is a useful aid on this point, while it also affords information on the activity of the bony changes in a rachitic case.

Treatment. In most rickety cases the use of long outside splints reaching from the hips to a point well below the feet to prevent standing, and kept in place with strong calico bandages, will bring about a cure in a few months. Massage and forcible manual correction of the deformity should be practised twice daily, and the general treatment suitable for rickets must be ordered. The question of the necessity for osteotomy must be decided after a review of the following points: the age of the child, the severity of the deformity, and the plasticity of the bones as determined by testing the elasticity with the hands and by the rachitic changes seen in a skiagram. Osteotomy is rarely necessary before five years of age, but the age is a less important factor than the activity or inactivity of the rickets. Osteotomy of the femur above the epiphyseal line (MacEwen's operation) is suitable for most cases that call for operative treatment, the tibia rarely requiring division.

In some cases correction on a splint may with advantage be followed by the use of a walking-iron, passing from the heel of the boot to a pelvic band, with no joint at the knee or one with a ring catch, and a knee-cap and other bands to hold the leg out to the iron. The irons may with advantage be slightly bowed. In the more severe cases the only treatment is that of osteotomy.

After osteotomy the legs are fixed in plaster of Paris, and it is as well to err on the side of over-correction, and also to fix the knees in slight flexion. Hyperextension at the knee joints is not uncommonly seen as a late result of this operation, and therefore it is best to take precautions to avoid it.

The plaster may be discontinued after six to eight weeks, and then knock-knee irons should be worn for a year.

In the cases met with in older children it may only be necessary to treat the accompanying flat-foot if the knee deformity is only slight. Correction of the feet tends towards correction of the knees.

In adolescents treatment must be either by gradual correction with irons or immediate correction by osteotomy. In all but the mildest cases operative treatment is to be preferred.

Treatment is incomplete unless it includes the removal of all sources of infection in the mouth, throat, etc., if any such are present, and the correction of any other deformity of weakness which a careful examination of the patient has revealed.

Genu Varum.—This is a comparatively rare deformity, most cases of bow-legs being due to curved tibiæ, or a combination of this and curved femora, and not to any bend centring

about the knee joint. It is almost always due to rickets and rarely to disease or injury of the bone. The principles of treatment are the same as for genu valgum.

Curved Tibiæ.—This condition is seen extremely commonly in rickety children. The curve is usually seen about the junction of the middle and lower thirds of the bones and is convex in an antero-external direction. Sometimes the convexity is directed almost directly outwards and sometimes directly forwards. In the last variety the edge of the tibia is often unusually sharp and the angle formed by the two portions of the tibia may be as small as ninety degrees. In some cases of genu valgum the tibiæ and fibulæ may be bent outwards in their lower thirds instead of inwards; and sometimes the curve is situated just below the upper end of the bones. The fibula is less curved than the tibia as a rule. The concavity of the curves is partially filled up by newly-formed bone.

The curved tibiæ seen in congenital syphilis present an antero-posterior curve involving the whole length of the bones, *i. e.* centring about the middle, and the anterior border of the bone is thickened and rounded.

Treatment. This consists in prevention of all walking and standing and in the use of splints. The splints are straight and made of wood and project below the feet, and should always be applied to the concave side of a curve, *i. e.* as a rule on the inner side of the legs.

Massage and forcible daily correction should be practised as in genu valgum. The rickets must be treated, as so long as this disease is present walking will tend to increase the deformity, whereas when once the bones have hardened walking can do no harm and the deformity will tend to disappear in the natural process of growth. The necessity for operation will depend on the severity of the deformity, the age of the child (to a small extent), the elasticity of the bones, and the appearance of the epiphyseal lines in a skiagram. Operation may take the form of forcible correction, osteoclasis, either manual or mechanical, or osteotomy. In the worst cases cuneiform osteotomy of the tibia is the operation of choice, coupled with simple division of the fibula.

Congenital Dislocation of the Hip.—This is a deformity which is rarely recognized before a child begins to walk. It affects girls much more commonly than boys, and may be unilateral or bilateral (two to one). The fundamental anatomical defect is a want of proper development of the upper and posterior part of the acetabular margin. The acetabulum is smaller than it should be, and later becomes somewhat triangular. The head of the femur is large in proportion, is flattened on its postero-internal

aspect, and later, probably as a result of osteoarthritic changes, becomes mushroom-shaped. The capsule surrounds the misplaced femoral head, which is not the case in a traumatic dislocation, and there is usually a constriction, or "isthmus," between the acetabular part of the joint cavity and that containing the head of the femur. The narrowness of this isthmus constitutes one of the difficulties met with in attempts at reduction. The dislocation is usually accompanied by delayed ossification in the pelvis as well as in the femur, while the whole limb, including the foot, may be smaller than its fellow. The history given will be that of a limp or waddle, according as whether one or both hips are affected, dating from the time the child began to walk, while sometimes shortness of the limb is noticed soon after birth. The gait is always strongly suggestive of the deformity. Lordosis is always obvious in bilateral cases, but is much less marked in unilateral cases, often being absent for a few years. In a unilateral case the shortness of the limb is at once seen to be chiefly accounted for by elevation of the trochanter, which is also unusually prominent. The movements of the hip joint are free and painless, except in one or two directions. Except occasionally in the youngest children, there is limitation of abduction, and less commonly of inversion. The shortening varies from half an inch to two or more inches. There is a want of resistance below the middle of Poupert's ligament, and the displaced head of the femur can be felt *in front* of the trochanter, usually just below and to the outer side of the anterior superior iliac spine.

The gliding movement, "telescopic movement," obtained by traction on the limb assists in confirming the diagnosis, while Trendelenburg's sign may also be looked for. To elicit this sign the patient is placed standing with her back to the surgeon and is told to raise one leg from the ground and then the other. On raising the sound limb the gluteal fold of that side is seen to drop a little and then remain stationary, while on raising the dislocated limb the gluteal fold is raised with the limb. This sign is seen in many abnormal conditions of the hip joint and is not diagnostic of congenital dislocation. The only certain sign is the feeling of the displaced head of the femur. A skiagram should invariably be taken; in a fat baby a certain diagnosis may be impossible without the aid of X-rays.

In bilateral cases the waddling gait, the lordosis, the high trochanters, with the presence of the femoral heads in their abnormal positions, make a diagnosis, as a rule, an easy matter. Coxa vara is the deformity most likely to be mistaken for dislocation. The diagnosis

depends chiefly upon the position of the head of the femur.

Treatment. This should be left in the hands of surgeons with experience of this deformity. The responsibility of making a diagnosis at a sufficiently early age to make a cure possible rests with the practitioner. It cannot be too strongly insisted upon that in every doubtful case a skiagram should be obtained. Failure to take this necessary step to clear up a doubtful diagnosis has allowed many a case of congenital dislocation to reach such an age before the nature of the case was recognized that hope of making a perfect cure by operation becomes out of the question.

The nature of every case of dislocation should at least be suspected even if a certain diagnosis can only be made by means of the X-rays. Eighteen months to three years is perhaps the most suitable time to operate, but success *may* be achieved up to the age of nine in unilateral cases, and six in bilateral. After, and sometimes before, these ages permanent reduction of the dislocation is accompanied by imperfect function, and the results are disappointing.

Results, perfect in every way, may be promised in the vast majority of cases that are dealt with before three years of age.

The treatment consists in reduction of the dislocation, either by manipulation, the so-called bloodless method of Lorenz, or by open operation, and fixation of the limb in plaster of Paris for several months, six or more. Walking in the plaster case is encouraged, as well as exercises and massage, which are continued after removal of the plaster till the position and function of the limb are normal or approximately so.

H. A. T. F.

DISEASES OF BONES

Inflammatory Affections.—The bones are liable to various grades of inflammation, acute, sub-acute or chronic, and such conditions may be caused by the ordinary pyogenic bacteria (notably by the staphylococci) or by the germs of specific disease, *e.g.* tubercle or syphilis. In every case, however, it is important to notice that it is the soft parts connected with the bone, *i.e.* the periosteum, marrow or epiphyseal growing tissue, which is the primary seat of the disease, whilst the dense parts of the bone are only affected secondarily.

Infective Osteomyelitis or Periostitis.—This represents the most acute form of infection of a bone by pyogenic organisms. The following bacteria are associated with it, their frequency being in the order mentioned: staphylococcus pyogenes aureus and albus, streptococcus pyogenes, pneumococcus, bacillus coli and bacillus typhosus.

The cases due to the first-named organism are probably more numerous than those caused by all the rest.

The primary focus of disease is usually the growing vascular tissue between the epiphysis and the diaphysis in the long bones of children. From this point of origin it may spread in various directions, the details of which modify the course and termination of the disease. The following are the more important of these varieties:—(1) **Local Periostitis.**—The inflammation spreads outwards, and strips up the periosteum over a small area without extending right up the shaft. (2) **Diffuse Infective Periostitis.**—Suppurative inflammation strips the periosteum off the whole diaphysis, which then necroses. (3) **Medullary Osteomyelitis.**—The inflammation spreads up the marrow, the veins of which become thrombosed, often leading to pyæmia. In a later stage death of the diaphysis and involvement of the periosteum follows. (4) **Acute Arthritis.**—Suppuration extends into the neighbouring joint either by bursting through the epiphyseal cartilage (in infants), by direct extension into the joint cavity, *e.g.* the hip or elbow, or by extension along soft tissues, *e.g.* the biceps tendon leading into the shoulder-joint. (5) **Chronic Abscess.**—Where the original infection has been mild and its focus of origin situated in the centre of a large bone, *e.g.* the lower end of the femur or the upper end of the tibia, the process may come to an end with the formation of a chronic abscess surrounded by densely thickened bone.

With the exception of the last two varieties, all cases of this disease present three stages, both in their clinical course and pathological progress. The first stage is that of infection, during which the patient is acutely ill, with high temperature and rigors. Severe pain is felt in the limb, which becomes swollen and brawny. Suppuration is set up, which sooner or later strips up the periosteum more or less extensively from the shaft of the bone. During this stage, lasting one or two weeks, acute septicæmia or pyæmia may arise, particularly when the causative organism is the streptococcus. In the second stage, after free outlet has been provided for the pus, whether by nature or art, the separated periosteum begins to lay down new bone. The acuteness of the symptoms, both local and general, has passed off, and the danger of fatal complications is much less. Eventually the periosteum forms an entirely new cylinder of bone, called the involucrum, which is pierced by several openings (cloacæ) to give vent to the purulent discharge. In the third stage, the symptoms of which do not differ from those of the second, the original shaft of the bone, or so much of it as has been denuded of periosteum, is separated from the

surrounding bone as a dead sequestrum. The duration of this process varies according to the size of the bone affected and the extent of the necrosis, but it is always a matter of months. If the sequestrum is removed, provided that there is a free outlet for the discharge, the cavity becomes filled by granulation tissue and recovery takes place. Owing, however, to the size or inaccessibility of the sequestrum, or to the thickness of the involucrum, this stage may be indefinitely prolonged, and there will be a liability for the patient to succumb to a chronic septicæmia or to lardaceous disease.

The treatment of this disease requires prompt and energetic surgical intervention, in order to avert the dangers of septic absorption, to limit the amount of bone destroyed, and to cut short the progress of the illness. As soon as the diagnosis is certain, or even reasonably probable, a free incision should be made down to the bone through the periosteum. If this is already widely stripped from the shaft, the latter should be removed, except in the case of the femur and humerus, and the periosteum may be trusted rapidly to regenerate it. If matters have not gone so far as this, the end of the diaphysis should be trephined or gouged away until the interior of the bone is freely exposed. If it has not been possible at an early stage of the disease to remove the affected part of the shaft, it will be necessary to wait until the involucrum has been formed and the sequestrum separated. Then the cloacæ are to be enlarged and the dead shaft removed.

Local Periostitis and Osteomyelitis.—When a bone is the seat of some local trauma, *e.g.* a compound fracture or contused wound, a localised inflammation, suppuration or necrosis may result. Such conditions must be treated on the general principles laid down above, by free incisions as soon as suppuration is evident, and by removal of dead bone as soon as possible.

Tuberculous Disease.—Tuberculous infection of the bones produces an exceedingly slow and chronic kind of inflammation, which has a special predilection for cancellous tissue and the growing parts of young bones. The slow progress of this disease allows time for the dense parts of the bone to become softened and eroded. The most characteristic lesion is known as **Caries**, which is in reality an inflammatory rarefaction. This caries may be associated with patches of necrosis, or with extensive suppuration. The suppuration is, however, of the kind peculiar to tuberculous disease, *i.e.* it is unassociated with the signs of inflammation, forming the so-called cold abscess. The pus from such an abscess contains neither cells nor bacteria in a recognizable form.

The following bones are liable to tuberculous

disease: the vertebrae (causing Pott's disease of the spine), the ribs (periostitis with cold abscess), the cancellous bones of the carpus and tarsus, and the phalanges, pelvis and the long bones. In the last case it is usually the epiphysis in which the disease originates, and the common result of this is the ultimate infection of the neighbouring joint. The treatment of tuberculous bone disease is of three kinds:— (1) Rest of the affected part with constitutional treatment. This is to be given a full trial in all early cases. The rest is attained by splints, plaster casing, or recumbency in bed with weight extension, but the confinement to bed must be curtailed as much as possible, so that the patient shall not be deprived of fresh air. Usually a few weeks in bed will suffice to lessen the muscle spasm, and then some form of retentive apparatus can be applied for months or years. In the meantime, tuberculin should be given according to the general principles laid down elsewhere, and the diet should be on generous lines. (2) Operation. As far as the tuberculous disease of the bone is concerned, operation will only be indicated when the above methods have failed to arrest the disease, or when a sequestrum or abscess has formed or a pyogenic infection occurred. Such an operation will consist in free removal of the diseased parts of the bone where these are accessible, scraping out of abscess cavities, removal of sequestra and filling up the cavity left with a paste containing iodoform or bismuth. (3) Amputation of a limb will be necessary when the disease has become very extensive, destroying several joints, *e.g.* the carpus or tarsus in unhealthy subjects, or if there is intractable sepsis causing hectic or lardaceous disease.

Syphilitic Disease.—In the late stages of the acquired as well as the inherited disease any or all of the bones may be affected. The only form of bone lesion earlier than the tertiary stage is a kind of local periostitis of symmetrical distribution, forming the so-called hard nodes. The two most characteristic affections of the bones are destruction, with formation of gummata and a chronic osteosclerosis. In cases where the diseased bone lies close to a cutaneous or mucous surface, its covering is generally broken sooner or later and chronic septic changes supervene.

The cranial bones, especially the frontal and parietal, become the seat of soft fluctuating swellings. From these a gummy material escapes and a patch of bare bone is left exposed. The surface of the cranium becomes furrowed and worm-eaten by necrosis and periostitis going on side by side. The whole calvarium becomes very thick and dense. Certain of the *facial bones*, especially the vomer, ethmoid and

nasal bones and the hard palate, may be destroyed by sub-mucous gummata or by the extension of tertiary ulceration. These changes destroy the bridge of the nose and the septum, and cause perforation of the palate.

The long bones are very liable to be affected by a slow and diffuse osteoperiostitis, which causes them to become immensely dense and thick. The tibia, femur, humerus and arm bones are liable to this affection in the order named. This lesion causes constant aching pain, which becomes much worse when the patient is warm in bed. It is of indefinite duration and leaves permanent thickening of the affected bones.

The bony manifestations of syphilis in the *inherited disease* are generally similar to those just described, with the following peculiarities: the skull presents thick bosses (Parrot's nodes), with intervening areas of defective ossification. The bridge of the nose falls in and the palate becomes narrow, high and arched, owing to the destruction of the septum nasi.

Acute Epiphysitis may occur in the first year of life, it may produce separation of the epiphyses or acute arthritis. The epiphyses adjoining the knees, elbows and wrists are those chiefly liable to this affection, which is often symmetrical.

Treatment. Apart from the general treatment of the disease, there is but little to be done in the way of direct surgical intervention for syphilitic bones. Operative interference with gummata or chronic osteitis is very unlikely to do good and involves the great danger of introducing septic infection.

Achondroplasia.—This disease consists in a defective growth of all the bones which develop from cartilage. It is often hereditary, but its results do not become manifest until some years after birth. The shafts of the long bones do not grow in length, owing to the defect in the epiphyseal cartilages, but they attain their normal thickness by growth from the periosteum. The general effect of this is to make the adult a short and thickset dwarf; and whilst the cranium is normal the face and jaws are stunted.

Osteomalacia.—This consists in a softening of the bones, which results in bending and fractures. In almost all cases its victims are women in whom the disease begins during pregnancy. Its onset is accompanied by deep-seated pain in the spine, pelvis and leg bones with emaciation and exhaustion. The limbs become bent or broken and the pelvis deformed. Its treatment is by oöphorectomy, it being presumed that the internal secretion of the ovaries is responsible for the disease.

Osteitis Deformans.—A rare disease affecting old men, in which the long bones become bent

and thickened, with severe aching pain. The skull becomes thickened and enlarged.

Acromegaly.—A condition of bony overgrowth beginning in young adult life, affecting the jaw, hands and feet, as well as the long bones, and leading to gigantism. It is associated with overgrowth of the anterior part of the pituitary body. It is often accompanied by headache, lassitude and some abeyance of the sexual functions.

New Growths of Bones.—The only certainly innocent tumours of bone are cartilaginous or bony outgrowths. Chondromata and cancellous exostoses arise as multiple outgrowths from the neighbourhood of the epiphyseal cartilages, and principally from those near the shoulder, wrist and knee. The chondromata also affect the bones of the hands and feet in rickety children. A very hard kind of tumour is the ivory exostosis which grows only from the bones of the face, particularly the lower jaw and bones round the orbit. The treatment of all these should be removal in those cases where they cause pain or disfigurement.

Malignant Tumours: Sarcoma.—This tumour may begin to grow from the periosteum or from the cancellous tissue in the interior of bones. It is usually a soft, rapidly growing tumour of the most intense malignancy. It often begins at the site of some injury, and is especially liable to affect the jaw or any of the long bones of the limbs, the femur being perhaps its commonest situation. At first it is very difficult to distinguish from an inflammatory affection, *e.g.* local periostitis or tuberculosis. Its comparative painlessness, together with its rapid and steady growth, are the most characteristic distinguishing features. Treatment is by free removal, *i.e.* by amputation of the jaw or limb. In a few cases the injection of Coley's fluid has brought about a cure.

Myeloma.—This is a much less malignant type of growth than the last. It always begins in the interior of the bones, where it produces a steady enlargement, the overlying bones becoming expanded and as thin as an eggshell. The growth is very soft and vascular and contains a number of multinucleated giant cells. It occurs in the jaws as a growth which fungates from an empty tooth socket (epulis), or as a central growth from the limb bones, especially those ends adjoining the shoulder, wrist or knee joints. The treatment is by free local removal.

Secondary Malignant Growth.—This is usually a carcinoma and occurs most frequently in the comparatively chronic cases of this disease, *e.g.* scirrhus of the breast. Its commonest situation is in the humerus, vertebræ or femur, and it causes spontaneous fractures, which may, however, unite.
E. W. H. G.

JOINTS, EXCLUDING TUBERCLE

The non-tuberculous diseases of joints may be due directly or indirectly to microbic infection, as in the case of septic, gonorrhœal or syphilitic arthritis; or they may be non-infective in origin, like traumatic synovitis or hæmarthrosis. Tuberculous inflammation itself is only a form of infective disease which has gained somewhat undue prominence on account of the frequency with which it occurs in civilized countries.

Synovitis

The synovial membrane is the most vascular tissue in a joint, and it is therefore the most easily inflamed. Some degree of synovitis is present in every inflamed joint, but the character of the synovial effusion varies greatly, in some cases it is abundant and watery, as in hydrops; in other cases it is viscid, as in osteoarthritis, and in yet other cases it is scanty and plastic, that is to say, it readily allows adhesions to be formed within the joint. It is met with in its simplest form when it is the result of a sprain. The joint becomes swollen and painful, but the swelling quickly subsides in persons who are ordinarily healthy and leaves a normal joint. Rest for a short time, followed by massage and passive movement, is usually the only treatment required in cases of traumatic synovitis. But there is an injury to the knee which is so often treated as a simple sprain and with such very unsatisfactory results that it is worthy of more detailed consideration. It is known as "internal derangement of the knee joint," and it was first described by William Hey (1736-1819), the great Leeds surgeon.

Displaced Semilunar Cartilage

The condition described by Hey is now known to be caused by an injury to one or other of the semilunar cartilages of the knee. The accident is more frequent now than it used to be, apparently owing to the greater prevalence of athletics, for the patients usually state that it happened in the gymnasium or on the football field. It occurs, therefore, more frequently in men than in women and the internal semilunar cartilage is more often injured than the external. The cause is nearly always a sudden twist of the joint whilst the knee is in a state of partial flexion.

Symptoms. The injury is followed at once by a painful locking of the joint, which is usually sufficient to bring the patient to the ground. The locking may be only temporary, when the patient is able to limp home; or the joint may remain fixed in flexion or extension—partial or complete—until it is set free by skilled manipulation, which may require an anæsthetic before it is successful. The injury is always followed

by a serious synovitis, but its great and distinguishing characteristic is the tendency to recurrence from quite trivial causes when there has been one well-marked attack.

Diagnosis. The history of the accident, the fixation of the joint, and the recurrence of the locking is sufficient to establish the diagnosis, but in spite of this the accident is nearly always treated as a simple sprain. Rest, extension of the joint by means of a back splint, and the use of evaporating lotions serve to subdue the synovitis, but unless the nature of the injury is diagnosed the cure is incomplete.

Morbid Anatomy. Examination of many joints shows that several different conditions may produce similar symptoms and that the severity of the accident bears no necessary relation to the extent of injury to the cartilage. In the simplest cases the wrenching of the joint may produce a mere slipping of the cartilage as a whole, due to a tearing of the fibres of the coronary ligament, which attaches it to the head of the tibia. In other cases the cartilage may be torn across. The torn ends may lie flat and in good apposition, causing but little inconvenience until an additional wrench may displace one or other fragment and lead to interference with the movement of the joint. The torn ends are sometimes twisted or tilted upon themselves, so that they lie vertically instead of flat in the joint. The cartilage may be torn into several pieces transversely, or it may even be torn into ribbons concentrically. It seems probable that displacement of the internal cartilage is usually associated with some laceration of the internal lateral ligament of the joint.

Prognosis. When a semilunar cartilage has been displaced in the knee it may become fixed again, and it is quite possible for a torn cartilage to repair itself by firm fibrous tissue. It is desirable, therefore, to replace the cartilage as accurately as possible in position and to keep the leg at rest until time is allowed for repair. Repeated recurrence, incomplete relief of the symptoms, or continued hampering of the movements of the joint call for operative measures, and the prognosis of operation is good if care be taken to avoid septic infection. The wound heals easily and there is free movement in the joint afterwards.

Treatment. It is impossible to tell the exact nature of the injury to the joint immediately after the accident which causes it. But when the patient is seen shortly after the accident, and there is reason to suspect that the internal semilunar cartilage has been torn or displaced, a deliberate attempt should be made to manipulate the joint until the patient regains complete freedom of movement. The proper manipulation in these cases is acute flexion, lateral deviation and rotation inwards followed by full

extension. The joint is afterwards fixed in full extension until the effusion subsides, after which the patient is allowed to walk, precautions being taken to prevent any lateral strain. If these methods fail, or when the original condition has been badly treated and the patient is left with a chronically inflamed joint which is insecure, painful and locking, an arthrotomy should be performed and the cartilage should be removed. It is best to do the operation with the leg hanging over the end of the table. It is more important to remove the anterior portion of the cartilage than the posterior. It is better not to put on a splint after the operation, and the surgeon should bear in mind that the operation is attended with much pain, which will be diminished in proportion to the care with which he stops the bleeding before closing the capsule.

Loose Cartilages

Loose cartilages in joints produce symptoms which may easily be mistaken for those of a slipped cartilage when they occur in the knee. But they are also found in other joints, more especially the elbow, shoulder and hip. They produce locking and weakness of the joint, but there is usually no history of injury. It often happens, too, that the patient knows of the existence of the loose cartilage and is able to make it project beneath the skin and capsule of the articulation.

These cartilages always consist of hyaline cartilage. They are formed in the synovial fringes, or in rarer cases they may be a portion of the articular cartilage itself which has been separated by a slow process of exfoliation. They are usually single, but are sometimes very numerous. The treatment consists in removing the cartilage, taking the precaution to fix it before the patient is anaesthetized, as it sometimes happens that the cartilage slips into the recesses of the joint, where it is difficult to find it.

Suppurative Synovitis

Suppurative synovitis is more frequently a process of secondary infection in cases of pyæmia than the result of direct wounds of joints. When a large joint like the knee or shoulder is involved there is great constitutional disturbance, with localised pain, swelling, redness and heat. The joint should be laid open freely and in such a manner as to secure effective drainage. It should be drained by tubes rather than by gauze wicks, and even long-continued drainage does not necessarily lead to ankylosis, though there is generally some impairment of movement due to fibrous thickening. Massage and passive movements of the joints should be employed as soon as the active inflammation has diminished.

Hæmarthrosis

A passive hæmarthrosis, coming on without adequate cause, is usually hæmophilic in origin (see *Hæmophilia*). It occurs in children and young adults, with the history that the patient bruises easily or that he is "a bleeder." The knees, ankles, wrists or elbows become hot, swollen and painful, and the body temperature may be raised. Fluctuation can be obtained, and it is often difficult to avoid making a diagnosis of suppurative synovitis, or acute rheumatism. Evidence of bruising over the affected joints or in other parts of the body, coupled with a history of previous attacks in the same child or in other members of the family, may prevent so disastrous a mistake. The treatment consists in keeping the joint absolutely at rest until the swelling has subsided. This is best done by enclosing it in a poroplastic or plaster of Paris case. Massage should be ordered early. When a joint has been repeatedly affected by passive hæmorrhages the articular cartilages become seriously injured, the articular ends of the bone become "lipped," the synovial membrane is thickened and blood-stained, and the naked-eye appearances are somewhat similar to those seen in advanced osteoarthritis. The movements of the joints are materially impaired or may be wholly lost. They are usually painful. Fresh horse serum in ten c.c. doses, either injected or given by the rectum as an enema, has sometimes yielded good results. The dosage should be considered most carefully as dangerous symptoms may arise from frequent administration (see *Anaphylaxis*).

Syphilitic Diseases of Joints

Syphilis often causes inflammation of the various tissues entering into the formation of the joints, but its influence in producing disease in them has only lately been recognized, since it was long described with tuberculous disease under the general classification of white swelling—tumor albus. It is indeed a question whether a syphilitic inheritance does not sometimes predispose to tuberculous joint trouble, or whether those who have suffered from tuberculous arthritis in their youth will not be more liable to gummatous synovitis if they afterwards acquire syphilis. The earliest sign of joint trouble in acquired syphilis may be

Arthralgia or Neuralgia

Symptoms. The patient complains of a neuralgic pain first felt a few weeks after inoculation and in some cases even before the appearance of any other secondary symptoms. The pain may be diffused over the whole joint or localised over various points. It is worse at night than in the daytime, and carefu

examination fails to show signs of any local inflammation.

Diagnosis. The persistence of the pain, the absence of fever or swelling of the joints, and the failure of salicylates to relieve it should distinguish syphilitic arthralgia from rheumatism. Gonorrhœal arthritis is accompanied by signs of local inflammation, it is generally limited to a single large joint, and the pain is much greater.

Treatment. Left untreated or treated incorrectly the neuralgia lasts indefinitely, but the administration of mercury in the usual medicinal doses speedily cures it, and even the local application of mercurial ointment under the mistaken notion that it is tuberculous in origin may accidentally give relief.

Syphilitic Synovitis

Synovitis occurs in acquired syphilis in two forms, the one is painful and intermittent, the other chronic and painless. The painful form is characterized by the rapid effusion of fluid into one of the larger joints. It is a secondary manifestation, and there is not much difficulty in recognizing its cause, as other signs of secondary syphilis are always present. The treatment consists in giving mercury either alone or in combination with potassium iodide, the swollen joint being strapped with Scott's dressing or some other ointment containing mercury.

Chronic synovitis runs its course with so little pain that it is generally discovered accidentally. It is more common in women than in men, the knees are most often affected, and the swelling is symmetrical.

Examination shows that there is considerable serous effusion, but the affected joints are never tense nor are they equally swollen. There is neither heat, tenderness nor any great limitation of movement. The affection runs a very chronic course, it is apt to recur, destructive changes occur in the joint and ankylosis may take place.

Treatment. The ordinary measures of rest, strapping and mercury should be tried first. If the condition remains stationary in spite of treatment, or if increased creaking on movement shows that the inflammatory changes are progressive, it may be necessary to open the joint and allow the synovial fluid to escape.

Symmetrical Synovitis of Children

A similar condition occurs in children with inherited syphilis. It was described by Mr. H. H. Clutton in 1886, and such children are often said to have "Clutton's joints." The knees and shoulders are affected most frequently, but the ankles and wrists are sometimes involved. The average age of the children is thirteen and they are usually between eight and fifteen years old. The synovitis is characterized by its symmetry,

freedom from pain, long duration and the amount of movement which remains in the joints throughout the whole course of the attack. There are often other symptoms of inherited syphilis. Interstitial keratitis accompanies or precedes the synovitis in a large proportion of cases.

Course. The swelling may remain unchanged for many months, and neither the application of splints nor prolonged rest seem to relieve the condition. The chronic character of the swelling is interrupted from time to time by periods of active increase without any apparent cause, and relapses may occur even when the patient seems to be cured.

Diagnosis. The condition may be distinguished from tuberculous synovitis by its symmetry, by the absence of wasting of the limb, by a much slighter tendency to ulceration and consequently by freedom from pain, and lastly by the absence of the triple displacement which is so marked a feature in chronic tuberculous disease of the knee when it has lasted for some length of time. The diagnosis between syphilitic and tuberculous synovitis is sometimes so difficult that it is necessary to employ Wassermann's test or to inoculate a guinea pig with some of the synovial fluid.

Treatment. The treatment consists in strapping the affected joints with mercurial ointment whilst mercury and iodide of potassium are given simultaneously. The fluid is then rapidly absorbed and the thickened synovial membrane returns to its natural condition after a longer or shorter period. When these measures fail—and they do so more often in cases of simple hydrops than in those where the synovial membrane is markedly thickened—it is best to open the joint and let out the synovial effusion.

Gummatous Arthritis

Gummatous inflammation of the joints occurs both in acquired and inherited syphilis, the stress of the disease falling sometimes upon the synovial membrane and sometimes upon the bone itself.

The knee is most often affected and the inflammation is generally confined to a single joint. The patient complains that the joint is swollen and that it moves awkwardly on account of its size, though it is not necessarily painful.

Examination of a case of gummatous synovitis shows at first sight that the joint bears a close resemblance to tuberculous inflammation. It is distinguished from this disease by the absence of wasting of the limb, because there has been no disuse, and by the freedom with which the joint is employed for its ordinary purposes. The disease, too, is often associated with other evidence of syphilis, for there may be rupia, nodes, gummatous ulcers, caries and necrosis.

When gummatous synovitis is seen in children it is distinguished from tuberculous synovitis by the slower course, less pain, better movement, less wasting of the limb, as well as by the slighter tendency towards suppuration and fungation. The cartilage remains unaffected for a long time, and there are consequently no starting pains to awaken the patient when he falls asleep and cause the "night screaming" which is so characteristic a feature in tuberculous arthritis of the knee and hip.

Treatment. These cases of gummatous synovitis respond very readily to treatment by mercury, even though the patient be allowed to go about his ordinary work, whether at school or in business. It should be remembered, however, that in a certain proportion of cases there is a true tuberculous infection superadded to the gummatous infiltration of the tissues, and that, as the French say, "syphilis has made the bed on which tubercle is born."

Chondro-Arthritis

Chondro-arthritis is that condition in which the articular cartilages are destroyed by a process of serpiginous ulceration which is generally associated with gummatous periostitis and in which the bones are secondarily affected. It is fortunately a very rare condition and is one of the last manifestations of inherited syphilis. The diagnosis is not difficult. The patient shows signs of inherited disease and the skiagrams of the affected joints show characteristic appearances. Treatment in the later stages is not of much use, but in the earlier conditions the effects of Salvarsan may be tried if the injections be afterwards followed by a course of mercury.

Tabetic Arthropathy

Charcot's disease of the joints is so frequently associated with a previous history of syphilis that it is impossible to disbelieve that the spirochæte pallida stands in causal relation to the nervous changes which produce it.

A single joint is usually affected, though the changes are sometimes bilateral. The knees, ankle, hip and tarsal bones are affected more often than the shoulders, elbows and wrist. A few cases are recorded where the articulation of the lower jaw has been involved. It occurs in men as often as in women, and the joint affected seems to be determined by the character of the patient's occupation, for the joint most used is most likely to show signs of disease. In 132 cases of tabetic arthropathy the joint was affected twenty-one times during the premonitory period of tabes; thirty-eight times between the first and fifth years; thirty-two times between the fifth and tenth years, and forty-one times after the tenth year from the initial symptoms of tabes, viz. Argyll-Robertson

pupil, inco-ordination, absent knee-jerks, with gastric crises and lightning pains.

The affection is rarely painful, and the first signs usually take the patient by surprise, though he may have felt some lightning pains in the neighbourhood of the joint which he has attributed to "rheumatism." The onset, therefore, always seems abrupt, and it may be so sudden that a patient falls owing to his legs giving way beneath him as he walks or he complains that he has dislocated the joint or even broken the bone without knowing how the accident happened.

Signs. Examination of the joint shows that it is swollen and, if it is seen early, the swelling is limited to the joint, though the whole limb becomes swollen, and sometimes so rapidly as to make it probable that the capsule of the joint has given way and has allowed extravasation of the synovial fluid into the cellular tissues. The swelling reaches a maximum in a few days and diminishes slowly. A skiagram shows that the joint is completely disorganized, partly from absorption of the articular ends of the bones, and partly from disintegration of the ligaments. The joint can therefore be moved in many abnormal directions so freely that it is said to be "flail-like." In spite of this abnormal mobility the patient goes about with comparative freedom, only complaining of the weight of the limb and that he is easily tired. Very little muscular wasting occurs so long as the patient uses his limbs, but in the later stages the inco-ordination, shortening and weakness of the limb cause the patient to be bedridden. The arthropathy here described is the ordinary hypertrophic form, but there exists a rarer atrophic variety in which there is more or less complete wasting of the ends of the bones.

Treatment. The treatment of Charcot's disease can only be palliative. Massage and passive movement may be employed in the earlier stages; complete rest and the application of a well-moulded leather splint are useful in the later stages. Operative interference is not to be recommended unless the joint is very painful and all other means have been exhausted. Neither mercury nor arsenic nor iodide of potassium have any influence in retarding the progress of the arthropathy.

Syringomyelia

The joint lesions occurring in syringomyelia form an interesting group. The changes are associated with a destruction of the grey matter of the spinal cord due to degenerative changes in the neuroglia. The degeneration results in the formation of spaces close to the central canal of the cord, into which they sometimes open. The disease is usually confined to the upper part of the cord. The shoulder, elbow,

wrist and vertebral column, therefore, are affected more often than the other joints. Men are more frequently affected than women.

The initial symptoms are not very dissimilar to those of Charcot's disease. The joint swells suddenly and painlessly without heat or redness, and the effusion may disappear equally rapidly. Sooner or later spontaneous dislocation occurs, and in time the joint is markedly deformed. The process is painless throughout and is often associated with suppuration, the suppurative process starting in accidental lesions which have been left untreated because they have not been felt. The joint affection also occurs in an atrophic form, in which extensive portions of the bone are absorbed, as well as in the more usual hypertrophic variety. Fractures and alterations in the shape of the affected bones are not uncommon. The cause of the disease is wholly unknown, though injury is, as usual, invoked.

Syringomyelic arthropathy may be distinguished from the tabetic form in well-marked cases by ascertaining that the patient has diminished sensibility or even complete anæsthesia for touch, pain or heat. The hands nearly always show signs of trophic disturbance, and lateral curvature of the spine is an almost constant feature. A skiagram will distinguish between the lesions of joints in syringomyelia and the swelling in their neighbourhood caused by periosteal and chondrifying sarcomata.

The treatment must be wholly symptomatic and on the principle that the parts, being insensitive, are liable to serious injury and that the patient has very slight power of resistance to microbic infection.

Osteoarthritis

The term osteoarthritis is convenient for clinical purposes as it includes a number of forms of joint disease which have a general resemblance to each other but are of wholly different origin and reach a similar end by a variety of pathological processes. The picture called up by the term osteoarthritis is a painful affection of one or more joints in a person advanced in years, very chronic in the course it runs, associated with alteration in the shape of the joint, with creaking and with impairment of movement. It is associated with, and is perhaps caused by, the absorption of toxins, the micro-organisms which produce them being situated in the alimentary canal, as in those who are habitually constipated, in the mucous membrane of the mouth, as in persons with pyorrhœa, or in the genito-urinary tract, as in cases of leucorrhœa or gonorrhœa. Osteoarthritis may follow purely mechanical injuries, for it is seen after fractures involving the joints, after dislocations, and as a result of repeated hæmarthrosis

in cases of hæmophilia. It is common after injuries to the nerves and as an arthropathy connected with disease of the central nervous system.

Symptoms. It is often difficult to fix the time at which the first symptoms of a chronic osteoarthritis first showed themselves, although in some cases the affection begins suddenly. The patient complains in the more chronic cases that he has a little stiffness or burning pain at some one point in a large joint. The stiffness wears off with use and the pain varies with his state of health and with the weather, so that he looks upon it as "rheumatic." The relief obtained from aspirin confirms him in the diagnosis, whilst the locally tender spot is cured temporarily by the counter irritation of a small blister. But the practitioner should not content himself with merely treating symptoms. He should make a resolute attempt to ascertain and treat the cause, although, in spite of every effort, there will always be some cases which appear, in the present state of our knowledge, to be idiopathic.

After a time the joints become swollen by synovial effusion, there is some wasting of the affected limb, and the pain alters in character. Instead of being localised and intermittent it is more continuous and neuralgic in character. The amount of pain varies greatly and may be wholly absent or may be replaced by cramp. Bier's treatment by passive congestion is sometimes useful in this stage. It consists in padding the limb above and below the affected joint with a layer of cotton wool and applying a thin rubber bandage over the padding just tightly enough to maintain a venous congestion of the joint without interfering with the arterial supply. The width of the bandage should not be less than two inches, and the longer the bandage the less tightly need it be applied. The congestion is maintained until the pain disappears and it is repeated when the joint becomes painful. In the later stages of the disease the joints become altered in shape, there is less synovial effusion but more creaking, and the movements may be hampered by changes outside or within the joint. Massage, passive movement and hot douching are useful at the beginning of this period, but the feelings of the individual patient must be consulted, for it often happens that rest in bed and the subsequent application of a well-fitting leather splint for a time will give more satisfactory results. Vapour-baths, radiant heat and high-frequency currents are all recommended, but in every advanced case the treatment is tedious and the results are discouraging. Bath, Buxton and Droitwich in England; Aix, Nauheim and Baden-Baden have special "cures" for osteoarthritis.

Tumours

The tumours of joints are so rare that they hardly need more than a few words of notice. The most common are fatty tumours—lipomata—of the synovial membrane. They are either single or they are multiple, when many synovial fringes are involved to form an arborescent lipoma. Sarcoma of the synovial membrane is seen occasionally and is always diagnosed at first as a tuberculous or gummatous synovitis. Its steady increase in size eventually leads to exploration of the joint and a microscopic examination of the thickened synovial membrane. Amputation should be performed, and the prognosis is good if the operation is done whilst the synovial cavity is still intact.

Exostoses springing from the intermediary cartilage, where the epiphysis lies wholly within the joint, occur with especial frequency in the knee. It is necessary to remember, therefore, in removing exostoses about this joint, that the articular cavity may have to be laid open before the exostosis can be removed.

Coxa Vara

The increased use of bicycles by tradesmen to deliver their wares has brought under treatment a much greater number of boys who ride them. They are fourteen to eighteen years of age, tall for their age, with well-developed legs, and they complain of pain and limping. When they are placed flat upon a couch one or both legs roll outwards into a position of complete external rotation. The hip joints are not swollen, flexion and extension are free. Adduction is usually unimpeded, but there is marked limitation of abduction. When both hips are affected there is lordosis, and the boy walks with a waddling gait like that seen in cases of congenital displacement of the hip. Measurement shows that the great trochanter has altered its normal relation to Nélaton's line. A skiagraph—which must always be taken—proves that the head of the femur has slipped upon the neck at the epiphyseal line, whilst the neck of the femur itself has become altered in shape, generally by arching so that it is convex upwards. The symptoms have been coming on gradually for several months, but it is only when the patient begins to suffer from muscular pain that he seeks advice. This condition is known as coxa vara adolescentium. It has only been clearly differentiated from tuberculous disease of the hip since skiagraphy has come into general use for purposes of diagnosis. A similar condition occurs in much younger children as a result of slight falls and other injuries of no great severity, the shortening of the limb being a marked feature in these cases. This condition is more acute in its onset and, except by the skiagraph, it is

difficult to distinguish it from the onset of tuberculous disease; indeed, it is difficult to persuade the parents by any other means that so slight an injury could have produced so serious a result.

Coxa vara is best treated by prolonged confinement in the horizontal position to take the weight of the body off the weakened head and neck of the femur. It is not possible to replace the parts in their normal position, but as the patient grows nature does much to restore the normal conditions. A weight and extension will often relieve the pain in cases of coxa vara in errand boys, but it usually passes off spontaneously after a few weeks' confinement to bed. Sandbags should be used to correct the external rotation of the thigh and leg, and a pair of crutches and calliper splints may be employed when it is considered advisable for the patient to get about. The treatment will probably extend over a year and it may be much longer. Operative measures are only required in neglected cases where the movements are much impeded and scissor-like progression is a feature.

D'A. P.

TUBERCULOSIS OF JOINTS

By far the most common period of onset is in the first two decades of life, and especially from the third to the tenth year.

The disease is invariably the result of infection with Koch's bacillus, which enters the body by inhalation or through the alimentary tract. In either case the point of ingress cannot usually be discovered, but these as the common avenues of infection have now been proved beyond all doubt by numerous observers. Tuberculosis joint disease should be regarded as a general infection in which the arthritis is a local manifestation.

The actual causal agent for the local lesion is still a matter of doubt, but the frequency with which the onset of the disease is preceded by a fall or other injury, usually comparatively slight, especially affecting the part selected by the bacilli, has led many to ascribe to local injury a prominent part in local tuberculous infection. The infection may be due to either the human or bovine type of bacillus.

Tuberculosis affecting joints is much commoner than tuberculosis confined to bones alone. The primary lesion may occur in any part of the bone or joint, but there are certain well-defined points of election.

In the long bones the extremities are most usually first attacked, but a primary synovial tubercle, extending later to the bone, may occur.

In the vertebræ central or sub-epiphysial origin is common in children; in adults subperiosteal infection is more common.

In the short long bones, such as the phalanges, metacarpal and metatarsal bones, infection in the centre in the form of a tuberculous osteomyelitis is common.

When the epiphysis and diaphysis are no longer distinct, the primary infection is usually immediately subjacent to the articular cartilage.

The disease is usually insidious in onset. The general symptoms are often indefinite, there is frequently malaise, some cachexia, and slight evening rise of temperature. Locally the pain is not often acute. Muscular atrophy and spasm about the site of the lesion are very early and important features, and there is generally swelling and tenderness at the infected site. This early stage is too often diagnosed as "sprain."

Mortality. Figures giving mortality rate are of little value. Under any conditions natural cure will occur in certain cases. Under the best conditions, with conservative treatment, ninety to ninety-five per cent. of patients affected should be discharged cured.

The treatment of tuberculous joint affections should be both general and local. A suitable climate at the seaside or in the country should be selected. High, dry and sunny districts are to be preferred if the country is chosen. A so-called "bracing" climate is especially valuable in chronic cases. The diet should be ample, in easily digestible form, and designed to suit the tastes of the individual. Milk and meat, if easily assimilated, should be largely prescribed.

Of drugs, cod-liver oil is often of value. Alteratives, such as arsenic, are indicated in suitable cases. Easily assimilated forms of iron should be used in the anæmia sometimes accompanying the disease.

Tonics are frequently of assistance and appropriate aperients should not be neglected.

Tuberculin as an aid to treatment, while highly commended by some, should still be considered *sub judice*. If employed, the dose to be used may be advantageously decided by repeatedly taking the opsonic index. The indiscriminate use of tuberculin is to be condemned.

Locally, conservative treatment is advocated. Radical treatment is recommended only when the disease can be completely removed by operation or under special circumstances to be presently indicated. The importance of adequate immobilization of the affected part should be most especially insisted upon in the conservative measures advised. To prevent reiteration the treatment of abscesses and sinuses—two common complications—merits description here.

Speaking generally, evacuation of abscesses by aspiration is recommended.

The abscess should be aspirated through as much healthy tissue as possible, the trocar should enter, where possible, on that side of the abscess where the abscess is least likely to extend.

Should the pus be fluid, the abscess may be completely evacuated at one aspiration, but it should be remembered that abscesses are often multilocular. Aspiration may have to be often repeated, but commonly the third or fourth aspiration effects the cure of the abscess.

If the pus is very fluid, injection of a ten per cent. solution of sterile iodoform in sulphuric ether exercises a drying and sclerosing effect and hastens the cure. The ether should be allowed to escape in gaseous form through the cannula, leaving a freshly precipitated iodoform on the abscess wall. The quantity of the solution to be injected should rarely exceed 10 c.c.

If the tissue about the abscess is infiltrated, a compound iodoform emulsion of the following composition is recommended—

Iodoform grammes v
Ether grammes x
Guaiaicol, Creosote āā grammes ii
Sterilized Olive Oil 100 c.c.

Dose 5-10 c.c.

Should the pus be caseous it may be liquefied by injecting the following solution—

Thymol 1 part
Camphor 2 parts
Sulphuric Ether 3 parts

Dose 2-5 c.c.

The former dose should first be employed, the larger dose may be used in very intractable large thick-walled abscesses. The action of this solution is physiological. It plays the part of a local irritant inducing the entry of phagocytes. These digest and liquefy the caseous pus.

The treatment of sinuses is still unsatisfactory. When due to an accessible sequestrum, this sequestrum should first be removed.

In many cases adequate drainage by gauze drains or alteration of position of the patient assists in closure. Sea-water baths, heliotherapy and change of climate are sometimes of great assistance.

Prominent among recent measures introduced for their cure is the employment of Beck's bismuth paste. Pure sterile bismuth subnitrate mixed with two parts of sterile vaseline, when injected into sinuses, particularly in old and chronic cases, has frequently a remarkable effect in procuring a speedy closure.

If cultures be taken of the organisms secondarily infecting the sinuses, vaccine therapy, by the use of autogenous vaccines, is sometimes

of great service, especially if followed by injections of the bismuth paste.

Tuberculous Disease of the Spine (*Syn.*: Spinal Caries, Pott's disease).—This, according to hospital statistics, is said to be the commonest form of joint tubercle. Various authors state that from forty to fifty per cent. of cases of tuberculous bone disease are spinal caries. It may occur at any age, but most commonly in children from three to ten years old. It is rather more common in males than females. The body of the vertebra is commonly attacked and, as already mentioned, the primary focus may be central, sub-epiphyseal or periosteal, the latter more commonly in adults. Two or more vertebræ may be simultaneously attacked, but much more usually the disease spreads from one vertebra to its neighbours, and infects the tissue in contact. The intervertebral cartilage is rather more resistant than the bone. Dorso-lumbar caries is commonest, while upper dorsal caries is most disfiguring and cervical caries most dangerous.

Symptoms and Diagnosis. The onset may be sudden, but is much more commonly insidious. The patient, usually a child, commonly refrains from undue movement, and prefers to rest in the recumbent position, often for choice on his belly. Pain, of an aching character, is complained of in the neighbourhood of the lesion, and is also very frequently referred, *e.g.* in the cervical region sub-occipital neuralgia or ear-ache is common, in the dorsal region "stomach-ache," and in the lumbar region sciatica. This referred pain may alone exist and local pain be absent, but careful palpation will usually reveal local tenderness. Pressure on the transverse processes of the vertebræ will elicit this more readily than palpation or percussion of the spine. Involuntary movement or jarring aggravates the local pain, and night cries—so-called "starting-pains at nights"—occasionally occur.

In early diagnosis unquestionably the most valuable sign is the manifestation of muscular spasm secondary to the inflammatory process, producing spinal rigidity. This rigidity is very characteristic. It is very noticeable in the gait of the patient, but is especially obvious when the patient is asked to pick up some article from the floor. In doing so the knees are bent and the back not curved but maintained stiff and rigid. In the case of a child it may be further tested by manipulating the spine with the patient lying on his belly, the lack of flexibility in active spinal caries in the region attacked then becomes very apparent. Apart from deformity the attitude of the patient is of importance in early diagnosis.

Primary deformity in spinal caries may be marked and is often extreme. Indeed, at one

time vertebral caries was rarely recognized until the characteristic deformity had appeared, and hence the term "angular curvature of the spine" was by many regarded as synonymous with spinal caries. It is caused by (1) destruction of bone; (2) the effect of gravity acting upon the weakened spine; (3) muscular spasm secondary to the inflammatory process; and (4) alteration in the intermuscular balance leading to certain muscles acting at an unduly great or diminished mechanical advantage, and ultimately becoming permanently contracted or attenuated. The effects of muscular spasm are more pronounced owing to the natural curves in the vertebral column, which allow the investing spinal muscles to act at greater mechanical advantage. Abscess formation may conceivably often assist in the production of deformity.

Secondary deformity occurs especially in the dorsal region and is the result of the displacement produced by the angular curvature and destruction of the vertebral bodies. The ribs become crowded together in the proximity of the lesion, and the sternum, especially in mid-dorsal caries, tends to become carinate. The viscera in both thorax and abdomen become correspondingly displaced, and their functions may be interfered with. Respiration may be impeded and become hurried and grunting in character.

Torticollis, hunching of the shoulders and flexion of the hip may occur as the result of muscular spasm when certain parts of the spine are affected, and may cause errors in diagnosis.

Abscess Formation.—In a considerable percentage of cases, from twenty to fifty per cent. according to various observers, an abscess may form secondarily to the spinal infection. Sooner or later, unless spontaneously absorbed, the abscess tends to point superficially, or else its pressure internally may give rise to symptoms which betray its presence.

In cervical caries it may appear at one of the triangles of the neck, or cause obstruction as a retro-pharyngeal abscess.

In dorsal caries it may follow the track of a thoracic nerve, emerging posteriorly, laterally or at the side of the sternum, or pointing anteriorly into the posterior mediastinum.

Lumbar caries, with abscess formation, results in lumbar, psoas, iliac or gluteal abscess.

In exceptional cases the abscess may proceed backwards into the spinal canal, producing a spinal pachymeningitis and possibly a compression myelitis. This occurs especially in caries in the cervical and cervico-dorsal regions, and results in a spastic paraplegia with, in some cases, loss of sensation, incontinence of urine, and even fæcal incontinence.

Treatment. The treatment of spinal caries

should be undertaken to (1) improve the general health of the patient and to increase his powers of resistance; to (2) heal the local lesion; to (3) prevent or correct deformity.

In active spinal caries a good result can only be obtained by treating the patient in a recumbent position. Indeed, in many cases the patient is so ill that any other position is impossible. But if the lesion is to be most speedily healed, not only must he be recumbent, but he must also be immobilized, and to prevent or correct deformity, traction, extension or hyper-extension of the spine is indispensable. Spinal extension or hyper-extension will usually abolish muscular spasm and prevent the deformity which it could cause, or may even correct a deformity which it has already caused.

These three essentials for treatment, recumbency, immobilization and hyper-extension, may be secured by employing a spinal board with

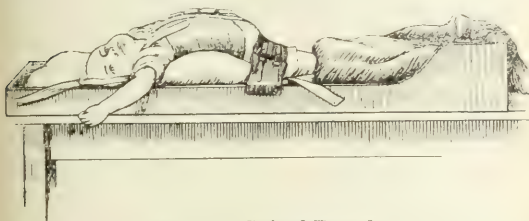


FIG. 1.—Spinal Board.

a jean jacket, as shown in the accompanying illustration.

The board should be made of light but strong wood, its edges should be raised to conveniently contain a firm horsehair mattress two to three inches in thickness, its lower edge should be raised some fifteen to twenty inches, to relieve the weight of the bedclothes and prevent the onset of foot-drop. The board should be some eighteen inches longer than the patient, and eight inches wider than his greatest width. Provision should be made at each extremity for head or leg extension. The bottom of the board should be perforated to facilitate the airing of the mattress.

Across the board, beneath the mattress, a cross-piece of wood or a small hard pillow should be appropriately fixed at the position which the angular curvature will occupy, so that the spine may be adequately hyper-extended.

The patient may be fixed in this hyper-extended position by means of a stout jacket which encircles his trunk. This jacket is attached to the board by webbing let in to the back of the jacket in the form of a St. Andrew's cross. Such an apparatus, which is a modification of that employed at the Maritime Hospital, Berck-sur-Mer, suffices for the treatment of any ordinary case of active spinal caries. It

is much to be preferred to the commonly used Phelps' Box or Double Thomas' hip-splint, neither of which satisfy the requirements already mentioned for adequate treatment. More efficient still is the back-door splint

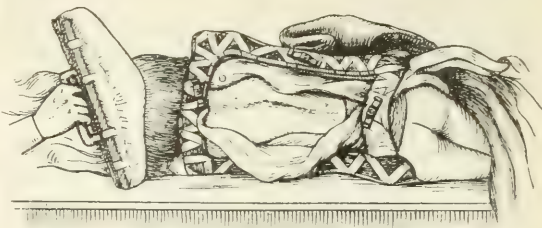


FIG. 2.—Back-door Splint.

(Fig. 2), or one of its modifications, which permanently immobilizes the spine and allows of progressive hyper-extension.

With this apparatus the attention required to prevent the patient's back becoming sore can be given without even turning the patient over or moving him in any way.

In cases of active cervical caries elastic extension should be applied to the head by means of a bridle pulling from chin and occiput. The jacket already described provides the counter-extension. The head may be fixed between sandbags, but this immobilization is very imperfect, and the adjustable box-splint apparatus here illustrated is much to be preferred.

Sooner or later the time arrives when recumbency may be abandoned. The change



FIG. 3.—Adjustable Box-splint Head-piece.

may be effected gradually by tilting the board more and more daily, until the vertical position is reached without complaint of giddiness from the patient.

Then, given a suitable case and the necessary skill in its technique, no form of spinal support is more effective than a properly applied plaster of Paris jacket. Such an apparatus

will maintain the patient safely immobilized for from three to six months, at the end of which time a removable jacket or spinal brace is usually permissible.

The best apparatus to use then is a jacket made of suitable material (celluloid for choice, because of its lightness, rigidity and elasticity), moulded on a cast of the patient. This ensures perfect fit, and therefore good fixation. Failing that, a Taylor's or other spinal brace is recommended.

What are the indications for radical treatment in spinal caries? If the conservative treatment of tuberculous abscesses advocated be employed, resort to radical measures becomes rarely necessary. Should difficulty arise in aspirating an abscess it may be incised and evacuated, and the incision immediately closed. This may be done in (1) retro-pharyngeal abscess, which may be evacuated through one of the triangles of the neck, but which should never be opened in the pharynx; (2) in a mediastinal abscess which is increasing in size or causing dangerous symptoms. Laminectomy or costo-transversectomy may be necessary in paraplegia, when prolonged conservative treatment has failed to effect a cure.

Tuberculous Disease of the Hip-joint.—Tuberculous disease of the hip-joint is usually comparatively slow in its onset. Not infrequently it is first manifested by the patient walking with a slight limp. The common sequence of events is then as follows. The leg on the affected side is slightly flexed at the hip-joint and becomes abducted and everted. On being questioned at this stage the patient usually admits pain, sometimes severe in character, and commonly relates a history of some slight antecedent injury to the joint. Starting-cries at night, which do not awaken the patient, are then common, and rapidly the deformity increases, walking becomes more difficult, and examination shows the thigh and gluteal muscles on the affected side to be much wasted and the muscles to be in a state of spasm. This spasm affects also the psoas muscle, and there is lumbar lordosis. Movements at the hip-joint are much restricted and are soon impossible. The order of disappearance is generally as follows: circumduction and rotation, adduction and abduction, flexion. The abduction gives the appearance of apparent lengthening of the affected leg, due to the necessary tilting of the pelvis downwards on the affected side. The first deformity produced is caused by distension of the joint cavity with excess of synovial fluid.

At a later stage the character of the deformity alters, and adduction replaces abduction, the foot is now usually inverted, flexion and lordosis persist. The pelvis on the affected side tilts

upwards when the erect posture is adopted, and apparent shortening occurs.

With the progress of the disease intra-articular destruction to varying degrees occurs.

At any stage abscess formation is common. It may produce extreme tension within the joint and cause extreme pain. Some part of the capsule at length ruptures, and the abscess points anteriorly or posteriorly or even perforates the acetabulum, and may be palpable per rectum.

During the whole progress of the disease the growth of the limb is retarded, sometimes markedly so.

Treatment. This should be commenced at the earliest possible moment. In the acute stage recumbency should be insisted on, and extension of the affected limb advocated. The extension gradually abolishes the muscular spasm, and is of the utmost importance in correcting or preventing deformity.

The patient should rest fixed on a flat hard mattress on fracture-boards—a Liston long splint should be attached to the sound side—and extension applied, bearing in mind the following rule: lordosis, if present, should be corrected by further flexing the affected limb until the spine is flat upon the bed—the anterior superior iliac spines should then be on the same horizontal plane and the straight line joining them should be at right angles to the long axis of the trunk.

Extension applied to the femur in the direction the femur now occupies will act effectively. The weight should be just sufficient to abolish the spasm of the muscles—usually from three to six pounds will be found sufficient. Adduction will be found most difficult to treat; it may be corrected by counter-extension applied by means of a perineal band taking a purchase on the ischial tuberosity on the side not affected.

Should fibrous or bony ankylosis not have occurred, a rapid and at the same time a perfectly safe method of treating the disease is afforded by the administration of a general anæsthetic. The muscular spasm is then at once relieved and the limb can instantly, painlessly and safely be placed in extension in the desired corrected position, or the hip-joint immobilized in plaster of Paris. Forcible manipulation should never be attempted because of the danger of general dissemination of the disease. Eversion or inversion may be prevented by applying the extension strapping to the foot-splint here figured (Fig. 4), which is in use at the Maritime Hospital, Berck-sur-Mer. The sole of the foot is placed flat against the bottom of this splint, and all danger of foot-drop is at the same time avoided.

When the acute symptoms have subsided immobilization by means of plaster of Paris

carefully applied to the hip and extending from the ankle to the nipple line is recommended (Fig. 5). This ensures rest in the

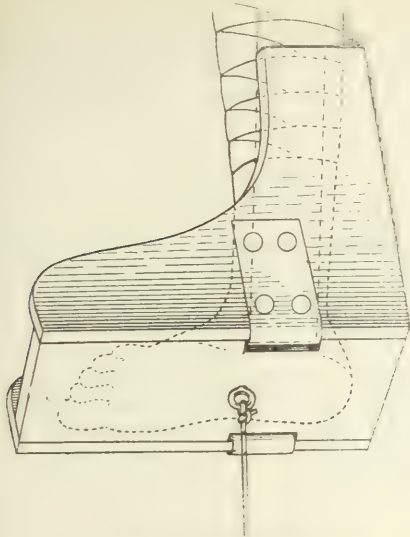


FIG. 4.—Foot-splint for Extension.

proper position. The plaster should be well moulded round the condyles of the femur and the iliac crests; a window cut in the neighbourhood of the hip-joint will permit all necessary observation of the joint. During convalescence a similar splint made of celluloid is admirable. For the first six months at least after recumbency is abandoned the patient should walk with the assistance of crutches and with a patten on the sound foot. The stage at which these various methods are adopted will depend on the progress made by the patient.

Under no circumstances is the employment of a Thomas' hip-splint advised, as immobilization with such a splint is necessarily imperfect and eversion of the foot cannot be prevented.

Radical treatment is best avoided, and excision of, or amputation at, the hip-joint is now rarely necessary.

Sacro-Iliac Disease is a rare tuberculous affection, and at least as common in adults as in children. The symptoms are pain, local tenderness increased by jarring, limp, and often some change in attitude. An abscess usually forms, which, if intra-pelvic, results in flexion of the thigh and may obscure diagnosis. In adults in acute cases "starting-pains" may be very severe.

Treatment. Conservative treatment should at first be tried, the pelvis immobilized and the legs strapped down, and if there is an extra-pelvic abscess it should be aspirated; should an intra-pelvic abscess form which does not speedily decrease in size after immobiliza-

tion, an attempt should be made to completely extirpate the disease if the area infected is not too extensive. Mere incision and drainage are inadequate.

Tuberculous Disease of the Knee.—Tuberculous disease of the knee may be primarily synovial or primarily osteal. The former is less common and probably confined to children, the latter much more common, and here usually the inner condyle of the femur or tibia is first affected, but any part of the bones forming the knee-joint may be first attacked.

The onset is commonly manifested by a sub-acute synovitis with effusion accompanied by some muscular spasm and pain. Full extension of the tibia at the knee-joint becomes impossible, and as a combined result of the pain and slight flexion the patient walks with a limp. Later the flexion is more marked, and accompanied by external rotation and subluxation of the tibia, forming the triple displacement so marked in untreated cases. There is usually well-marked localized tenderness.

Treatment. At first, rest in bed, with extension to abolish muscular spasm. Should triple displacement be commencing, extension of the

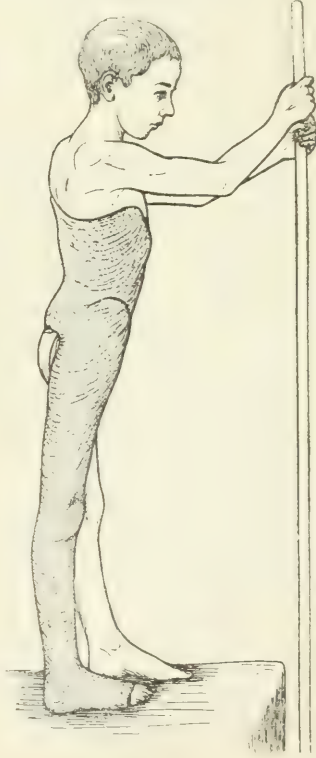


FIG. 5.—Plaster Case for Hip-joint Disease.

tibia should be assisted by counter-extension of the femur, which should be sufficiently flexed to allow the tibia to lie parallel to the trunk.

In many cases it will be found that the deformity may be most quickly reduced by repeated plaster applications, but in that case the plaster should extend above the pelvis and should be carefully moulded around the tuberosity of the ischium on the affected side. When the knee is straight a well-fitting Thomas' knee-splint is admirably effective and may be used in ambulatory treatment.

Parenchymatous infiltration of iodoform emulsion is effective, and Bier's congestive treatment is often of assistance.

If bony infection is localised before the joint is involved, radical removal of the diseased focus without opening the joint is the most rapid and effectual method of arresting the disease. Erasion is not commended and excision of the joint cannot be advised in children because of the flexion with ankylosis, which is almost inevitable, and the consequent shortening which results. In adults, however, early excision is often followed by excellent results and materially shortens the treatment. Thorough and complete removal of the disease is imperative if excision is attempted.

Tuberculous Disease of the Ankle.—This affection is more frequently synovial at first. The symptoms are usually sub-acute and are often mistaken for sprain. There is stiffness, limp, some pain, swelling which may be localised or diffuse.

Treatment. If the disease is confined to the astragalus complete removal of that bone is the best treatment, as the function of the foot is little impaired. Scraping operations should be avoided. If other bones are attacked, or if the disease is synovial, immobilization in plaster is preferable. Bier's treatment is often of assistance. Tuberculous disease of the bones of the foot, not involving the ankle-joint, is not uncommon. In early cases the removal of the bones affected is advised because of the tendency of the disease to spread, and because of the excellent results which usually follow.

Tuberculous Disease of the Joints of the Upper Extremity is relatively uncommon. In the shoulder it is usually manifested by pain, tenderness, limitation of movement and muscular wasting (usually most marked over the deltoid). On the other hand, painless abscess formation may be the first sign of the disease. If the disease is very localised its early removal by operation may be indicated, otherwise the joint should be immobilized in plaster of Paris, with the arm fully abducted, in case ankylosis ensues, inspection of the joint being maintained by means of a window. During convalescence a moulded removable splint will suffice. In the elbow the local signs are swelling, muscular wasting, rigidity, flexion, pain and tenderness. In children the disease should be treated con-

servatively, the elbow being flexed to a right angle and immobilized in plaster, thumb, elbow and shoulder in the same plane. In adults early excision is advisable.

In the wrist joint, swelling, rigidity, muscular wasting, generally palmar displacement, pain and tenderness indicate the disease. Treatment should be by plaster fixation and gradual correction of any deformity which may be present. H. J. G.

SURGICAL DISEASES OF THE SCALP

Contusion of the Scalp.—Effusion of blood into the subcutaneous tissues produces a firm smooth swelling which moves with the scalp. Hæmatoma under the aponeurosis is as a rule not extensive, but this depends on the size of the torn vessel. The edges of the swelling may be raised and firm whilst the centre is soft and fluctuating. It is important therefore to differentiate such a condition from depressed fracture. Sub-periosteal hæmatoma is rare except in newly born infants. No special treatment is necessary as a rule for these conditions. Absorption of clots may be hastened by massage or, in the case of large effusions, the blood may be aspirated or removed through a small incision with subsequent elastic pressure.

Wounds of the Scalp.—As the scalp is very vascular wounds bleed freely, and for the same reason large portions may be semi-detached without losing their vitality. The first step in treatment is to shave the surrounding hair and to disinfect the skin and wound. Ligature of bleeding points over forceps may be difficult because of the density of the subcutaneous tissues, and a catgut suture passed around the vessel may be required. In every case an examination must be made with finger or probe for fracture of the skull. Interrupted sutures should be inserted and a small drain or piece of rubber dam placed at one corner if the wound is extensive. For severe injuries a general anæsthetic may be required to facilitate cleansing or to stop bleeding. In cases of incomplete avulsion the question of replacing the scalp will depend on the blood supply of the torn flap. It is surprising how often this suffices. In complete avulsion, or when the vitality of the scalp fails, Thiersch grafts should be applied to the denuded surface.

Suppuration.—If sepsis develops in a wound stitches must be removed and the wound sprayed with hydrogen peroxide. Fresh incisions may be necessary for drainage. When pus collects beneath the aponeurosis it is apt to spread widely and is associated with œdema and cellulitis of the overlying tissues. Incisions for abscess should be made parallel to the main vessels of the scalp, and drainage must be free

and dependent. Secondary suppuration in lymphatic glands may occur in the parotid, mastoid or occipital groups, but is most frequent in the occipital glands, following pediculosis and eczema of the scalp.

Tumours.—Sebaceous cysts should be removed with local anæsthesia. One per cent. novocaine is injected around the cyst and on its deep aspect. The cyst is then transfixed through its base and divided from within outwards and the lining membrane pulled out with dissecting forceps. If the cyst is large it should be dissected out intact with an ellipse of skin, and if the tissues are matted it is also better to dissect out the cyst entire or to remove the wall piecemeal. Dermoid cysts are subcutaneous and often rest in a depression or gap in the bone. They should be dissected out with local anæsthesia. Adenomata from the sebaceous or sweat glands and flat-topped warts are both fairly common in the scalp and should be removed, as they may develop into epithelioma.

J. M. G.

DISEASES OF THE BRAIN AND ITS MEMBRANES

Pyogenic Diseases.—These take the form of localised abscesses or acute diffuse infections; any degree of localisation between these two extremes may be met with. All these varieties arise from the same causes, namely, (a) caries and necrosis of the cranial bones, more particularly in connection with middle-ear disease, (b) compound fracture of the skull, (c) septic diseases or injuries of the soft parts (*e.g.* boils and burns), (d) pyæmia, from septic foci elsewhere in the body (*e.g.* bronchiectasis). The infection reaches the interior of the skull either by direct extension from the diseased focus, through the emissary veins, or by way of the general blood stream. The organisms commonly found are the pyogenic cocci and the pneumococcus.

The symptom-complex of these infective diseases is made up of three groups of symptoms, (a) those of toxæmia, (b) those due to increased intracranial pressure, (c) localising symptoms of a paralytic or an irritative nature dependent upon involvement of cranial nerves or cerebral areas. Under (a) we recognize rise of temperature, acceleration of the pulse, and the other customary signs of septic intoxication, but both the rise of temperature and the acceleration of the pulse may be absent on account of the increase of intracranial pressure. Under (b) are headache, vomiting, optic neuritis, drowsiness, convulsions and coma. Under (c) we recognize various localised spasms and paralyses according to the region of the brain specially affected.

Generalized Pyogenic Meningitis is recognized by the onset of headache and vomiting with fever, and is accompanied by retraction of the head, "meningitic cry," convulsions, squint, Kernig's sign, drowsiness and coma. A lumbar puncture withdraws fluid under pressure which is turbid, and which exhibits under the microscope enormous numbers of polymorphonuclear leucocytes and organisms. The general pressure symptoms are often temporarily relieved by such withdrawal of cerebro-spinal fluid.

Meningitis Serosa is a name given to that condition in which a localised septic focus is complicated by the presence of a general excess of cerebro-spinal fluid sufficient to cause symptoms of cerebral compression. The fluid withdrawn by lumbar puncture in these cases is clear or very slightly turbid, shows little or no increase in its cell contents, and contains no micro-organisms.

Treatment of Septic Meningitis. In the earlier stages these cases are by no means hopeless. The primary focus must first be thoroughly dealt with, *e.g.* by the complete mastoid operation. Repeated lumbar puncture may be attended with some measure of success, but a more efficient procedure is the performance of a decompressive operation which combines with the relief of the cerebral compression a certain amount of drainage. The administration of urotropin by the mouth should always be tried, on account of its antiseptic action on the cerebro-spinal fluid.

Localised Abscess of the Brain is commonest in connection with disease of the middle ear, and is most often situated in the temporo-sphenoidal lobe or in the cerebellum. As a rule the abscess lies close beneath the carious bone; the very chronic abscesses may be found at some distance from the diseased focus. The general signs of a cerebral abscess are those of intracranial pressure, namely headache, vomiting and optic neuritis. The chief localising signs in temporo-sphenoidal abscess are hemiparesis with increased deep reflexes, diminution or loss of the abdominal reflexes, and Babinski's extensor toe-reflex, on the opposite side; paralysis of the third nerve on the same side; "sensory" aphasia; and the peculiar mental condition known as the "dream state." The chief symptoms of cerebellar abscess are occipital headache; retraction of the head, which may also be flexed towards the side of the abscess; a staggering gait, with a tendency to fall towards the side of the lesion; vertigo, ataxia and nystagmus, especially marked during movement of the eyes towards the side of the lesion. Weakness of the limbs on the same side may occur, and the deep reflexes tend to be abolished. In cerebellar abscess, unless of a very chronic encapsuled character, these signs are usually not so marked as in cerebellar tumour.

In a large proportion of cases of cerebral and cerebellar abscess optic neuritis is not noted.

The treatment for such abscesses is, firstly, removal of the original focus of the disease where that is practicable, and, secondly, efficient drainage of the abscess. Temporary relief of the general pressure symptoms may be obtained from a lumbar puncture in those cases in which operation cannot at once be proceeded with, and where the abscess is accompanied by meningitis serosa (see above).

Sinus Thrombosis.—This is most frequently seen in the lateral sinus as a complication of middle-ear disease; occasionally in the cavernous sinus as a complication of disease of the nose. Septic thrombosis of the lateral sinus is recognized by tenderness and œdema behind the base of the mastoid process, together with rigors and the symptoms of acute toxæmia. There may be a tender swelling along the course of the internal jugular vein, indicating thrombosis, but this is deceptive, as a chain of inflamed glands along the course of the vein may cause a similar appearance. Occasionally optic neuritis is present. In a neglected case pyæmia follows. The treatment required is the immediate opening up of the mastoid process and lateral sinus groove, and ligation of the internal jugular vein below the thrombosis.

Thrombosis of the cavernous sinus rapidly produces immobility and proptosis of the eyeball, with dilation and fixity of the pupil and œdema of the conjunctiva. The other eye soon becomes affected in a similar manner from extension of the thrombosis to the opposite cavernous sinus. Nothing can be done for this condition.

Tumours of the brain and its membranes are Tuberculoma, Syphiloma, Endothelioma, Glioma, Sarcoma, and less commonly other varieties. Metastatic growths secondary to malignant disease elsewhere are sometimes met with.

The symptoms of cerebral tumour are general or local. The general symptoms are those of increased intracranial tension, namely headache, vomiting and optic neuritis. The headache is often paroxysmal; its situation possesses no localising value. The vomiting occurs independently of food, and is unaccompanied by nausea. Optic neuritis may be the first symptom to call attention to the nature of the case, or it may appear late in the course of the disease. These three cardinal symptoms may be present without any localising signs whatever, and, on the other hand, a tumour may be present and cause focal symptoms without any of the general pressure phenomena.

The focal symptoms depend upon the situation of the growth, and cannot be dealt with in any detail within the compass of this article. Briefly,

those in the frontal region cause chiefly mental and motor phenomena; those in the Rolandic area Jacksonian epilepsy; those in the temporal region motor phenomena and, if left-sided, defects of speech and writing; those in the parietal region sensory defects and Jacksonian fits; those in the occipital region visual phenomena; and those in the cerebellar fossa ataxia, vertigo, nystagmus, and cranial nerve paralyses. Pituitary tumours cause characteristic alterations in the visual fields.

Many cerebral tumours are innocent in histological character, and are surgically accessible. Syphilitic and tuberculous tumours come clinically into the same category as true neoplasms, and the earlier operation is undertaken the better is the prospect of cure. Two points in this connection are especially worthy of notice, firstly, that a syphilitic patient may suffer from tumour other than syphiloma, and, secondly, that cerebral gummata usually take the form of extremely dense masses of tissue, and that it is only in the earliest stage of their development that antisyphilitic drugs have any influence. If a syphilitic patient with signs of cerebral tumour does not show marked improvement after three or four weeks of antisyphilitic treatment, surgical measures ought not to be delayed.

Another point of practical importance in this connection is that a patient with increased intracranial pressure who has been up and about often shows marked improvement after a few days' complete rest in bed. Such improvement may erroneously be attributed to the influence of antisyphilitic drugs. The treatment of cerebral tumour is surgical, and takes two forms. Firstly, the enucleation of an accessible tumour through a temporary bone defect (osteoplastic flap); and, secondly, in the case of an inaccessible or unlocalisable tumour, the establishment of a hernia cerebri by removing a large area of bone and incising the dura mater, with the object of relieving the headache and vomiting and saving the eyesight (operation of decompression).

P. W. G. S.

INJURIES OF THE SKULL

The chief importance of cranial injuries lies in the accompanying injuries of the nervous system. There is no constant relationship between the two in point of severity, for an extensive fracture of the skull may be accompanied by no cerebral symptoms whatsoever, whilst the brain may be severely lacerated without any concomitant fracture of the skull.

In the examination of a case it is always wise to bear in mind that the cerebral symptoms may be the cause and not the consequence of the head injury—for instance the victim of an

apoplectic stroke may fracture the skull in falling.

Every unconscious patient exhibiting signs of cranial injury must be most carefully examined in order to exclude any other condition which might be the cause of coma. Thus the urine must be examined for sugar and albumin, and the optic discs for neuritis, whilst the whole history of the case must be reviewed as closely as possible.

Fracture of the skull is recognized by the presence of indentations (depressed fracture); by actual inspection of the broken bone when the scalp is also lacerated; by the occurrence of hæmorrhage from the nose, pharynx, or ears; or by the appearance of effused blood beneath the conjunctiva or over the mastoid process. Bleeding from the ear must not be hastily assumed to come from a fractured base, as a ruptured membrana tympani may be the source of the blood. Similar caution must be observed in connection with bleeding from the nose, or of subconjunctival effusion.

Cases of head injury may be grouped as follows—

1. Concussion with or without fracture of skull or gross injury of the brain. It must be remembered that a patient may recover from concussion and later, in the course of a few hours, exhibit symptoms of progressive intracranial hæmorrhage.

The loss of consciousness which is distinctive of concussion is of immediate onset, may be of any degree, and may last from a few seconds to many hours.

The *diagnosis* rests upon the occurrence of such loss of consciousness following immediately upon an injury to the head, and the absence of symptoms pointing to intracranial hæmorrhage (*q.v.*). It is very rare for a patient suffering from concussion alone to be absolutely irresponsive to strong sensory stimuli.

Inequality of the pupils is often present in concussion, but its presence should always arouse the suspicion of gross damage to the brain or its membranes.

Treatment. The withdrawal of cerebro-spinal fluid by lumbar puncture sometimes results in restoration of consciousness, and may be tried if the unconsciousness is at all prolonged. The presence of blood in the fluid would demonstrate that the case was not purely one of concussion, though its absence would not necessarily prove that the brain had sustained no gross damage. The complete rest in bed, and the complete freedom from mental exertion of any kind, which are the most essential points in the treatment of concussion, must be proportionate to the duration of the unconsciousness, and must be regulated according to the patient's occupation. Thus, a business man

requires a longer period of convalescence than a labourer.

Laceration of the Brain may be accompanied by sufficient hæmorrhage to produce gross symptoms of compression, but in many instances this is not so, and these are the cases which provide so many examples of the later sequelæ of head injuries. Laceration of the brain is usually accompanied by concussion, and followed by the train of symptoms known as "cerebral irritation." The patient lies curled up in bed, complains of headache and intolerance of light and noise, and resents any sort of disturbance. He may refuse food and exhibit incontinence of urine and fæces. The pupils are contracted, and may be unequal; the optic discs may show a slight degree of cedema. The treatment is that of concussion, but in cases bordering upon "compression" the question of a decompressive operation should be considered, not as a means of saving life, but in order to minimize, as such operations undoubtedly do, the more remote after-effects.

2. Cerebral Compression following injury may be due, if of immediate onset, to hæmorrhage; if appearing later it may be due to meningitis following infection through a fracture or penetrating wound.

The hæmorrhage takes place from torn meningeal vessels or venous sinuses, or from actual laceration of the brain itself. In such cases the fluid withdrawn by lumbar puncture contains blood, unless the hæmorrhage lies, as it sometimes does, entirely outside the dura mater.

The chief symptoms of compression are first drowsiness, followed by gradually deepening coma according to the rapidity of the hæmorrhage; a progressive diminution of the pulse-rate, together with elevation of the blood pressure; inequality of the pupils; and certain localising effects according to the position of the hæmorrhage, particularly spasms or rigidity of the limbs, followed by flaccid paralysis. If unrelieved by operation, a state of prolonged unconsciousness, with widely dilated unequal pupils, is reached, and towards the end the pulse and respiration become irregular, and the blood pressure rapidly falls.

The *treatment* of compression must be by an operation for relief of the increased intracranial pressure.

3. Depressed Fracture of the Skull.—If accompanied by symptoms of cerebral compression, operative treatment must be proceeded with at once. Frequently no such symptoms are present, but it is none the less necessary to trephine and to elevate or remove the depressed bone, as otherwise Jacksonian epilepsy and other cerebral symptoms are very likely to supervene later. The obstetrical depressions in the newly

born may be left alone, unless of very severe degree, as spontaneous rectification tends to take place.

4. Compound Comminuted Fracture, with or without laceration of membrane or brain. These injuries are diagnosed at a glance, although their extent is often shown by operation to be much greater than was at first supposed. Immediate operation is essential for the proper cleansing of the wound, the removal or elevation of fragments of bone, and the suture of the scalp. If the dura is torn, no attempt should be made to suture it. The scalp wound should be partially closed and covered with abundant antiseptic dressings to absorb the large amount of cerebro-spinal fluid which usually escapes for several days afterwards.

5. Fracture of the Base of the Skull.—If the fracture passes through the anterior fossa, blood may escape from the nostrils, or, passing into the pharynx, it may be swallowed and subsequently vomited. If the fracture involves the bony wall of the orbit, blood infiltrates the cellular tissue of the orbit and appears, sometimes at once, and sometimes after two or three days, beneath the lower part of the conjunctiva. Oculomotor palsies may result from damage to the nerves passing through the sphenoidal fissure.

When the middle fossa is involved, blood and cerebro-spinal fluid escape from the ears. The facial and auditory nerves may be injured, but this is not common.

If the line of fracture passes through the posterior fossa alone, there may be no visible hæmorrhage to call attention to the injury, though the appearance, after an interval of two or three days, of supramastoid ecchymosis is a most valuable diagnostic sign.

Apart from concomitant concussion, intracranial hæmorrhage, or injury of cranial nerves, basal fractures are of comparatively little importance, and require no special treatment beyond the disinfection of the ears or nose and keeping the patient at rest in bed. The ears should not be syringed in these cases, lest septic material be driven inwards. They should be carefully cleansed by mopping with some antiseptic solution, and very lightly plugged with antiseptic wool. Meningitis is an occasional sequela of basal fractures, which are of necessity compound when blood escapes externally. Urotropin administered by the mouth is followed by the appearance of formaldehyde in the cerebro-spinal fluid, so that this drug may be used with advantage in all cases of head injury accompanied by laceration of the dura mater.

Sequelæ of Head Injuries.—A large variety of symptoms may result from head injuries. They may be grouped as either purely functional,

or as the manifestations of gross injuries. Not infrequently the two groups of symptoms occur together, but no doubt many of the after-effects of head injuries which are called functional are based upon an underlying gross lesion.

The most common after-effects are comprised under the term "traumatic neurasthenia." Persistent headache, sleeplessness, loss of appetite, disturbances of vision and other special senses, irritability, loss of memory and inability to attend to business are the chief symptoms which characterize the condition. Actual insanity follows in a small percentage of cases. Inasmuch as "optic neuritis" occurs in a considerable number of cases of head injury, permanent narrowing of the visual fields is sometimes noted. Epilepsy of the focal or Jacksonian type is frequently met with. Oculomotor palsies, deafness, and facial paralysis occasionally result from damage to cranial nerves in fracture of the skull. Spastic paralysis is a common sequela of head injury at birth. Rarely a pulsating exophthalmos results from injury to the cranial portion of the internal carotid artery.

P. W. G. S.

DISEASES OF THE CRANIAL BONES

The cranial bones are liable to the same diseases as other bones, and were it not for the danger of involvement of the intracranial contents they would require no special notice.

Caries and Necrosis of the skull bones result from many causes, among the commonest of which are disease of the middle ear, disease of the nasal and accessory cavities, and compound fracture of the skull; among the less common causes are syphilis, tuberculous disease, and pyæmia.

Tuberculous Disease of the cranial vault gives rise to a chronic subperiosteal abscess which, if neglected, makes its way through the skin and, becoming secondarily infected with pyogenic organisms, gives rise to a septic sinus leading down to bare bone.

Syphilis manifests itself as a chronic inflammatory swelling, attended with headache; it may, if untreated, soften, break down and involve the skin, the resulting lesion being a gummatous ulcer with bare bone in its floor. The sequestrum may take many months to become loose, and during the whole of this period the patient is threatened with the same dangers of intracranial complications as if the necrosis had primarily arisen from an infected fracture, from a pyæmic embolus, or from suppurative disease of the middle ear. These complications are dealt with elsewhere.

The lines upon which treatment is to be directed are: firstly, the constitutional treatment of the primary cause; secondly, the disinfection

of the diseased and septic focus; and, thirdly, operative measures for the removal of the dead bone. These cases should never be regarded as trivial, and the patient's friends should be fully informed of the possibility of dangerous intracranial complications. Nor should any operation for the removal of dead bone be undertaken without due appreciation of the fact that sometimes the same complications follow closely upon, and are apt to be attributed to, such operations.

Tumours of the cranial bones. Ivory osteomata occur (1) upon the exterior of the skull, when they cause no symptoms which would warrant their removal, (2) within the accessory nasal cavities and external auditory meatus, when symptoms may be caused which are referable to these special regions (*q.v.*), and (3) upon the inner table of the skull, in which case symptoms of dural or cerebral irritation may arise, necessitating surgical treatment.

Sarcoma may involve the cranial bones primarily and invade the brain, or it may arise in the brain or meninges and secondarily involve the bones. A primary growth of one of the cranial bones, seen at a time when its removal would be practicable, would have to be distinguished from (1) a gummatous or tuberculous osteitis, (2) subperiosteal hæmatoma, and (3) leontiasis ossea. X-ray examination will assist in the diagnosis, as such sarcomata are apt to show evidence of ossification. The secondary sarcoma which, arising in the membranes, invades the skull bones, is usually a rapidly growing tumour exhibiting marked pulsation. In the presence of a positive Wassermann reaction, or of other evidence of syphilis, the effect of salvarsan may clear up the nature of the case. A hæmatoma will be distinguished by the history and by its more rapid development. In the rare disease known as leontiasis ossea, the extremely slow progress, and the presence of other bony bosses, would decide between it and sarcoma.

Endothelioma is a form of tumour affecting the cranial bones in connection with a subjacent primary growth arising in the cerebral membranes. The presence of a hard sessile tumour of the skull should always lead to a minute examination of the nervous system for evidence of intracranial growth. If such be found, the case should be submitted to operation without delay, as a favourable result is to be expected.

Secondary sarcoma and carcinoma of the cranial bones is not common, but in suspected malignant disease in this situation careful search must be made for a primary growth elsewhere in the body. Nothing but palliative treatment is available for such tumours.

P. W. G. S.

DISEASES OF THE SPINE AND CORD

Acute Necrosis of the Spine is occasionally met with, and may involve any part of the vertebra, the body, lamina or spinous process. The resulting abscess may appear behind or in front of the vertebræ. In the former case it may present itself as a retropharyngeal abscess, or it may spread in the mediastinal connective tissue. The pathology and symptoms are those of acute necrosis elsewhere, with the added danger of invasion of the spinal canal and involvement of the cord and its membranes. The treatment consists in opening and draining the abscess by the nearest available route as soon as a diagnosis has been arrived at.

Caries of the Spine (Pott's Disease).—In the early stage, when diagnosis is of the greatest importance, the signs may be very few. Pain in the back, or pain referred along individual nerve roots, occurring in a child of tuberculous tendency, would naturally lead to a close examination of the spine, as also should an otherwise unexplained torticollis. Such examination may reveal local tenderness and rigidity, and a good X-ray examination may confirm the diagnosis of caries. On the other hand, the first symptoms to call attention to this disease are sometimes the appearance of a cold abscess either in the groin, in the iliac fossa, through Petit's triangle, or behind the pharynx; or symptoms of pressure upon the spinal cord may be the first indications. In other cases, again, an angular deformity gradually appears without any obvious pre-existent symptoms.

Treatment. As long as symptoms of active disease are present absolute recumbency is essential, in order to take the body weight off the diseased bones. At the same time some suitable jacket or other means must be devised to prevent movement, whilst in addition fresh air and general tonic treatment must be employed. If, after a period of this treatment lasting from six to twelve months, pain and tenderness have disappeared, the patient may be allowed to walk, but the spinal support should still be worn for a further period of twelve months or so. During the whole of the treatment examination must be made from time to time for the appearance of an abscess, as such abscesses are apt to form very insidiously and painlessly, and they may easily be overlooked unless specially and systematically sought.

Abscesses require incision as soon as discovered. The greatest caution must be exercised to prevent infection of the abscess, an accident which can only be regarded as a grave calamity. Some surgeons advocate the removal of the fluid contents of such abscesses by aspira-

tion. This method leaves the caseous contents behind and fails to deal with the abscess wall; it does not find general acceptance as the most satisfactory method. It is best to evacuate the contents through a small incision, at the same time curetting the abscess wall and thoroughly irrigating the cavity with a stream of hot saline solution. The wound is then closed without drainage. If fluid re-accumulates, it can be removed by aspiration, such fluid being thin and free from caseous masses. The treatment of compression paraplegia due to caries is discussed below.

Tumours of the Spine are, except in rare instances, malignant, and take the form of secondary carcinoma and of primary or secondary sarcoma. As the breast is the commonest primary site for a carcinoma involving the spine secondarily, it follows that this form of malignant disease is most commonly met with in women. It usually affects the vertebral bodies, and may be accompanied for a while by no symptoms, or at most by "rheumatic" pains. Sooner or later the weakened bodies collapse, and an angular curvature abruptly makes its appearance. This may be accompanied by violent pain and by rapidly developing symptoms of compression paraplegia. Primary sarcoma of the spine, on the other hand, more commonly affects the neural arches and, unlike secondary carcinoma, is more liable to give rise to recognizable tumour masses posteriorly. It also more commonly invades the spinal canal and intervertebral foramina, causing severe root pains and a gradually developing paraplegia. When it affects the vertebral bodies deformity is liable to occur from telescoping, as in carcinoma.

These conditions have to be distinguished from Pott's disease, and the diagnosis must rest upon the presence of a primary focus of malignant disease, the more rapid appearance of the spinal deformity, the presence of tumour locally, the age of the patient, radiographic examination, and sometimes exploratory operation.

Treatment can only be palliative, unless the use of Coley's fluid can be regarded as an attempt at curative treatment. In some cases section of involved posterior roots for the relief of pain might be advisable, and laminectomy for the relief of cord pressure might be done in an early case, especially when doubt exists as to the diagnosis. The avoidance of bedsores, and the treatment of cystitis in the paraplegic would naturally be attended to, whilst some suitable form of spinal support might ease the root pains.

The *diseases of the spinal cord* which call for direct surgical treatment are those which give rise to compression paraplegia. Pressure-effects

may be produced by disease of the vertebrae giving rise to inflammatory or neoplastic material which invades the spinal canal, of which tuberculous disease and malignant disease are examples, syphilitic disease of the spinal meninges, and tumours of the spinal membranes or of the cord itself.

Paraplegia in Pott's Disease.—In the great majority of cases pressure symptoms in Pott's disease are a complication which becomes evident long after the disease has been recognized, but, as stated above, occasionally the paralysis is the first symptom, and in these cases diagnosis is a matter of some difficulty. The pressure symptoms are rarely due to bony displacement; they are most frequently the result of abscess formation within the spinal canal. In these instances the inflammatory products may make their way backwards from the body of the diseased vertebra, and, unable to penetrate the strong median part of the posterior longitudinal ligament, appear on either side of it in such a manner as to compress the cord from side to side. In other cases the pus travels into the spinal canal through an intervertebral foramen, when it may come to lie between the laminae and the theca, so as to compress the cord antero-posteriorly. But pressure from abscess formation is not the only cause of paraplegia in Pott's disease; the functions of the cord may be interfered with by thrombosis of its vessels from direct involvement of the membranes in the disease. The practical importance of recognizing this will be readily understood, for, whilst the outlook in the cases of paraplegia due to simple pressure is comparatively good, that in thrombosis is bad.

In the early stages of a gradually oncoming pressure paraplegia the symptoms are commonly those of weakness of the legs, together with increased deep reflexes, Babinski's sign, diminished abdominal reflexes, and some disturbance of the bladder functions. Gradually complete spastic paraplegia is developed. The alteration in sensibility is often slight in proportion to the motor symptoms, and may need careful looking for, especially in children. In the cases due to thrombosis the paralysis is of more rapid, or even of sudden onset, and tends to be of the flaccid type, with loss of reflexes and more pronounced alteration of sensibility.

Treatment. Operation should not be lightly undertaken, and is not indicated until a fair trial of non-operative treatment has been given, because many cases recover without operation. Complete recumbency, together with treatment on the general lines required in Pott's disease, should be tried for a period of two or three months. If improvement is then in progress, this treatment should be persisted in, but if there is no improvement, or if the pressure

symptoms are becoming more pronounced, laminectomy should be advised. In the cases with flaccid paralysis, especially when of rapid or sudden onset, operative measures should be considered with the greatest caution, as in them the prospect of improvement is very remote.

In children the prognosis after laminectomy is good; in adults it is by no means good, and even greater caution should be exercised in advising operation for an adult than for a child.

Syphilitic Meningitis.—Certain cases of syphilitic disease of the spinal meninges are capable of being benefited by operation. It is not always possible to distinguish between these and cases of tumour, and exploration for suspected tumour sometimes reveals a gummatous meningitis which is causing constriction of or pressure upon the cord. In the case of a spastic paraplegia in a syphilitic patient which does not clear up under antisyphilitic treatment, the question of an exploratory laminectomy should be considered.

Tumours.—Tumours of bone causing pressure symptoms have been mentioned above. These are almost always malignant, and operation is likely to do little or no good. Tumours of the cord and its membranes are either extra-medullary or intra-medullary. The former are the more common, and are usually met with inside the spinal theca, growing from the membranes and involving one or more nerve roots. They are most frequently endotheliomata or sarcomata; fibromata are also met with, whilst hydatid cysts sometimes occur and present the symptoms of true tumours. The intra-medullary tumours, arising within the substance of the cord, are commonly gliomata, sarcomata, or occasionally tuberculomata. Malignant tumours are much more common than benign.

The symptoms of a spinal tumour are those of a progressive pressure paraplegia. The first symptoms may be those of pain, referred to the distribution of a particular nerve root, together with some loss of power, alteration of sensibility and changes in the reflexes below the site of the tumour. The cord symptoms may be of the Brown-Séquard type. Later a complete spastic paraplegia develops; the superficial abdominal reflexes are lost; the plantar reflex is of the extensor type; the sphincters are affected; and there is a varying degree of loss of the different forms of sensation below the site of the tumour. The region of impaired sensibility may fade off very gradually into that of normal sensibility, and so cause difficulty in localising the level of the tumour. When the tumour is intra-medullary there is likely to be dissociation of sensation, whilst root pains are not so common as with the extra-medullary cases.

The treatment of a spinal tumour is surgical, and the earlier its removal can be undertaken,

the better, of course, is the prospect of recovery. In a neglected case such profound changes may have taken place in the cord that recovery of conductivity cannot be attained even after removal of the tumour, whilst infection of the urinary tract may render the outlook hopeless. The removal of an intra-medullary tumour is not within the scope of legitimate surgery, but exact diagnosis between intra- and extra-medullary tumour without exploration is not always possible. The relief of pressure afforded by an exploratory laminectomy in the case of an intra-medullary tumour may be followed by a temporary amelioration of the symptoms.

Tumours involving the cauda equina below the termination of the spinal cord are recognized by the involvement of lumbar and sacral nerve roots, giving rise to pain, anæsthesia and paralysis, with reaction of degeneration in the muscles, together with loss of reflexes, varying according to the roots involved. As with tumours of the cord, the treatment of tumours of the cauda equina is purely surgical.

P. W. G. S.

RESECTION OF THE POSTERIOR SPINAL NERVE ROOTS

The manner in which the nerves of efferent and afferent functions are separated from one another at their junction with the spinal cord makes it comparatively easy to carry out operative procedures on these nerves without any danger of causing motor paralysis. There are three great indications for such operations, viz. pain, visceral crises and spasticity of spinal origin.

For Pain.—There are certain cases of intractable neuralgia in which no operation on the peripheral nerves has any lasting effect. Amputation of a painful limb is in such a case worse than useless, for the pain is still felt as severely as ever. In a few cases of tabes the lightning pains defy all medicinal remedies, and some conditions of malignant growth which are beyond radical operations may cause intolerable pain. In all such cases the operation of resection of the posterior spinal nerve roots has been undertaken, with a varying measure of success. In about one-third of such cases there has been entire and lasting relief, in another third the relief has only been partial, whilst in the remainder no good has resulted. Provided that enough roots have been divided, anæsthesia and analgesia of a permanent kind is certainly produced, but this does not necessarily imply that the anæsthetic parts may not continue to be the seat of referred pain. This fact is partly to be explained by the wide overlapping of the areas of distribution of the sensory nerves, and partly by the large element which psychical

processes have in the production of pain, especially in cases of neuralgia and tabes.

For Visceral Crises.—There are some cases of tabes dorsalis associated with such severe vomiting which no drug can relieve, that emaciation becomes extreme and the patient's life a burden. These gastric crises are associated with great pain and highly exaggerated abdominal reflexes. The victim of such a condition will sooner or later become addicted to morphia, the frequent injection of which will make him still more ill and wretched. This visceral crisis is brought about by a morbid increase in the reflex arc which controls the stomach functions. The afferent limb of this arc runs with the seventh to the tenth or eleventh dorsal nerves. By division of the posterior roots of these nerves on both sides the vomiting is cured and the pain ceases.

Since 1908, when this brilliant idea was first suggested and carried out by Prof. Foerster of Breslau, the operation has been performed twenty-nine times, with three deaths and twenty-four successes, in eight of which, however, some degree of relapse took place.

For Spasticity.—In all cases where the motor tracts from the brain to the limbs have been partially interrupted some degree of muscular weakness results, which is associated with a great deal of spasm, from an exaggeration of the normal spinal reflexes. This spasm does more towards crippling the limb than the mere loss of motor power. Such a condition is seen in its most extreme form in Little's disease, where the motor tracts have degenerated to some extent as the result of a cerebral injury during birth. It also occurs in the ordinary forms of spastic paraplegia, as well as in those of syphilitic origin. It is in these cases that the resection of the posterior spinal nerve roots has given the most brilliant results. It is generally only necessary to divide about half of the afferent roots of the spastic limb, so that no extensive anæsthesia results, but the spasm is immediately and permanently relieved. And further, when once the spasm has gone, the motor power increases very greatly, especially in children. This idea, of the power of posterior root resection to relieve spasm, we also owe to Prof. Foerster, and it has been carried out in over eighty cases with very gratifying results. Little's disease offers undoubtedly the greatest scope for its employment and the best promise of permanent success. Spastic paralysis of the traumatic, ordinary or syphilitic varieties have all given good results. Cases of disseminated sclerosis have been attempted, but without much encouragement, owing to the progressive character of the disease.

Technique of the Operation.—The skin incision should be made in the form of a curved line,

the arc of the chord being on the centre of the spine. By this means the lines of skin and muscle divisions do not lie over one another. The muscles are separated from the bones by a raspatory and the necessary laminæ removed. This stage of the operation is often attended by profuse hæmorrhage, which may be greatly lessened by the preliminary subcutaneous and intramuscular injection of several ounces of a 1 in 50,000 solution of adrenalin. In the cases of the roots of the brachial plexus it is enough to remove the half laminæ, whereby much less muscular division is necessitated. When the dura mater has been fully exposed it is divided by a longitudinal incision and retracted by long sutures. The posterior roots are picked up one by one and a short piece of each excised. There are only two points of difficulty, first, the identification of given roots, and second, the decision of which roots to resect. In the case of the brachial roots the marked contrast in size between the first and second dorsal nerves is the best guide to identification. In the lower dorsal region the seventh root lies opposite to the tenth spine; in the lumbo-sacral region the last root of any size is the third sacral, and enumeration may be made upwards from this. For exposure of the brachial roots it is necessary to remove the laminæ on one side of the fifth to the seventh cervical and the first dorsal vertebræ. In the case of the lower dorsal roots the fifth to the eleventh dorsal vertebræ are resected, whilst in the lumbo-sacral region all the nerves can be exposed by removal of the laminæ of the eleventh and twelfth dorsal and first and second lumbar vertebræ.

The actual roots resected in the case of the arm should practically be all those of the brachial plexus on one side. When dealing with gastric crises the sixth to the tenth dorsal roots require resection on both sides. In the lumbo-sacral region it is advisable to resect not more than two connective roots on the same side, otherwise an artificial ataxia will be produced.

Further details, together with a complete bibliography of this subject, may be found in the articles by Prof. Foerster and Hey Groves in the Surgical Section of the *Proceedings of the Royal Society of Medicine*, 1911, pp. 199–254.

E. W. H. G.

DEVIATIONS OF THE SPINAL COLUMN

Lateral Curvature of the Spine (Scoliosis).—Lateral curvature is an habitual or fixed deviation of the spine, in whole or in part, to one or other side of the median line (Whitman). It is convenient to classify the cases according to the cause or group of causes at work.

Congenital Scoliosis is rare. Sometimes it is due to the presence of a half-vertebra, and it

may be associated with congenital elevation of the scapula.

Rickety Scoliosis is due to loss of muscular tone, coupled with softening of the bones and ligaments.

Paralytic Scoliosis is due to infantile paralysis, or one of the other rarer forms of paralysis.

Scoliosis due to tubercular or other disease of the spine, directly, is rare.

Secondary Scoliosis may be secondary to phthisis, empyema, torticollis, want of use of one arm on account of paralysis or tubercular disease of the shoulder, or inequality in the length of the legs, whether congenital or the result of tubercular hip disease, congenital dislocation, genu valgum, etc.

Ordinary Scoliosis, or Adolescent Scoliosis.—Under this heading may be placed the great bulk of the cases, both in children and adolescents. The curvature in these cases is a *deformity of weakness*, due to diminished muscular tone, and is therefore often accompanied or preceded by other deformities of weakness, *e. g.* round shoulders, genu valgum, and flat feet. It should be remembered that shortness of one leg is not in itself sufficient to cause scoliosis, for when the patient is seated the cause of the temporary spinal curve disappears and the spine corrects itself. It is only after several years, or if loss of tone from any cause occurs, that habitual or fixed deformity ensues. The various factors which may contribute to the formation of scoliosis are best enumerated by describing a case displaying all of them. But the author would call attention to the importance, hitherto insufficiently insisted upon, of chronic sepsis, in some form or other, as being at the bottom of the muscular weakness which allows the curvature to develop. Girls are more commonly affected than boys, but this influence of sex is less marked in childhood than adolescence, and is altogether absent in early childhood. A typical case, say in a girl of twelve years, may display the following features on examination. She is a pale, thin, unhealthy-looking child with an adenoid facies. She has stooped for some years; her chest is flat, and the respiratory movements are feeble. Many of her teeth are carious; her tonsils are enlarged and septic; adenoids are present; she has chronic enlargement of the cervical glands, below and behind the angles of the jaw, proving the absorption of septic material from the mouth and throat. She is anæmic, and a hæmic murmur may be heard over the precordium. Her school hours are too long; when in school she sits on a *form*, and when writing is allowed to assume any position her tired muscles suggest; the school-room is badly ventilated. Her play-hours she usually spends indoors. When standing she usually keeps one

knee flexed and the pelvis tilted down on the same side; there is knock-knee, more marked on one side; both feet are "weak." Her mother gives a history of snoring at night and of frequent colds and sore throats; the child never sleeps with the window open on this account. Constipation is troublesome.

The above notes should be quite sufficient to indicate the line along which inquiry should be made and the examination of the case conducted. Such patients complain of getting tired easily, and of pain in the back or the side. With regard to the spine itself there may be a single or a double curve. The commonest types met with are double or S curve, convex to the right in the dorsal region and to the left in the lumbar, and the single long curve (total scoliosis) convex to the left. It must be remembered that an habitual curve in the spine cannot exist for any length of time without the addition of rotation of the individual vertebræ. This rotation is such that the body swings towards the convex side of the curve, and as a result the line of the vertebral bodies deviates much further from the mid-line than does the line of the spinous processes. It is probable that in many cases rotation occurs before lateral deviation, *i. e.* the body deviates before the vertebræ as a whole.

Rotation of the dorsal vertebræ leads to deformity of the whole thorax, the angles of the ribs being increased and prominent on the convex side of the curve, and flattened on the concave. On the front of the chest the conditions are reversed, the ribs and breast being flattened on the convex side and prominent on the concave. The ribs are approximated on the concave side and separated on the convex. One hip may "stick out," and one scapula may be raised above the level of the other. It is the usual, but not the invariable, rule for the prominent hip and high shoulder to be on the same side, *e. g.* on the right, in the common right-dorsal-left-lumbar S curve. The lateral curvature is often accompanied by some dorsal kyphosis; in severe cases this kyphosis is usually a marked feature.

Treatment. This must depend, in the first place, upon the cause of the deformity, if such can be determined. The lungs and heart should always be examined, for it is hopeless to try to cure a spinal curve due to collapse of one side of the chest around a fibrosed lung, while the discovery of a heart lesion may modify the advice given as to remedial exercises. The rickety cases are usually intractable; in addition to other treatment in such a case it is essential that the child be taken entirely off his feet for a time. The paralytic cases, when recovery of the muscles is not to be expected, require apparatus to support them. In a case of

infantile paralysis affecting the spinal muscles, means should be taken early to prevent or limit deformity, for otherwise the curvature may become so extreme that it is impossible to correct it though the muscles have regained their power.

The diagnosis of tubercular disease is most important, as treatment in such cases is entirely different; in cases of doubt a skiagram should be taken. Inequality of the legs must receive treatment appropriate to the cause. The legs should always be measured, for a difference of half an inch or more is often met with, without any discoverable cause, and entirely unsuspected by the patient or parents.

The above causes having been excluded, the daily routine of the child, the hours of work and play, the style of the desk and seat used in class, and so on, should be inquired into, and corrections and improvements suggested. The surgeon should not be too hasty in taking the child away from school and the companionship of other children and sending it off to the seaside. Each case must be carefully considered on its merits. A scoliotic patient should always use a chair, not a stool or form, and the back should have a cushion or pad adjusted so as to fit into the lumbar concavity. The desk should be sloping and close to the chair, and a footstool should be fixed beneath it. The next and most important detail is to remove all sources of sepsis discoverable, such as septic teeth, infective tonsils and so on. It must then be decided whether the case requires a "support" of any kind or not. It is a sound rule, if possible, always to endeavour to treat a case by exercises and massage only. If in doubt make a careful note of the amount of deformity present and watch the effect of exercises for three months. With a little experience it is easy to recognize the degree of deformity which calls for instrumental support. Here it can only be said that this should be necessary only in the severe cases, but even these require massage and exercises, for much may be done to relieve pain, prevent increase of deformity and improve the general health of the patient by these measures. In giving a prognosis it should be remembered that, as a matter of fact, the cases with definite rotation are never cured. They may be improved, but at any rate the deformity should be checked and all the symptoms relieved.

The details of the treatment by remedial exercises will be found under *Physical Exercises*. (*Special Forms of Treatment*.)

Kyphosis.—This implies an increase in the dorsal convexity of the back. The varieties met with are—

1. **Rickety Kyphosis** in young children. The most prominent part of the curve is low, about

the dorsi-lumbar junction, the normal lumbar concavity having disappeared.

2. **Round Shoulders.** In children and adolescents the etiological factors are much the same as in ordinary scoliosis, imperfect expansion of the lungs due to nasal obstruction being, perhaps, the most important of these. Defects of vision may be a cause of the stooping. In adults the deformity is the result of the patient's occupation.

3. **Kyphosis accompanying Scoliosis.** (*See above.*)

4. **Kyphosis resulting from disease of the spine,** e. g. osteoarthritis.

Tubercular disease of the spine is not usually included under this term.

Rickety kyphosis should be treated by keeping the child lying down always. This is best done by using a wicker tray or padded board, from which the child is only removed for washing. Massage to the spinal muscles may be used with advantage, while the general condition calls for appropriate treatment.

Round shoulders in children and adolescents call for careful investigation and correction of all aggravating circumstances. If present, adenoids, together with the septic tonsils, should be removed. Special exercises, in which breathing exercises should take the foremost place, are necessary, while occasionally the lightest of all supports—"spinal corsets"—may be ordered as a reminder rather than a support to the child.

Lordosis is the name given to an increase of the normal lumbar concavity. It is seen in rickety children and adults with large abdomens, notably in women with a pregnant or fibroid uterus, while it is a common result of fixed flexion of the hip-joint. It may be present in infantile and other paralysis.

It calls for no treatment other than that of its cause.

H. A. T. F.

SURGICAL AFFECTIONS OF THE FACE

Wounds are important because of the subsequent deformity which may follow the scarring, and because important structures such as the facial nerve, etc., are liable to be damaged. Facial wounds heal with great readiness. In treating them, as few stitches as possible to ensure accurate apposition of the edges should be employed; the stitches should be fine horse-hair or silkworm gut, and should be placed close to the margin of the wound. A continuous intradermal stitch is very useful and completely avoids stitch-marks. The sutures should be removed at the end of four or five days. If the facial nerve is damaged after it has divided into its branches little can be done to bring them together; if the main trunk is injured, an

attempt should be made to unite the divided ends, fine silk or catgut being used. Injuries to the parotid and its duct are dealt with under salivary glands.

After bad burns, very severe deformities, such as ectropion of the lips and eyelids, or contraction of the face towards one or other side, are very liable to occur; these will require to be treated by plastic operations and skin grafting.

Inflammatory Affections.—Acute subcutaneous abscesses are not infrequent. They should be dealt with early by making an incision parallel to the normal lines of the face and making it as small as possible consistent with the free evacuation of pus. Boils and carbuncles are frequent; they may cause severe constitutional disturbance and great pain if they occur in places where the skin is dense. Thrombosis of the deep veins sometimes follows, consequently surgical treatment should not be delayed.

Acne vulgaris, rosacea and comedones are very common. For treatment see under these headings.

Erysipelas is not infrequent: it is liable to spread to the scalp and neck. The treatment is that of the disease in other parts.

Syphilis is a very common affection. *Primary* sores occur on the lips, eyelids, etc. *Secondary* rashes, especially on the forehead and at the roots of the hair—the corona veneris—are frequent. *Tertiary* eruptions in the form of nodular syphilides are commonly seen on the cheeks, nose and forehead, the latter situation being also a frequent site for gummata originating in the pericranium or occipito-frontalis aponeurosis. Such gummata form rounded elastic, painless tumours, to which the skin is not attached at first. Subsequently a characteristic gummatous ulcer may form and necrosis of the bone result unless efficient treatment is adopted. Gummata are also frequent in the masseter and parotid regions.

When syphilis attacks the nose it may affect the bones or the cartilaginous parts and the skin over it. As a result of congenital syphilis the bridge may not be developed, and the septum may be destroyed in both the congenital and acquired forms, leading to the sinking in of the bridge. Gummata of the skin and cartilages may cause severe scarring and contraction of the nostrils. In the most severe cases the whole nose may be destroyed, only an oval or round opening being left on the face.

The *treatment* should be carried out as for syphilis generally. Salvarsan is especially useful in the primary and secondary stages. When there is a gummatous ulcer of the forehead, great care must be taken to keep it free from septic infection: otherwise widespread destruction of the bones may follow.

When the bridge of the nose has been destroyed, and when there is healthy loose skin over the remains of the nose, the injection of solid paraffin to form a new bridge may be advantageous. When the whole nose is destroyed an artificial nose should be supplied. Plastic operations are not to be recommended in these cases.

Tuberculosis occurs as lupus vulgaris and ulcers. For the signs and treatment of the former see under *Lupus*.

The tuberculous ulcers are generally secondary to disease of the glands or of the bones, and the treatment must be directed to the primary focus. These affections are of great importance, because of the severe scarring and consequent deformities which follow. Therefore energetic treatment must be undertaken early, and if operative measures are used the incisions must be planned so as to leave the least amount of scar tissue.

Lupus Erythematosus.—The face is the commonest seat of this disease. For signs, treatment, etc., see *Diseases of the Skin*.

Tumours.—**Sebaceous Cysts** are most frequent in the parotid region; they must be carefully dissected out, the incision being so placed as to lie in the direction of the natural folds. These cysts are often inflamed and suppurate; even so, it is better to excise them rather than open and scrape out their contents.

Dermoid Cysts occur about the external angle of the frontal bone, the middle line in front, and the line of the fissure between the nasal and maxillary bones. The former situation is most common. The cyst may be partially embedded in the bone, or there may be an aperture in the bone through which the cyst extends to the inside of the skull. They are always deeply placed and require careful dissection for their removal. The incision should be placed so that the scar will be least visible; in most cases it will be a transverse one.

Meningoceles occur at the root of the nose and form cystic swellings which may have an expansile pulsation. It is generally advisable to leave them alone, at least until the child has reached adult life.

Moles are very common and are usually of the hairy type. Their size is variable. Excision, with skin grafting if the edges of the wound cannot be brought together, is the best method of treatment. The grafts should be large and only a small amount of scarring is left. Sometimes treatment by radium or electrolysis may be preferable.

Nævi.—All the varieties are frequent, and the treatment adopted will depend on the particular variety.

Fibrous and Fatty Tumours sometimes occur on the face and forehead; in the latter region

they may be deeply placed and they are liable to be mistaken for gummata. They may become inflamed and the only treatment is excision.

Malignant Tumours are primary or secondary, the latter originating in such structures as the parotid, the jaws, tonsils, etc. The former are squamous-celled carcinomata or rodent ulcer. The squamous-celled carcinomata usually begin on the lip; sometimes the cheek is primarily affected. The treatment is free excision and removal of the glands involved; in some cases radium applied locally will cause the disappearance of the tumour; the glands, however, must be dealt with surgically.

Rodent Ulcer is very frequent on the face, the favourite sites being just below the inner canthus or on the side of the nose, the outer part of the forehead and in the parotid region. It has to be diagnosed from epithelioma and other malignant tumours and gummatus ulcers. In any doubtful case a part of the ulcer and adjacent healthy skin should be excised for microscopic examination. Whereas formerly excision was the method of treatment, now radium and X-rays have replaced the knife. In very extensive growths, especially if the bone is affected, a combination of these methods will be required. The scar which follows the application of X-rays or radium is quite supple and inconspicuous. But it must not be forgotten that recurrence may take place and that some ulcers do not yield to X-ray and radium treatment. In excising these ulcers, at least half an inch of tissue all round must be removed. Ionization with zinc sulphate has been also found to be sometimes efficient.

Rhinophyma (Hammer Nose ; Lipoma Nasi).—These names are given to a condition of the extremity of the nose in which the sebaceous glands are enlarged and their orifices being visible. The skin, which is thickened and often covered with dilated venules is thrown into folds or irregular masses. Men are most frequently affected. The mass should be dissected off the cartilages and the raw area covered with skin grafts. Sometimes it may be possible to raise the skin as a flap on each side and replace it after the removal of the underlying mass.

Oedema of the Face, especially of the eyelids, may follow exposure to the sun. It may also occur apparently after the ingestion of certain articles of diet, such as shellfish, and in other instances it would appear to be a giant urticaria or to be allied to angio-neurotic oedema. The patient is quite well and complains of nothing except the swelling. The conjunctivæ may be also affected. The important point is not to confuse these cases with erysipelas. Recovery in two or three days is the rule, a saline purge,

and possibly calcium lactate (10 gr. t.d.s.) if the blood coagulation time is delayed (as it may be), is the only treatment required. Locally, evaporating lotions may be applied.

Neuralgic Conditions require special investigation in order to ascertain the primary cause, which should be treated accordingly. Similarly if the seventh nerve is affected the source and situation of the lesion must be localised before treatment is begun. T. P. L.

AFFECTIONS OF THE ORBIT

Wounds of the orbits may be contused, leading to the effusion of blood into the cellular tissue and into the conjunctiva. Penetrating wounds are very important because of the liability of damage to the eyeball and to the base of the skull and overlying brain. No matter how small the wound in the eyelid may be, and how insignificant the symptoms, the depth of these wounds should always be carefully probed and careful investigation made as to the presence or absence of injury to the eyeball, skull and brain. Penetrating wounds should not be sutured, and it is often advisable to insert a drainage tube.

Fractures of the skull in the region of the orbit lead to hæmatoma of the eyelids, of the subconjunctival tissue and of the fat of the orbit; the eyeball may be considerably proptosed. As the blood is absorbed the eyeball recedes to its normal position. When the carotid artery is damaged, or if a communication between that vessel and the cavernous sinus is formed after an injury, pulsating exophthalmos with engorgement of all the veins, and often paralysis of the ocular nerves, will result. The best treatment for these cases is to ligature the internal carotid artery in the neck, just above its origin.

Cellulitis is a serious affection which may result from a penetrating wound of the eyelid or be secondary to disease in the ethmoidal cells, frontal sinus or acute inflammation of the bones of the orbit. The whole of the cellular tissue may slough, and the affection may spread backwards to the meninges, to the eyeball, or to the bones.

The lids are cedematous and the eyeball is proptosed and hampered in its movements. Free incisions, through the eyelids and parallel to their folds, must be made to evacuate the pus and drainage tubes inserted, hot fomentations being applied subsequently. If the eyeball is affected it is better not to enucleate it but to make crucial incisions into it. Enucleation is more likely to be followed by meningitis.

Syphilitic Affections of the Orbit are generally gummatus, and most often of periosteal origin. Paralysis of the nerves, usually the third or sixth, is a frequent accompaniment.

Treatment consists in the administration of iodides and mercury.

Tuberculous Disease sometimes occurs, and usually attacks the external angular process of the frontal bone or the malar. It is very chronic, and leads to the formation of abscesses and sinuses which, when healed, produce a depressed scar and possibly considerable deformity of the eyelid. Treatment is conducted on the lines of the disease in bones elsewhere.

Tumours may be innocent or malignant.

Innocent.—Dermoid cysts are most frequent at the outer angle of the orbit; sometimes they occur at the inner angle.

Hydatid cysts also occur; they may be removed by enucleation. Exostoses of the ivory type are sometimes seen and may be an extension from the frontal sinus.

Malignant.—Sarcoma may be primary, originating in the bones or periosteum, or be an extension from similar growths beginning in the antrum, the nose, ethmoid or sphenoid and pterygo-maxillary fossæ. They cause displacement of the eyeball in varying directions according to the situation of the growth. Operative treatment may be possible: much depends on where the growth originates, and the nature of the operation must depend on this factor. If inoperable, Coley's fluid should be used.

Secondary deposits of cancer are not very uncommon.

Post-Orbital Aneurysms give rise to signs similar to those of tumours. They are usually traumatic: the immediate effects of the original injury may have been slight. The internal carotid, or that vessel and the cavernous sinus, are usually affected. The signs are pulsating exophthalmos, congestion of the veins, œdema of the eyelid and conjunctiva and a loud systolic bruit over the frontal region. The aneurysm may develop soon after the injury or its signs may be delayed for some time. Ligation of the internal carotid artery in the neck is the best method of treatment. In addition it may be necessary to tie prominent vessels about the eyelids.

Cirroid Aneurysm sometimes occurs in this region. *Treatment* should be, if possible, by excision; failing this, by electrolysis—in all cases it is difficult and dangerous. T. P. L.

AFFECTIONS OF THE LIPS

Injuries are of importance on account of the immediate hæmorrhage, which may be very profuse, and because if they are not properly treated much disfigurement may be left. The hæmorrhage is easily arrested by compression or application of a ligature. Generally, however, if the parts are sutured in accurate apposition the bleeding ceases at once. In suturing

these wounds the most important point is to ensure correct alignment of the muco-cutaneous junction. Fine sutures should be employed, and they should be removed early to avoid stitch marks. Dressings are not necessary.

Ulceration is very frequent. The simplest form is a cracked or fissured lip. It is difficult sometimes to heal, owing to the constant movement of the part; the application of silver nitrate or astringent ointments may be advisable.

Herpes is a very common accompaniment of catarrhal affections and of pneumonia and may lead to ulceration. Similar treatment, if any is required, should be adopted.

Hypertrophy (Macrocheilia).—(1) Congenital, when it is caused by a distension and dilatation of the lymphatic spaces; the lower lip is most often affected. (2) In tuberculous children the upper lip is often thickened and projects beyond the lower. There are also cracks and fissures, which keep up a condition of chronic inflammation and aggravate the condition. (3) Tertiary syphilis in adults may cause an overgrowth and thickening of the whole lip, the lower one being that usually affected.

Treatment. In the congenital form, if any treatment is required, excision of a part of the lip, and a plastic operation to restore the shape, will be necessary. Electrolysis may be sufficient in some cases. The second form is symptomatic, and the patient must be treated on general lines, any local condition of ulceration being at the same time rectified. Sometimes it may be necessary to remove a portion of mucous membrane and adjacent parts. The incisions must be planned so that the scar is parallel to the line of the free margin of the lip. In the third form antisiphilic remedies must be employed, but the deformity does not always disappear, even when prolonged treatment is carried out.

Syphilis frequently affects the lips in all its stages.

Primary Sores are not uncommon, and may be caused by kissing or the use of infected articles. The upper lip is more often affected than the lower, and though more frequent in adults, children may be affected. It is most important to make the diagnosis early, so as to prevent the spread of infection to others. When occurring in older people a primary chancre may be mistaken for malignant disease. The induration is not always so marked as when the sore is on the penis, but the glandular enlargement is usually great and of early occurrence. Treatment must be undertaken at the earliest moment, and consists in the administration of mercury or the injection of salvarsan. The latter remedy causes the sore to disappear rapidly. The patient must be especially warned as to the risk of infecting other people by contact or

through the medium of various utensils. In the **secondary stage** mucous patches or tubercles and ulcers are very frequent and are highly infectious. Smoking should be strictly prohibited. The application of chromic acid (ten grains to the ounce, or even in stronger solutions) is very beneficial as a local application. Ointments containing calomel are also advantageous. The general treatment of the disease for this stage must also be employed.

Gummata occur in the later stages, and form ragged irregular ulcers, without induration. There may be a good deal of thickening in the tissues of the lip around the ulcer, which is often very foul from septic infection. Antiseptics should be applied locally and mercury and iodide of potassium given internally. Healing is generally rapid.

In the late stages of syphilis the epithelium on the mucous membrane is often very much thickened from overgrowth in a manner similar to that on the tongue in chronic superficial glossitis. White patches or masses of epithelium are present, and if irritated may become epitheliomatous. Avoidance of irritation is a most important point in the local treatment. In all the stages of syphilis the employment of salvarsan will require to be carefully considered.

Tuberculous Disease occurs as lupus, as a part of that affection on the face, and as primary or secondary ulcers on the mucous membrane; they may be very painful. Excision may be required, and if contra-indicated local applications, such as lactic acid twenty per cent. painted on the surface once or twice a week, may be employed. Orthoform one part, with boracic acid two parts, may be freely dusted on the surface to relieve pain.

Tumours may be innocent or malignant.

Innocent.—**Mucous Cysts** are not uncommon, and form translucent swellings on the inner aspect of the lip. They should be treated by excision of the projecting portion and the application of pure carbolic acid to the inner surface of the remainder. Recurrence is not very infrequent, so it is often better to dissect out the whole cyst wall. The incisions must be placed on the mucous surfaces and in suturing the wound great care must be taken not to disturb the line of the muco-cutaneous junction.

Nævi are frequent and often venous. They may be very large and extend on to the cheek. Treatment will be by excision, electrolysis, or a combination of these methods, according to circumstances.

Papillomata should always be removed, as they may be the starting-point of epithelioma.

Malignant Tumours.—The commonest and practically the only form is a squamous-celled carcinoma. The lower lip is the usual site, and men are almost invariably affected, though

occasionally this form of cancer is seen in women. The disease often begins as a superficial warty growth or ulcer, which slowly extends. Sometimes the extension spreads superficially, whilst at others rapid infiltration of the deep parts of the lip takes place. If left untreated, the whole lip is converted into a foul ulcerating mass, which extends to the jaw and leads to constant dribbling of the saliva. Even with extensive ulceration pain may be absent. The disease is often of very slow growth, and many months, or a longer time, may elapse before the patient seeks advice. The submental and submaxillary lymphatic glands are involved sooner or later. Extensive glandular involvement, rendering radical treatment quite impossible, may be present without the patient being aware of it. It is imperative that all warty growths on the lips should be excised without delay and a microscopic examination be made. If found to be malignant, the glands should be removed, or the patient seen at short intervals (three to four weeks), so that they may be removed at the first sign of enlargement. It is a notorious fact that many patients are cured of the local disease and yet die from glandular affection, because the association of the steadily enlarging lump in the neck and that on the lip have not been recognized by the patient, after the primary growth has been removed.

The *treatment* of an epithelioma consists of the free excision of the tumour. This may involve the removal of a large part, or the whole, of the lip. The incisions must therefore be appropriately planned, and a plastic operation to restore the lip may be required. At the same time, or by a second operation, the glands in the submaxillary and submental regions, together with all the fat and fascia, must be removed. A very extensive operation is required, because recurrence is most frequent in these glands. Radium may be used for the growth on the lip. It is sometimes quite successful, but the glands will require operative removal.

Deformities of the lip may be congenital or acquired.

Congenital.—**Harelip** (p. 725) is most frequent. Less common and less important are prominent tubercles on the mucous surfaces or large folds of mucous membrane. The former are sometimes seen on the lower lip in association with harelip.

The **Acquired Deformities** are the result of traumatism, such as burns, etc., or are due to a surgical operation. They are very important because of the disfigurement and the interference with speech, swallowing, and the constant dribbling of saliva. To remedy these deformities a plastic operation will be necessary. The main principles of such operations are to plan the incisions so as to give a maximum

amount of tissue for the restoration of the lip, and that the resulting scars will be least visible and produce a minimum amount of contraction. Especial care must be taken in the formation of the free margin of the lip, so that there is a complete mucous lining to it and a continuous muco-cutaneous line. After these operations there is often dribbling of the saliva and some escape of food during mastication, but the personal appearance may be very considerably benefited.

T. P. L.

SURGICAL AFFECTIONS OF THE MOUTH

Deformities.—Congenital cleft palate will be described on page 726.

Macrostoma is due to non-union of the maxillary and mandibular processes, and consequently the mouth is wider than normal. Both sides may be affected and not infrequently there are other associated developmental deformities. The defect may be remedied by a plastic operation.

Microstoma.—The orifice of the mouth is much smaller than normal, and is due to too great fusion of the processes just mentioned. In other cases the deformity is acquired and follows sloughing from burns or other injuries and diseases. It may also be remedied or improved by a plastic operation.

Acquired Perforations and clefts of the palate are due usually to some form of traumatism, to syphilis, either congenital or acquired, or to other diseases. If the hard palate is involved an obturator, or a plate fixed to the teeth, may be all that is necessary. A mechanical apparatus with a plug fitting into the hole should never be employed, for this tends to make it bigger.

If the amount of scar tissue is not excessive, and the patient objects to wearing an obturator, a plastic operation may be performed, but it should always be pointed out to the patient that failure is not unlikely to occur when a syphilitic element is present.

Syphilitic Defects in the soft palate are generally best left alone. An operation frequently fails, mainly on account of the large amount of scar tissue, and because of adhesions to the pharynx. Any flap is therefore likely to necrose, and it is often impossible to bring the parts into apposition owing to the tension. In the hard palate a plate or obturator is usually sufficient, but sometimes the hole can be closed by turning over a flap of muco-periosteum. Nasal speech is the symptom chiefly complained of by these patients, and inability to get rid of the secretion which accumulates in the nose is a constant source of annoyance when the soft palate is adherent to the pharynx. In such cases any aperture

should be kept dilated by the constant use of suitable bougies passed from the mouth to the naso-pharynx.

Stomatitis presents very diverse characters. In **Aphthous Stomatitis** there are numerous circular yellowish-white spots or ulcers surrounded by a bright red ring of hyperæmia. These spots or ulcers may occur in any part of the mucous membrane and are very painful. Internally, chlorate of potash (5 to 10 gr. t.d.s.) in some syrup and water is very efficacious. Locally, 10 gr. of the same drug in half an ounce each of glycerine and water may be applied to the ulcers, or they may be touched with solid nitrate of silver. The mouth must be kept clean of debris of food.

Thrush is due to a parasite—the *oidium albicans*. It is most frequent in children, but may occur in any debilitated person. In infants, the bottle and teat must be kept perfectly clean. The bowels should be evacuated. Glycerine of borax, or potassium chlorate and glycerine (10 gr. ad $\frac{3}{4}$ ss) with water (ad $\frac{3}{4}$ i) should be applied by means of a camel's-hair brush over the mucous membrane.

Ulcerative Stomatitis is characterized by ulcers which not infrequently are of large size on the gums and inner aspects of the lip and cheek. The gums are swollen and tender; bleeding from the ulcers readily occurs, the breath is foul. The affection is most commonly seen in children, who are often very ill for the time being. The treatment is to apply chlorate of potash locally, and give the same drug internally as in the case of aphthous stomatitis. Improvement is often very rapid.

Cancerum Oris or **Gangrenous Stomatitis** usually occurs in children recovering from a severe illness, or after a specific fever. It affects the cheeks and gums, spreads rapidly, and causes a rapid destruction of the affected parts. It may spread so quickly that the mother's attention is first attracted by the appearance of a dark patch or dusky area of inflammation on the outer aspect of the cheek. The general symptoms are exceedingly grave and of a profound toxæmic type.

Treatment to be successful must be prompt and thorough. A general anæsthetic must be given, and all sloughs cut away till a bleeding surface is everywhere produced. Pure carbolic acid or nitric acid is then applied, the latter acid being neutralized by a solution of sodium bicarbonate. Care must be taken to prevent the acid gaining access to the throat. Afterwards the mouth must be kept irrigated with various antiseptic washes, and plenty of good food given. Much deformity and ankylosis—partial or complete—of the jaw is liable to follow if the child survives, and to remedy these, various plastic operations will be necessary.

Mercurial Stomatitis is especially likely to arise when bad teeth and spongy inflamed gums are present. In the slighter cases the patient complains of tenderness in the gums on eating, an unpleasant taste, and foul breath. The gums are swollen and bleed easily. In severe cases the pain is very great, salivation is abundant, the tongue is swollen and cannot be protruded, the mouth often cannot be opened, and is very tender from the presence on the mucous membrane of foul ulcers, a favourite site of which is far back on the inner aspect of the cheeks. The patient is often very ill and unhappy. If sloughing occurs extensively, partial or complete, ankylosis of the lower jaw may result.

Treatment. Before giving mercury the teeth should be attended to by a dentist and put into a healthy state. In the slighter cases the amount of mercury must be reduced, and in the severe cases the drug must be stopped completely. Astringent mouth-washes, alum and chlorate of potash, should be prescribed. It is a good plan to apply them to the ulcers with a soft brush or mop of cotton-wool. Chlorate of potash (10 gr. t.d.s.) internally with tonics, must be ordered. The diet must be liquid and highly nutritious, the mouth being cleansed after food is taken by draughts of water.

Syphilitic Stomatitis manifests itself by the presence of mucous patches, superficial ulcers and condylomata. General treatment for the disease is required. Locally the application of chromic acid (10 gr. ad $\frac{5}{8}$ i, or in stronger solutions) is very beneficial. In tertiary syphilis and in smokers, the epithelium on the inner aspect of the cheeks or lips may be hypertrophied and give rise to the formation of white plaques or areas. On these patches, papillomatous growths and even epithelioma may form. Such growths should always be excised and every care should be taken to avoid irritation of the thickened epithelium.

Affections of the Floor of the Mouth.—A sublingual inflammation is usually the result of traumatism. It may also be associated with submaxillary cellulitis. The tongue becomes pressed up by the inflammatory products, and its movements are interfered with; salivation is a prominent symptom, and the inflammation, unless checked, may spread to the submental region, or oedema of the glottis may supervene. Hot fomentations should be applied outside; antiseptic mouth-washes should be used internally. Incisions through the mucous membrane should not be delayed if the inflammation does not subside; afterwards the frequent use of mouth-washes should be continued. A similar condition may be associated with an impacted calculus in Wharton's duct; a sinus or ulcer with large granulations may form from the

same cause, and is liable to be mistaken for an epithelioma. In these cases the duct must be freely opened, and the stone extracted.

Cystic Swellings are not very infrequent. They are (1) *Mucous Cysts*, due to distension of the mucous glands. They should be opened and a large part of the wall removed, after painting the surface with a ten per cent. solution of eucaine or cocaine. (2) *Ranula*, which is due to the blocking of the ducts of the sublingual gland, and its consequent distension. A painless, thin-walled swelling, with a bluish translucent aspect is produced. It is usually situated between the tongue and the jaw, and sometimes reaches a large size, extending deeply between the structures in the floor of the mouth. The contents are thick, glairy mucus. It is best treated by painting the surface with ten per cent. solution of eucaine or cocaine, and then excising a large portion of the cyst wall. The lining membrane is scraped with a sharp spoon, or painted with pure carbolic by means of a small swab, care being taken to limit the action of the acid to the cavity of the cyst, which may be packed afterwards with antiseptic gauze, changed daily, till healing has taken place from the bottom. Dissection of the cyst should not be attempted unless recurrence occurs after repeated attempts at cure by this method have failed. Such an operation is very difficult, and should be done under a general anæsthetic. A large cavity may be left which is very liable to become infected, and therefore special care must be taken to provide free drainage. (3) *Dermoid Cysts* are not uncommon in the middle line of the floor of the mouth. They are situated beneath the mucous membrane, and frequently project in the neck, and may be detected on deep palpation in the submental region. They are not translucent and thin-walled like a ranula. Sometimes a yellowish tinge may be seen in the tumour, when it is inspected from the mouth. They are to be removed by extirpation through an incision in the neck. A median or transverse incision is made between the hyoid bone and the jaw. The muscles lying over the tumour are separated, and the whole cyst wall must be removed, otherwise recurrence will take place.

Malignant Disease of the Floor of the Mouth is generally a squamous-celled carcinoma. Primarily, it is most frequent between the tongue and symphysis of the jaw; it generally begins about the frenum or the orifices of the salivary ducts. As an extension from epithelioma of the tongue it is very common and may involve any part of the floor, but usually the lateral surfaces. The primary form being placed beneath the tongue may exist for a long time before the patient seeks advice, as there

are practically no symptoms in the early stages. Often its presence is only discovered accidentally, or when the ulcer has become so large as to cause interference with the movements of the tongue, salivation and pain on talking or taking food. The ulcer has an irregular surface with hard raised edges. It tends to spread rapidly and deeply on to the under surface of the tongue, and into the muscles of the floor of the mouth. The submental, sublingual and submaxillary glands are early involved. The prognosis is most unfavourable owing to the wide extensions of the disease to neighbouring structures, and the difficulty of getting clear of the infiltration. Recurrence is therefore very liable to take place. The only possibility of cure is to remove the growth widely, and very often with part of the tongue. It is also necessary in many cases to remove a portion of the jaw; wherever this is done, the inferior margin of the horizontal ramus should be left, a quadrilateral part of the bone being removed. By so doing the deformity is much diminished and there is no fear of necrosis of the jaw following the operation. In fact, it is remarkable how quickly granulations cover in the whole of the exposed bone. The operation is a severe one, but generally rapid recovery is the result. The lymphatic glands and the fascia covering the muscles should be removed from both the submaxillary and the submental regions, either at the time the mouth operation is done or preferably two or three weeks later.

The Palate.—Inflammatory affections are acute or chronic. An acute abscess from a carious tooth in the upper jaw may spread inwards and raise the muco-periosteum of the hard palate; a peritonsillar abscess is liable to burrow in the soft palate. Chronic inflammation is generally due to syphilis or tubercle. In syphilis, the epithelium may be hypertrophied and cause a condition of leucoplakia with excessive dryness of the surface. Gummata are frequent in both the soft and hard palates, and when they break septic infection follows and thus there is usually much œdema of the surrounding portions. A very large part of the palate may be destroyed, leading to the production of holes which are usually circular or oval in shape. When the soft palate is affected by syphilis, either congenital or acquired, the greater part may be destroyed, and during the healing of the ulcers much scar tissue, which often causes adhesions between the palate and pharyngeal walls, is formed. The evidence of old gummata on the palate is often present in the shape of circular white depressed scars. When the patient is seen before the gumma has broken, antisiphilitic treatment as a rule quickly resolves the trouble,

and even when a hole is present the further extension of the disease may be prevented and healing take place rapidly, unless some necrosed bone is present. The hole, however, does not always close, but becomes surrounded by thin scar tissue. The question is often raised whether such holes should be closed by a plastic operation.

Lupus sometimes occurs and is usually an extension from the disease on the face, but tuberculous affection may be primarily in the palate.

Acquired Perforation of the palate in addition to being of syphilitic origin may be caused by traumatism or follow some operative proceeding such as removal of an endothelioma of the palate, etc. It may also be caused by sloughing from acute disease. The treatment is either by obturators or a plastic operation.

Tumours.—The palate is sometimes the seat of a new growth which has the structure of an endothelioma. It occurs most frequently at or near the junction of the hard and soft palate, and is most common in adults, but children may be affected. The tumour is smooth, elastic, and oval in shape, covered by normal mucous membrane, quite painless, and yellowish white in colour. It is encapsuled and may be embedded in a cavity in the bone. The rate of growth is very slow and often its presence is found out accidentally, and when it has reached a considerable size. Microscopically it resembles the "mixed parotid tumours," and is often called an adenoma of the palate. These tumours are usually quite innocent, but sometimes they may be malignant, in the latter case they recur *in situ*, in the nose or naso-pharynx, and sooner or later involve the lymphatic glands about the angle of the lower jaw. The treatment is enucleation, an incision being made over the tumour which is shelled out. Sometimes this is not possible, and a portion of the bone has to be removed. The lymphatic glands should be removed if enlarged. The patient should be kept under observation for some years, and recurrence locally or in the glands watched for. If the recurrence is in the nose, blocking of the nostril and a watery discharge are important signs. If it is impossible to remove the tumour, treatment by radium may be tried, and sometimes is very successful.

Besides this special form of tumour the palate is not infrequently affected by other growths; it may be involved secondarily to tumours in the antrum. Epitheliomata, beginning on the tonsil or tongue, or in the alveolus, frequently spread to it. On the soft palate papillomata are found sometimes near the base of the uvula; they are pedunculated, and may be removed by scissors. The bleeding may be free, but is easily controlled.

T. P. L.

AFFECTIONS OF THE GUMS, TEETH AND JAWS

The gums may be spongy and soft, bleeding easily when touched, and receded from the teeth. These conditions are generally due to neglect of the teeth, the administration of mercury, or to scurvy. Recession of the gum may occur, however, quite apart from any obvious cause. In all cases the assistance of a dentist will generally be required to put the teeth into correct order.

Pyorrhœa Alveolaris is a common condition in which pus exudes in greater or less quantity from the tooth sockets, the margins of the gum being swollen and inflamed. The amount of swelling and inflammation is very variable; it may be so great as almost to hide the tooth, or it may be so small that there is only a slight swelling at the free margin of the gums. As the affection persists the gums recede, leaving the fangs of the teeth exposed to a greater or less extent, the pus burrowing about and forming pockets. The teeth become loose; they may be apparently healthy, but in most cases there is an excess of tartar and a carious condition. The affection is probably due to a streptococcal infection of the periosteum of the alveoli. Different methods of *treatment* are recommended. Dental measures are essential in all cases; these consist in the removal of tartar, syringing out the alveoli and pockets around the teeth with antiseptic lotions—hydrogen peroxide (ten vols.) being a favourite remedy—and the local application of astringents, powdered copper sulphate being warmly advocated by some dentists. Vaccines prepared from the organisms present and to which the opsonic index is low are probably of value and should certainly be employed.

Alveolar Abscesses are nearly always due to sepsis originating in a decayed tooth. The pus may be limited to the margin of the gum, forming a gumboil, or it may burrow more extensively beneath the periosteum and outwards towards the cheek. These latter cases are of importance for several reasons.

1. The pus may be slow in forming and there may be great inflammatory infiltration of the cheek without any precise indication of the locality of the pus. In such cases there is much œdema of the face and spasm of the masseter and pterygoid muscles.

2. The pus may extend widely beneath the periosteum and cause necrosis of the jaw. These cases are likely to be very troublesome on account of the slowness of the separation of the dead bone and because of the new bone which is irregularly formed round the sequestrum.

3. A persistent sinus or sinuses may be present if the abscess has burst spontaneously or has been opened externally. There is either

a dead tooth, a portion of a fang, or a piece of necrosed bone keeping open the sinus. An ugly depressed scar is liable to follow healing.

4. The pus may burst into the antrum of the upper jaw or extend deeply and widely in the neck.

Treatment. The first essential is to remove the tooth; in the slighter cases this may be enough to cure the affection, the abscess draining through the tooth socket. When an incision is necessary it should, if possible, be made inside the mouth between the gum and the cheek. It is best to give a general anæsthetic. The bleeding temporarily may be free. The incision must be large enough to open the abscess cavity fully; gauze packing may be afterwards lightly inserted. If an external incision is required it should be made transversely and in such a position that the scar will show least. A large-sized drainage tube is required. So long as the indications of pus formation are absent hot fomentations must be applied. A persistent sinus must be treated by removal of the tooth or the necrosed bone, the sinus being scraped and packed with gauze. In these cases a fibrous cord may often be felt passing across the cheek under the mucous membrane to the site of the trouble in the jaw.

Necrosis of the Jaw is more common in the lower than in the upper. It may be due to (1) sepsis following fracture or after the extraction of teeth with dirty instruments; (2) alveolar abscesses; (3) excessive use of mercury—this is rarely seen now; (4) syphilis, generally attacking the palate process of the upper jaw in the tertiary stage; (5) phosphorus, occurring in workers using the yellow variety—it is possible that tubercle is really the cause in these cases; (6) after the exanthemata, especially scarlet fever; (7) tuberculosis. In the case of the maxilla very little formation of new bone may take place; in the lower jaw a great deal may be formed. The separation of the sequestrum may be slow and its removal should not be attempted till it is loose. Whenever possible the dead bone should be removed from inside the mouth and if external incisions are required they should be placed so that the scars will be as little visible as possible.

Dental Cysts are frequently found in the upper jaw in association with the canine teeth. They form in connection with erupted teeth which have decayed, and they may develop after the tooth has been extracted, a fang or portion of the tooth having been left in the jaw. The cyst forms a fluctuating swelling beneath the mucous membrane; at the periphery of the swelling the bony margins of the expanded jaw may be detected. These cysts must be clearly differentiated from dentigerous cysts.

The *treatment* is to remove the tooth or fang,

open the cavity of the cyst, freely scrape away all the lining, and pack with gauze so as to obtain healing from the bottom.

Epulis.—This term should be limited to tumours originating in the gum. The simple fibrous growth is the commonest, and it develops in the periodontal membrane. It is often found near a decayed tooth, grows slowly and forms a more or less pedunculated tumour of the same colour as the gum; the surface may be ulcerated and irregular. Microscopically an epulis consists of fibrous tissue and spindle cells; the rapidly growing tumours contain much cellular tissue.

The **Myeloid Epulis** contains numerous giant cells, is dark in colour and soft. Its origin is in the bone and unless it is freely removed, it recurs.

Treatment. The simple fibrous growth should be removed, together with the adjacent tooth. If the latter is healthy it may be replaced after the tooth socket has been scraped out. If the growth is extensive or recurs, a more radical operation is required. The tooth on either side is extracted and the alveolus sawn through vertically; the lower ends of these cuts are then united by a horizontal cut, so as to mark out a quadrilateral portion of the bone to which the tumour is attached. The myeloid epulis is treated in a similar way, care being taken that the saw cuts in the bone are well wide of the disease.

Papillomatous Warty Growths occur sometimes on the gum. They may be due to irritation of a carious tooth and may be present on the opposite gum to that in which the tooth is. Removal of the tooth should be carried out and the growth excised if it does not rapidly disappear, for if left epithelioma may develop.

Fracture of the Lower Jaw is usually caused by direct violence. The commonest seat of injury is the region of the canine tooth, but the fracture may occur at the angle, at the coronoid process, the symphysis or the neck of the condyle. There may be more than one fracture. The fracture is compound when the mucous membrane is involved, and therefore septic complications, abscesses and pneumonia and necrosis are liable to follow. Severe pain due to stretching of or pressure on the inferior dental nerve is common. The signs of the injury are irregularity in the line of the teeth, hæmorrhage from the gums or severe bruising if the angle or ascending ramus is the part involved. Crepitus is evident on grasping the jaw and moving one part on the other. Five weeks is the average time required for union to take place; if sepsis occurs a much longer time may be necessary. Non-union may be caused by a displaced tooth lying between the fragments or it may be due to necrosis of the bone.

Treatment. Whenever possible the assistance of a dentist should be obtained in order that a suitable splint may be made to keep the parts in a proper position. Such a splint will take the form of a Hammond's interdental wire splint, which is suitable when there is sufficient room to pass the wires between the teeth, or a Kingsley's apparatus, which consists of a vulcanite splint moulded to the teeth. To the front of the splint two metal bars are attached; these project laterally beyond the angles of the mouth, and by means of a bandage passed beneath the chin from one bar to the other the splint is fixed in position and the fragments are kept at rest. If dental assistance cannot be obtained a four-tailed jaw bandage with or without a moulded gutta-percha splint applied outside the jaw must be used. The lower tails of the bandage should be tied over the vertex of the head and the upper ones behind the occiput, the four ends then being fastened together to prevent slipping.

The after-treatment consists essentially in keeping the mouth sweet with antiseptic lotions and feeding the patient with liquids and soft foods till union has taken place. If an accumulation of pus occurs it must be evacuated from the outside.

Wiring the fragments is rarely advisable, it is generally impossible to do the operation without the wound communicating with the mouth, and therefore the risk of septic infection is very great.

Fractures of the Upper Jaw are always due to direct violence. Not infrequently the fracture is only part of a more severe injury in which the other facial bones are involved. Partial fractures limited to the alveolar margins sometimes occur. The antrum may be involved and the bone is usually comminuted. There is often severe hæmorrhage and much swelling of the face from bruising. Unless quite detached, loose fragments should not be removed, because union readily takes place. The fragments should be restored to their proper position as far as possible; it is often unnecessary to use any form of dental splint. The mouth must be kept clean, and if suppuration takes place the pus should be evacuated at once.

Tumours of the Jaws. Odontomata.—These tumours arise in connection with the developing tooth; several varieties are described, but only the epithelial and follicular odontomata are common in human beings. The fibrous, composite and radicular odontomata and the cementomata are very rare.

The **Epithelial Odontome** begins in the germ of the enamel organ, and is formed of a mass of cysts of various sizes, with fibrous tissue. Adults are most frequently affected. Its rate

of growth is slow; usually it is in the lower jaw. The lymph glands are not affected. This tumour is also known as a fibro-cystic tumour or a cystic epithelioma. The treatment is complete removal of the affected part of the jaw; if any portion is left behind recurrence will take place.

The Follicular Odontome or Dentigerous Cyst is not uncommon; the lower jaw is more frequently the seat of the tumour. It arises in connection with an unerupted tooth and consists of a sac containing a tooth and fluid. These cysts are most common in children and young adults. As they form in the substance of the jaw the bone is gradually expanded and thinned, so that "egg-shell crackling" may be detected. In the upper jaw the cyst may extend into the antrum or backwards into the bony palate or beneath its muco-periosteum. These odontomes are liable to be mistaken for myeloid sarcomata, the points of difference being the absence of a tooth, the normal colour of the mucous membrane, which in a myeloid is often purplish, and the fluid contents.

Treatment should be carried out from inside the mouth and consists in incising the mucous membrane, removing a portion of the bony wall and compressing the remains of the latter together to diminish the size of the cavity, which is packed with gauze. Healing is allowed to take place from the bottom.

Tumours of the Lower Jaw.—**Osteomata** are usually of the ivory type; they are not very frequent. **Sarcomata** are either endosteal or periosteal. The former are frequently *myeloid* or *giant-celled*, with a low degree of malignancy, they grow somewhat tardily, expand the jaw, and their characteristic dark-red colour can often be seen. It is usually sufficient to remove the growth by gouging it out and plugging the cavity with gauze, or a quadrilateral portion of the jaw containing the diseased part may be removed, leaving the inferior margin of the jaw in order to preserve its shape intact. Sometimes the endosteal sarcoma is round-celled and is then much more malignant. Excision of the jaw is the only treatment.

Periosteal Sarcomata may be spindle- or round-celled and have the characteristic features of these growths, as in other bones; they are to be treated by excision of the jaw.

Epithelioma may be primary or secondary. In the latter the jaw is affected secondarily to cancer of the tongue or of the floor of the mouth. The former is a squamous-celled carcinoma beginning on the gum, usually about a carious tooth. It grows rapidly and may produce few symptoms. It invades the bone widely and early and presents all the characteristic features of an epithelioma. The lymphatic glands are infiltrated early in the disease. Excision of the affected half of the jaw and removal of the lymphatic glands is

the only treatment. If the disease has not spread deeply into the jaw it may be possible to save the inferior margin. The prognosis as to recurrence is bad.

Tumours of the Upper Jaw.—The antrum is most commonly the seat of tumours, which may be cystic or solid. Cysts produce symptoms when they are large enough to distend it; the outer wall is usually bulged forwards, so that a swelling of the face is produced, or the swelling may be felt most easily between the cheek and gum from inside the mouth. On transillumination the affected side is less opaque than the other.

Treatment consists in opening the cyst from inside the mouth and providing free drainage into the inferior meatus of the nose.

Solid Tumours are generally either sarcoma or epithelioma and therefore malignant. The former are more common and are usually round- or spindle-celled; giant-celled or myeloid tumours occur sometimes. After the growth has filled the antrum cavity it causes bulging and absorption of the walls and thus produces a swelling of the cheek, blocking of the nose and lachrymal duct, displacement of the eyeball, and sometimes depression of the palate. Hæmorrhage and discharge from the nostril and epiphora are therefore frequent symptoms.

Epithelioma is usually squamous-celled; it extends rapidly in all directions, and begins very often in connection with a tooth socket. The term "boring epithelioma" is often applied to this form of disease because it destroys and penetrates the bones rather than forms a definite tumour mass. The pain is often severe and is mistaken for neuralgia. The lymphatic glands are involved early.

Besides these antral tumours sarcomata beginning on the posterior aspect of the jaw are not uncommon. They will push the jaw forward and grow up to the temporal region and displace the eyeball forwards.

The diagnosis of antral tumours is often difficult and examination by transillumination and of the nasal cavity should never be omitted. It may be necessary to open the antrum and remove a portion of the growth. A ragged ulcer or sinus near a tooth socket or on the palate is always suggestive of epithelioma.

The only treatment for these tumours is the removal of the upper jaw. Before deciding on this proceeding great care must be taken to determine the limits of the disease and how far it has extended beyond the jaw. If the lymphatic glands are affected and are not capable of being removed operation is contra-indicated.

The upper jaw is also the seat of another solid tumour which grows slowly and fills up the antrum and may extend to other bones of the face. This tumour is called hyperostosis. Both

maxillæ may be affected. It generally occurs in young adults. When limited to the maxilla it may be treated by partial or complete excision according to the extent of the disease.

Actinomycosis usually occurs in the lower jaw and produces a slowly growing tumour. Sooner or later the soft tissues are infiltrated and the skin becomes reddened, sinuses form and from them the characteristic yellow granules containing the fungus may be expressed. There is often inability to open the mouth and the inflammatory infiltration may extend far down the neck. The treatment consists in giving large doses of potassium iodide, scraping thoroughly the sinuses and laying them open. The inflammatory exudation is often very tough and vascular, so that the operation is accompanied by free bleeding. Exposure to X-rays sometimes does good.

Closure of the Jaw may be due to (1) fibrous or bony ankylosis of the temporo-maxillary joint; (2) excessive cicatrices after burns, lacerated wounds, operations or gangrenous stomatitis; (3) reflex spasm of the masseter and internal pterygoid muscles from an impacted wisdom tooth (a common cause) or infiltration by inflammatory exudation—occasionally the spasm is neurotic: spasm of the masseters and pterygoids is one of the first signs of tetanus; (4) disease in the mouth, alveolar abscesses, quinsy, epitheliomata of the jaw, palate, tongue, etc.

A true ankylosed condition will require to be treated by excision of the condyle of the jaw. Reflex spasm (trismus) will be treated by removal of the impacted tooth or opening of the abscess. If the muscular spasm is neurotic in origin a general anæsthetic should be given and the mouth opened, a suitable prop being inserted and left in after the patient has recovered from the effects of the anæsthetic. When the closure is due to cicatricial contraction a plastic operation, combined with Esmarch's operation on the jaw, will be indicated. The latter consists of removing a triangular portion of the jaw in front of the contraction so as to make a false joint. Some of the soft tissues may be placed between the cut ends of the bone, in order to prevent osseous fusion taking place.

T. P. L.

HARELIP

Harelip is a congenital deformity due to imperfect union of the processes which normally form the lip. There are many varieties which are classified according to the extent of the defect. It may be incomplete or complete; in the former the nostril is not involved, in the latter the cleft extends into the nostril which is flattened. In the slightest degrees of incomplete harelip there is merely a notch

in the free margin of the lip. In the next degree the deformity extends into the substance of the lip for a greater or lesser extent, the tissues above the apex of the notch being normal, or more commonly thinner than normal. The deformity may be single (unilateral) or double (bilateral), and in very rare cases it is strictly median. Cleft palate is often present, and when the cleft is complete the premaxillary process projects to a greater or less extent. In double harelip this process is usually very prominent and is attached to the extremity of the septum nasi. Besides being prominent, the premaxillary process is often obliquely placed, so that its alignment is not continuous with that of the alveolar margins.

Treatment. Several important matters have to be considered in the treatment of this affection.

1. *Feeding.* Many infants with this deformity will be unable to take the breast; therefore artificial feeding must be resorted to, either by means of a spoon, or by a bottle with a special teat, which should be short and wide, with a hole sufficiently large to allow the milk to be poured into the child's mouth. Special teats provided with a flange to cover in the cleft in the palate (if one is present) can be procured. Feeding must always be carried out slowly, and intermittently, with the child lying on its side, and, if possible, the mother's milk should be utilized. Otherwise the infant must be fed on cow's milk prepared in the usual way. Children with harelip and cleft palate may lose weight rapidly; this is often due to ignorance of the proper way to feed such children.

2. *Best Time for Operation.* Speaking generally and granted that the child is in good condition, three to four weeks is about the most suitable age for operation. There is no reason why, other things being equal and circumstances demanding it, the operation should not be done sooner. The writer is not in favour of operating on the cleft palate, if one is present, before the harelip is closed, unless Brophy's operation is done.

3. *Operative Treatment.* The most important principles are (a) to free the lip so as to bring the margins of the gap together without tension; (b) to pare completely the edges of the gap; (c) to restore the nostril to its proper shape; (d) to ensure that the muco-cutaneous junction is a continuous line. During the operation hæmorrhage is controlled by clamps applied to the upper lip near the corners of the mouth; it is unnecessary to ligature vessels as the bleeding stops when the raw surfaces are sutured. When the harelip is incomplete the incisions for paring the edges should be carried into the nostrils to obtain the most satisfactory effects, which is only possible by excising all thin

tissue. In suturing the pared edges a stitch should always be placed within the nostril and one at the muco-cutaneous junction. These stitches are most essential. The mucous surface may require one or two sutures. The sutures should be of fine horsehair or silkworm gut; they should not be left in more than four or five days, unless special circumstances demand them being kept in longer, for then stitch marks result. They should be taken out separately, not all at once. Harelip pins are quite unnecessary if the undercutting be properly carried out. In double harelip, the central part, namely that portion attached to the premaxillary process, is not usually large enough to form the whole depth of the restored lip. It can be used only to form the upper part of the lip and the resulting scar will have a Y-shape. In other cases it is better to use this central part to form the columella, and by free undercutting of the lateral parts of the lip to bring them together in the middle line.

Treatment of the Premaxillary Processes. In single harelip if there is not great prominence of the premaxillary process closure of the lip will be sufficient to repress the process to its natural position. In other instances it will be necessary to partially divide the attachment of the premaxillary process to its maxilla, by a pair of bone forceps, the blades of which should be slowly closed. The premaxilla is then bent into position sufficiently to allow the harelip to be closed over it. Sometimes the adjacent surfaces of the alveolus and premaxillary process should be refreshed, and the bones united by a silkworm gut or silver wire suture.

In double harelip in the majority of cases the premaxillary process is very prominent. It should never be removed, for then considerable falling in of the upper lip results, and an unsightly appearance is given to the facial aspect. Nor should the incisor teeth be gouged out. The best way of dealing with the process is to remove a triangular-shaped portion of the septum from immediately behind the process. This can be carried out through an incision along the free lower margin of the septum and separating on each side the septal mucous membrane. Enough of the cartilaginous septum is removed to allow the process to be pushed back into its proper position. Another method is to divide the septum obliquely and then slide one portion upon the other. The objection to both these proceedings is that the teeth tend to grow obliquely backwards when they erupt, and this displacement will require correction by a dentist.

The immediate complications after the operation for harelip are few—failure of union and septic infection are the most frequent. A badly

performed operation will require a secondary operation to rectify the disfigurement.

T. P. L.

CLEFT PALATE

Congenital Cleft of the Palate may be complete or incomplete—the former involves the alveolus, and the latter only a portion of the palate—it may be the soft, or the soft and part of the hard. The cleft may be unilateral or bilateral and be accompanied, or not, by harelip. The width and the shape of the cleft, and the height of the arch of the palate, vary in different cases. Of great importance is the shape of the anterior end and the amount of tissue on either side of the cleft. A cleft with a wide anterior rounded end is much more difficult to close than one with a narrow pointed extremity; a cleft with a small amount of tissue on either side is also difficult to close. The effects of the deformity are defective speech and imperfect power of suckling and swallowing. It is also said that a cleft-palate child is particularly prone to septic diseases, diarrhoea and vomiting. It is very doubtful if there is any reliable evidence to support this statement. A child born with a cleft palate may be perfectly healthy and robust at first; but unless properly fed the infant may rapidly waste, owing to the inability to suckle. The proper way to feed a child with this deformity is to give the milk either by means of a spoon, slowly pouring it into the mouth, or by means of a bottle with a wide short teat, the bottle being held slightly above the horizontal and the teat having a hole sufficiently large to allow the fluid to run gently into the mouth, the child being placed in a horizontal position. Whichever method is employed, the milk should be given slowly, and sufficient time allowed for it to be swallowed without undue regurgitation. A great deal of time no doubt is required to be spent in the feeding of these cleft-palate children. But if care be taken to ensure that sufficient nourishment is given, the child will thrive, and infants who have been allowed to waste often recover when properly fed.

Very few parents will be unwilling to have the child operated on, and the most important question is when and how the cleft shall be closed. The main object of operating is to enable speech to be properly performed. Difficulties in swallowing are usually overcome, and it is rare to find an older child with cleft palate who has any great difficulty from regurgitation of food. The operation should be done before the child has learnt to speak. Unless the cleft is very narrow and is limited to the soft palate, it is best to do the operation in the second year, and special care should be

taken to ensure that the cleft in the soft palate is completely closed and restored as nearly as possible to its natural state. In bad, wide clefts some shortening and limitation of the movements of the soft palate are almost certain to occur. The child should be in the best possible state of health, and if it is suffering from any illness or has just recovered from such, or is anæmic and ill-nourished, the operation should be delayed. It is of much importance that the mouth should be free from septic infection of any kind at the time of the operation. If adenoids are present they should not necessarily be removed; if they are inflamed or suppurating, treatment should be adopted to remedy such condition. If for any reason it is considered advisable to remove the tonsils or adenoids, the wounds should be allowed to heal and the patient should have recovered before the operation on the palate is undertaken.

The best operation is that known as Langenbeck's or median suture, in which the muco-periosteum is raised as a flap from each side of the cleft, and the flaps are united in the middle line after the edges of the cleft have been refreshed. In dealing with the soft palate this structure must be carefully detached from the posterior extremity of the hard palate before its pared edges can be sutured without tension. Silkworm gut is the best material for sutures. The operation may be done in the first few months of life if the cleft is narrow and the amount of tissue sufficient. When the cleft is wide it is better to delay operating, because with the growth of the child the width of the cleft diminishes and therefore renders a successful operation more probable.

In this, as in any other method, secondary operations may be necessary to close any hole which may result from defective healing. Such holes are most likely to be present at the junction of the hard and soft palate. Small ones often close spontaneously, and even large ones diminish in size, so that some time should be allowed to elapse before any further operation is done on them. If a secondary operation is required it should be carried out when the granulations are healthy and before complete cicatrization has taken place.

The writer cannot recommend what is known as Lane's "turnover flap" operation, which consists of raising a flap of muco-periosteum from the hard palate, and of the mucous membrane from the soft palate on one side of the cleft, and turning it over the cleft and suturing it to a prepared area on the opposite side of the cleft. The cleft can undoubtedly be closed in this manner, but the mere closure should not be the main object of the operation, which is to enable the speech to be as nearly perfect as possible. Moreover, it would appear that the

flap is liable to atrophy, and the amount of scarring which results is certainly greater than in a successful Langenbeck's operation. The ultimate result in all those cases the writer has seen are not nearly so good as in those which have been operated on by Langenbeck's method.

Brophy's operation, which consists in forcing the bones of the hard palate together by manipulation from the outside, and then keeping them in position by means of silver wires passed from one alveolar margin to the other, is in theory the most suitable operation, for it should restore at once the parts to their natural position. In this country the operation has not been often properly performed, and if it can be shown to have a low mortality it may become a valuable method. The operation is best done at from three to six weeks of age; after five months it is difficult to get the bones together satisfactorily. Properly performed, there is only slight hæmorrhage and very little accompanying shock.

After any operation the mouth must be kept clean and free from food débris. At first, liquids only should be given, and when healing is well advanced soft solids may be added. It is a good plan to give a drink of water after each meal. To attempt to clean the mouth by irrigation or swabbing with antiseptics usually frightens a young child, and therefore should not be done. In older patients such methods may be employed if necessary. The patient should be kept as quiet as possible, sedatives, such as bromides or opium, being given as required. No attempt at talking should be allowed for fourteen to twenty-one days, and the mouth should not be examined for a week at least after the operation, unless an unpleasant odour or a persistent elevation of the temperature suggest that sloughing and sepsis are present. In such cases a spray of hydrogen peroxide (ten vols.) may be used.

As soon as the child reaches the age at which speech begins every care must be taken to teach him to pronounce letters and words properly. Too much time cannot be expended in doing so. Certain consonants, P, B, T, D, K, G, and combinations of consonants are more difficult than others, and bad habits once developed are most troublesome to eradicate. When an operation is done on an older patient who has already learnt to speak, a good deal of improvement may be anticipated if sufficient time and care are devoted to this object. It is also important to correct any deficiency or irregularity of the teeth.

The employment of obturators is now rarely, if ever, advocated or carried out. There are serious objections to their use. In the first place it is almost impossible to get a satis-

factory one for the cleft in the soft palate. It is easy to have one made which will close the cleft in the hard palate. But with the movable soft palate it is quite different; no substance can take the place of the soft palate, the delicate movements of which are essential to proper articulation. Another grave objection to obturators arises from the fact that very few children would tolerate their presence in the mouth and oro-pharynx; and just at the time when they should be constantly worn, namely, when the child is learning to talk, the shape of the mouth is continually changing, and therefore it would be necessary to frequently renew the obturator. Even in the case of very wide clefts it is generally possible to close that in the soft palate, and this should always be done, even if the remainder of the cleft cannot be closed.

T. P. L.

SURGERY OF THE TONGUE

Injuries of the Tongue

These injuries are most frequently inflicted by the teeth, and the first danger is that of primary hæmorrhage, which is the greater the nearer the wound is to the base of the tongue. This hæmorrhage is easily controlled by means of stitches when the wounds are near the tip or side of the tongue, but when the wounds are farther back it may be necessary to seize and tie the bleeding vessel. At times this is impossible, owing to the rapid and great retraction of the divided vessels within the muscles of the tongue; and it may be necessary to administer an anæsthetic, and to expose and tie the lingual, external or common carotid artery in the neck.

Every wound of the tongue should be sutured with iodine catgut for preference.

Primary hæmorrhage is the first important clinical event in wounds of the tongue. The second must be anticipated by treatment, and is suppuration. Mouth-washes (listerine \bar{z} iii to aq. \bar{z} viii), tooth-brush antiseptic powder and wash, oral lavage before and after food, fluid nourishment administered if necessary, with a tube on the spout of a feeder, or even rectal feeding should be enforced. Mainly owing to the presence of decaying teeth and pyorrhœa alveolaris, the mouth is often an intensely septic area. If sepsis occurs, the sutures cut through the tissues, allowing the pus to escape. This obviates the necessity of removing the stitches and prevents the imprisonment of the pus with consequent extension of the septic inflammation to the neck, glottis, etc. The importance of this oral sepsis is appreciated if the mouth is well cleansed and teeth removed before the operation of excision of tongue; the convalescence is robbed of three-quarters of its distress and dangers.

Suppuration may lead to secondary hæmorrhage, the third clinical incident of wounds of the tongue. As a rule this can be stopped by means of passing sutures through the tongue, and tying them, but this tying is not usually done. Hæmorrhage can always be controlled temporarily by inserting a gag in the side of the mouth and compressing the stump of the tongue with two or three fingers in the throat against the front of the lower jaw or hyoid bone.

Burns and Scalds of the Tongue are of minor degrees of importance, the hot material being either ejected or swallowed; even the swallowing of a corrosive acid causes the condition of the tongue to become an inconsiderable item in the general symptoms, but the consequent swelling may extend to the throat and necessitate tracheotomy.

Acute Glossitis.—This is usually the result of a burn or wasp sting. It is very painful and distressing; the tongue feels too large for the mouth and seems to asphyxiate the patient. As the acute symptoms subside in twenty-four or thirty-six hours, special feeding is rarely resorted to. Similarly tracheotomy is seldom needed, and even longitudinal incisions are not often required. Abstinence from food, calomel, hot fomentations, sedatives and general attention to the comfort of the sufferer constitute the treatment for acute glossitis.

Cellulitis of Tongue.—This is associated with much pain, distress, fever and tongue-swelling. It is almost always a general (parenchymatous) glossitis due to a streptococcus. It demands immediate and free incision (longitudinal) into the tongue, and, owing to its rapid spread to the submaxillary region, incisions below the angle of the jaw may also be necessary. A great danger is swelling of the glottis and consequent dyspnœa.

Dental Ulcer.—A septic inflammatory ulcer caused by the rubbing of the tongue against a sharp septic tooth. It is found on the side of the tongue in adults and elderly people. Remove the tooth.

"Dyspeptic Ulcers."—Small, often multiple ulcerations at the tip of the tongue of young adults. Treat the dyspepsia. The ulcers should be touched with silver nitrate.

Chronic Superficial Glossitis.—Present in several conditions, *e.g.* the red, raw-beefy-looking tongue; best known in the condition of leucoplakia.

The majority of such patients have an ancient syphilitic history; and, if the tongue is fibrous and fissured, syphilis has possibly something to do with its origin. Otherwise the chief factor is oral sepsis (pyorrhœa alveolaris, decaying teeth, etc.). This condition is often a starting-point for cancer, which in the early

stages *cannot* be diagnosed with certainty. Hence suspicious areas (unduly hard, infiltrated, ulcerating, etc.), should be excised and microscoped.

The presence of enlarged lymphatic glands in the submaxillary regions is no sure evidence of carcinoma, as it is very usual for the chronic superficial glossitis to be complicated with some septic absorption.

The treatment in the main must consist of oral cleansing by a skilled dentist. Alimentary disturbances must be rectified by dieting and drugs; special attention must be given to drinking (alcoholic and non-alcoholic) and smoking. In some patients the chronic oral uncleanness has led to changed secretions from the salivary glands discharging into the mouth. Such cases are the most difficult to cure, and are most easily recognized by dry mouth and loss of taste. Mouth-washes should be used frequently on getting-up, going to bed, and before and after food.

Painting the tongue with silver nitrate (two grains to the ounce), or chromic acid (ten grains to the ounce), or lactic acid (twenty per cent.), produces only irritation, and is generally useless. It has been historic to give general treatment as for syphilis, and the vast number of failures testifies to the uselessness of such treatment. A mixture of soda and gentian for the dyspepsia, caused by swallowing the oral sepsis, is often of more use.

Smoker's Patch is a local manifestation of the disease of leucoplakia.

Tuberculosis of the Tongue.—This is found in younger subjects, associated with general tuberculosis or pulmonary tuberculosis (infection by blood-stream or sputum, or by direct extension of lupus from the face). Diagnosis is easy. Treatment usually palliative only, painting with cocaine, morphia, lactic acid, etc., or even removal of part of the tongue.

In older subjects, tuberculosis is mistaken for carcinoma. The differential diagnosis is difficult and a partial excision should be done, the excised portion being submitted to microscopic examination. With the diagnosis of tuberculous glossitis the tumour should be excised.

Treatment. General, as for tuberculosis; local, morphia, cocaine and lactic acid.

Removal of a Portion of the Tongue, for microscopical examination.

Prepare and sterilize a knife, scissors, three pairs of artery forceps, one pair of dissecting forceps, three curved cutting needles, and some catgut. One or two retractors for the cheek, and a spatula, are useful.

First pass a stitch through the tongue near the tip, after the patient has brushed his teeth and rinsed his mouth with an antiseptic mouth-wash. Clamp both threads of the stitch through

the tongue, which is protruded from the mouth. Wipe moisture from the portion of the tongue to be excised, paint the locality with two per cent. iodine in spirit. Excise the portion with knife or scissors. Close the wound with a row of rather close sutures, in order to stop all hæmorrhage and make the wound "water-tight." Cut all stitches "short," wipe off any remaining iodine, and release the tongue by cutting the stitch which is holding the tongue forward.

When it is needful to employ a local anæsthetic use a mixture of adrenalin and eucaine; and after inserting the stitch which holds the tongue forward, plunge the needle of the syringe containing the anæsthetizing fluid a little in front of the portion to be removed, pass it deeply until the point of the needle is behind the same portion. Then begin the injection. After this release traction on the stitch which holds the tongue forward, until the anæsthetic has acted; then proceed with the little operation as above described, in addition tying all obvious bleeding vessels.

After the operation the mouth must be washed out frequently, hourly whilst awake, particularly at night and morning and before and after food. For this purpose a good mouth-wash is listerine \bar{z} iii, potassium chlorate \bar{z} ss, water to \bar{z} viii. Food, of course, should be taken in a liquid form at first, and the diet advanced to semi-solids and solids as the condition of the tongue improves.

Syphilitic Diseases of the Tongue

Primary Syphilitic Disease.—A hard, tender, ulcerating, septic nodule, seen on the tip of the tongue, most frequently in men about thirty years of age. The only proof of its syphilitic nature is the demonstration of the spirochæte pallida in the sore. Hard discrete lymph glands rapidly appear in the submental region. The primary sore has dual characters, septic and syphilitic. So, too, the lymph glands, which, in consequence, may or may not conform to the definition of the glands of the syphilitic bubo; "small, hard, discrete, and never suppurate."

Examine for signs of secondary syphilis, and treat as recommended for syphilis; remembering the dual character of the infection and using mouth-washes freely. Do not expect the primary sore to be like a penile chancre.

Secondary Syphilitic Disease.—This is seen in conjunction with the syphilitic sore throat, and usually as condylomata and subacute glossitis. It is accompanied by a septic condition of the teeth.

Treatment should be local and general, as recommended for secondary syphilis.

Tertiary Syphilitic Disease.—1. A general

sclerosing glossitis, the tongue being hard, creased, mammillated, with crenated edges. The condition is often associated with chronic superficial glossitis.

It is the result of the fibrosis of a diffuse gummatous infiltration of the tongue.

2. A gumma, usually found on the dorsum, either as a swelling, hard or breaking down, or an ulcer. It is indolent, and unless it gets septic and inflamed, gives little discomfort.

3. Syphilitic Fissures. Long, narrow, deep clefts in the tongue, with ulcerating bases, are attributed to syphilis.

Except the gumma, syphilitic manifestations in the mouth take little or no notice of anti-syphilitic treatment. They heal slowly and surely if all sepsis, teeth, etc., are removed and mouth-washes freely used.

Treatment general and local, as for syphilis.

Carcinoma of the Tongue.—This is most often found in men between fifty and sixty years of age, its development undoubtedly being favoured by chronic irritation (decayed teeth, pipes, tooth-plates, oral sepsis, etc.). It is most often seen on the side of the anterior half of the tongue.

It has a dual nature; carcinomatous and septic. An ulcer is practically always present, and has hard, raised, irregular, everted edges. There is no tenderness or bleeding unless the ulcer is inflamed. The base is hard, irregular and warty. There are septic and carcinomatous glands under the jaw.

As a general rule the diagnosis is easy; if it is not so, a portion of the growth should be removed and examined with a microscope.

The first step in treatment is to remove as much "oral sepsis" as possible; this can only be done by a competent dental surgeon. It allows the inflammation around the growth to subside, and I have seen a growth previously regarded as irremovable thus become easily removable. This step is like doing a colotomy before an excision of the rectum. It takes ten days to a fortnight. The second step consists of the thorough removal of the contents of the submental region and both submaxillary regions. The third step consists in the removal of the tongue, and is best done by cutting through the mucous membrane attaching the floor of the mouth to the lower jaw, the tongue can then be separated with the finger from its attachments and drawn forward, so that the whole organ can be excised without any splitting of the cheek or jaw.

The after-treatment must be directed towards keeping the mouth clean and giving liquid food through a tube attached to a feeder. If great care is taken to cleanse the mouth before operation, the after-mortality is diminished, the convalescence is much shorter, and the pains and

discomforts much less. Malignant ulcers commonly improve, or appear to improve, after a treatment of cleanliness and iodide of potassium; the improvement being due to diminution of the inflammatory factor in its character, and not to any change in the carcinomatous factor. But this treatment with a course of iodide is so apt to mislead that it is undesirable; it really is far better to remove a portion of the suspicious ulcer for microscopic examination, after the method above detailed. (A dental surgeon can be cleansing the mouth whilst the microscopist is doing his report.) A Wassermann's serum reaction may also be taken. It is of use in giving indication, but, if positive, there is no certainty that the lesion of the tongue is syphilitic.

The most frequent simple tumour of the tongue is **papilloma**. They are of so unsatisfactory a nature that they should always be removed.

Dermoid Cysts, from branchial clefts, are found under the tongue, in the middle line, between the genio-hyoglossi muscles. They differ from ranulae in being medial, yellow and opaque. (Instead of asymmetrical, purple and translucent.) These also should be removed.

Thyreoglossal Tumours or Cysts.—The thyroid gland is connected in embryonic life with the foramen cæcum at the back of the tongue. The cysts bulge up behind from the dorsum towards the roof of the mouth and, being within it, interfere with movements of the tongue. Hence patients recognize their presence and seek advice early.

The treatment is excision, with strict oral cleanliness.

Malformations.—The tip of the tongue is sometimes cleft, making the tongue bifid and serpentine.

Tongue-Tie.—A condition more often talked about than seen. When necessary the frenum linguae can be snipped close to the lower jaw with blunt-pointed scissors, completing the freeing of the tongue with the forefinger.

Macroglossia is either a congenital or an acquired condition. In the former case, the defect in the tongue is usually associated with a grave mental defect; and if it is worth while to operate, a wedge-shaped portion is removed and the gap so formed closed. But most frequently macroglossia is acquired from blocking of the lymphatics of the neck from cellulitis in the submaxillary region. It is relieved by incising the submaxillary region. The exposed tongue is the result of lymphatic oedema, and in children rarely is due to fibromatosis of the nerves.

Neuralgia.—Give potassium bromide or potassium iodide; treat gouty, rheumatic and other conditions by appropriate drugs. In inveterate cases it is necessary to divide the lingual nerve,

particularly where there is an inoperable carcinoma of the tongue. If the neuralgia does not quickly subside under treatment with ordinary remedies, either division of the nerve or its injection with alcohol must be considered. In severe neuralgia a careful search should be made to find a focus of malignant disease.

E. M. C.

THE TONSILS AND PHARYNX

Injuries of Tonsils and Pharynx are usually inflicted from within. Pipe stems and similar articles may cause a severe lacerated wound, the hæmorrhage from which may be abundant. In the treatment of these accidents it is most essential to have a good light and the patient's mouth widely opened. Sponges held in suitable forceps should be used to wipe away the blood. Pressure exerted by the sponge may be sufficient to arrest the bleeding, if not, the application of adrenalin chloride (1 in 1000), or tannic acid by means of gauze plugs or mops, should be tried. If there is an obviously spouting vessel an attempt to tie it may be made. In other cases a stitch may be passed from one pillar of the fauces to the other through the tonsil, and the ends tied over a small plug of gauze or wool. Only very rarely will it be necessary to ligature a main vessel in the neck. In injuries inflicted from the outside the wound must be opened up and the hæmorrhage arrested by gauze plugging or by ligaturing the vessel. If the latter is impossible forceps may be left on for forty-eight hours or longer if thought advisable.

Foreign Bodies.—The symptoms from these vary according to their nature. Fish bones and similar small bodies cause constant pain, which is worse on swallowing; large masses of food impacted at the opening of the larynx cause severe dyspnœa. Tooth-plates and the like may cause few symptoms. When dyspnœa is present the mouth should be gagged open and the finger passed to the back of the pharynx and the body hooked up if possible. It is advisable to invert and shake vigorously a child; the foreign body may then be displaced. Failing this, laryngotomy or tracheotomy will be required; the former operation is impossible in children. After the dyspnœa has been relieved the foreign body must be removed by suitable forceps, and if these fail it will be necessary to have resort to the operation of pharyngotomy or extraction through Brünings' tubes. An X-ray photograph should always be taken so as to localise the foreign body whenever circumstances render it possible to do so.

Inflammatory Affections of the Pharynx and Fauces.—Acute inflammation is most common in the form of a peritonsillar abscess or quinsy.

The affection may be bilateral, one side being affected before the other. The œdema is often extensive and may extend to the glottis. One of two methods for opening these abscesses may be adopted. In one a narrow-bladed knife is taken and the blade wrapped round with adhesive plaster to within half an inch of its point; in the other a pair of sinus forceps with fine points is used. A good light is essential. The mouth is opened as widely as possible, the tongue being depressed by a spatula, and a ten per cent. solution of cocaine is applied either by a spray or swab. The pus is best reached behind the anterior fold of the fauces and above the tonsil. The knife or forceps is pushed in at this region and an opening at least half an inch long made. Free bleeding will occur at the moment, but it usually stops spontaneously. If the mouth cannot be opened sufficiently, or the patient is very nervous or frightened, a general anæsthetic may be given if certain precautions are taken. It is unnecessary deeply to anæsthetize the patient, who should lie on the affected side. The mouth is opened by a gag placed on the side opposite to that on which the abscess is. The cheek is retracted, and a sponge firmly held in forceps is placed far back on the tongue. The sponge acts as a tongue depressor and serves to prevent the pus going down to the larynx, while the lateral position and the retraction of the cheek allows the pus to escape forwards. A good light is essential. The incision should be made deliberately, and if at first it is of small size the pus escapes slowly and can be mopped up. Afterwards the cut can be enlarged by forceps or the knife.

Another form of acute suppurative arises in the glands behind the pharynx and is due to infection from affections of the tonsils or pharynx. It is met with in children, and is one of the forms of retro-pharyngeal abscess. As the pus increases the pharyngeal wall is bulged forward, leading to dyspnœa and œdema of the glottis. The bulging forward can be seen or felt by the finger introduced to the back of the mouth; the diagnosis is more often easily made by feeling than by looking, as it may be difficult to get the child to open the mouth sufficiently. The pharyngeal swelling is not infrequently unilateral. The lymphatic glands in the upper part of the neck may be enlarged and tender. If the dyspnœa is very urgent the abscess may be opened from the mouth, the head being lowered, and the knife guarded to within half an inch of its point. Under other circumstances it is better to open it from behind the sterno-mastoid. A good deal of venous bleeding may occur during the operation, but it ceases when the pus is evacuated. Opening the abscess from the front of the sterno-mastoid should never be attempted, as it is impossible, owing to

the relations of the carotid vessels and other structures.

The chronic retro- or post-pharyngeal abscess is due to disease of the cervical vertebræ or caseation in the lymphatic glands. This abscess should never be opened from the mouth, but always from the neck behind the sterno-mastoid. Opening from the mouth exposes the patient to the risk of septic infection of the abscess cavity.

Syphilis is a very common affection in all its stages in the fauces and pharynx. The earlier manifestations are curable by general and constitutional means. The late gummatous affections are chiefly important because of the deformities which result from healing of the ulcers. Fibrous stricture is a most troublesome condition and has to be treated by the regular passage of bougies. Once a stricture has developed the bougies will require to be passed for the rest of the patient's life, and in some intractable cases gastrostomy may be necessary.

Pharyngocele.—This name is applied to a diverticulum of the pharynx which is occasionally met with. It is also called a pharyngeal pouch, and may be congenital in origin or acquired. The patients are nearly always adults of middle age and of either sex. The symptoms are very similar to those of a stricture; they slowly increase in severity and their history often lasts over a number of years. From time to time a tumour may form in one anterior triangle of the neck, generally that of the left side. By pressure from the outside the tumour may be emptied, the patient bringing up its contents, which are undigested food and liquids. By the use of a bismuth meal and X-rays the dimensions and situation of the pouch may be determined, while by means of Brünings' tubes the orifice of the pouch may be seen. The *treatment* is excision and suture of the mouth of the pouch.

Tumours of the Fauces and Pharynx are most commonly malignant. In the tonsil itself round-celled or lympho-sarcoma may occur. These growths are very malignant and grow rapidly. At first they may produce no symptoms except a uniform smooth enlargement of the tonsil. Later ulceration and sloughing occur. The lymphatic glands are involved early. The *treatment* is removal either through the mouth or from the neck. The former operation may be done when the disease is still limited to the tonsil, and the galvano-cautery is most useful, as it arrests the hæmorrhage and allows the exact limits of the disease and line of section to be seen clearly. After either operation recurrence is likely; the prognosis is very unfavourable.

Carcinoma occurs as a squamous-celled growth beginning either on the tonsil or on the mucous

membrane of the pharynx, usually the lateral wall. These regions are also often secondarily involved in cancer of the tongue and larynx. When the disease develops primarily it may make considerable progress before symptoms are evident. Not infrequently a small growth, especially one on the side wall of the pharynx, may cause a great enlargement of the glands of the neck, and this may be the first sign to attract attention. A careful examination of the pharynx and naso-pharynx should be made in all these cases, not only by the ordinary methods and digital exploration, but by the laryngoscope and Brünings' tubes. The growth when developed has all the signs of a cancerous ulcer, with a great amount of inflammatory reaction. In any doubtful case a portion should be removed for microscopic examination.

The *treatment* of these cases is removal by means of a lateral pharyngotomy. Sometimes a sub-hyoid pharyngotomy may be performed. The glands in the neck are removed at the same operation, because the pharyngotomy necessitates opening up the anterior triangle, and there is therefore no point in doing the operation in two stages. A preliminary laryngotomy or tracheotomy should always be done at the time of the operation before the pharynx is opened. The prognosis is bad, and when operative measures are impossible there is very little to be done. The use of radium has not been found to be of any benefit in these cases.

T. P. L.

THE SALIVARY GLANDS

It will be convenient to consider separately the affections of the parotid and submaxillary glands.

Injuries of the Parotid may involve the gland itself or its ducts. In the former such important structures as the external carotid artery or a large vein may be damaged; or the facial nerve or its branches may be partially or completely divided. When the ducts are injured a salivary fistula is very likely to follow.

If the hæmorrhage is slight in amount, firm pressure by a gauze dressing and tight bandage will be sufficient to arrest it. If the bleeding is more profuse, and especially if it is arterial, it may be necessary to enlarge the wound; this should always be done parallel to the branches of the facial nerve, that is, in a more or less transverse direction. The wound should be enlarged just sufficiently to expose the bleeding point. The vessel may be so deeply placed that it is impossible to ligature it; under such circumstances a forceps should be left on for twenty-four to forty-eight hours. When the hæmorrhage is venous in origin a gauze plug may be quite enough to arrest the bleeding,

and sometimes this may be introduced without enlarging the wound.

If the external carotid is damaged the wound should be temporarily plugged with gauze or the hæmorrhage arrested by the pressure of the finger, whilst the artery is exposed by the usual operation in the neck. A ligature is placed round it, and the gauze plug or finger pressure removed. As the ligature is pulled on the effect on the hæmorrhage is noted, and it may be possible, as the wound can be wiped free of blood, to secure the artery in the gland and ligature it. When this is impossible the ligature round the carotid in the neck is tied, the parotid wound being packed with gauze and allowed to heal by granulation.

Injury to the Facial Nerve.—If the main trunk is severed before it has divided into its terminal branches, an attempt should be made to find the ends of the nerve and to unite them. To do this the main trunk of the nerve should be exposed as it is passing from underneath the posterior belly of the digastric, whence it is traced forwards to the point of division. The distal end of the nerve is then sought for and, if found, the two ends are joined together. The operation is a difficult one and requires a thorough knowledge of the anatomy of the region, and the chances of successful union are not very great. If the branches of the nerve are divided it is practically impossible to secure their union.

Wounds of the Ducts.—When the smaller ducts in the gland substance are injured a temporary fistula may result; as a rule this closes spontaneously. Healing may be hastened by touching the granulations with the actual cautery or pure carbolic. Injury to Stenson's duct is much more serious, as it is likely to be followed by a permanent fistulous opening. Such fistulæ are caused by stabs and operation wounds. The essential point of treatment is to establish an opening for the saliva to pass into the mouth. Stenson's duct opens into the mouth on a papilla opposite the second upper molar tooth, and its diameter is about one-eighth of an inch. The small size of the duct increases the difficulty of treatment. If the buccal portion is involved it may suffice to slit open the orifice and to keep it dilated by the passage of probes, the edges of the opening in the cheek being pared and stitched together, or the actual cautery may be used to destroy the epithelium on the surface and to cause fresh healthy granulations to form.

When the masseteric portion is affected a more elaborate proceeding is necessary. A fine probe, threaded with silk, is passed along the duct from its buccal orifice to the external wound, which may be somewhat enlarged. The probe is withdrawn, leaving the silk in the lumen

of the duct. A small drainage tube, with a silk thread at one end, is attached by its other end to the silk thread in the duct. Traction on this thread will draw the tube into the duct, where it is allowed to remain, one end projecting into the mouth and the other at the external wound on the cheek, the silk threads being tied round the angle of the mouth. After three or four days the external portion of the tube is cut off, the remainder being left in the duct. The fistulous opening will gradually close as more of the saliva passes along the duct into the mouth. The tube should be kept in position till the fistula has soundly healed, the granulation tissue being touched, if necessary, with the actual cautery. If a drainage tube cannot be introduced in this manner, the following plan may be adopted. A large trocar and cannula are pushed obliquely forwards through the cheek at the site of the external wound, and through the track of the cannula a large drainage tube is inserted. To each end of the tube a silk thread is attached, the two threads being tied together round the angle of the mouth or behind the ear. The outer end of the tube projects beyond the opening of the fistula, and the inner end lies between the alveolus of the jaw and cheek. After a few days, when the new passage is formed, the tube is gradually shortened at its outer end and withdrawn into the mouth, the fistulous opening being closed by paring the edges and uniting them with a stitch. As soon as the saliva finds a ready passage into the mouth the fistula will close.

Parotitis.—Inflammation of the parotid occurs in several different forms.

1. Epidemic Parotitis or Mumps.—An acute specific disease usually occurring in children, though it may attack adults. It is highly infectious and has an incubation period of about three weeks. One or both parotid glands may be affected and sometimes the other salivary glands. Suppuration very rarely occurs, but orchitis in males, and ovaritis or mastitis in females, are not infrequent complications. A high temperature and delirium occur in some patients. Treatment consists in isolating the patient and confinement to one room while the acute symptoms persist. Hot fomentations sprinkled with tincture of opium may be applied locally. Internally, salines and diaphoretics should be administered, with anodynes and soporifics if necessary. Sponging with cold water may be required when the nervous symptoms are pronounced. The patient should be isolated for a month. The orchitis and mastitis will require the treatment usually adopted for those affections. Atrophy of the testis is liable to follow the orchitis.

2. Simple Parotitis occurs sometimes as a result of exposure to cold, or is secondary to

inflammatory conditions in the mouth and the administration of mercury. It may be also due to injury and the impaction of a calculus in the duct. Suppuration occasionally follows.

The *treatment* must be directed to discovering the cause and removing it. Thus the administration of mercury must be stopped at once and astringent mouth-washes used. An impacted calculus must be removed, and as it is generally close to the orifice of the duct, this should be enlarged from inside the mouth sufficiently freely to enable the calculus to be extracted. Hot fomentations should be applied to the outer surface of the gland, and if suppuration occurs the abscess must be opened.

Secondary Parotitis occurs not infrequently in the course of acute specific diseases, such as typhoid fever, and after operations for perforated gastric ulcer, etc., and in other abdominal lesions or injuries. Two views have been held as to the origin of this parotitis: (1) that it is pyæmic, (2) that it is due to infection ascending the duct from the mouth. In a great number of cases the latter view is probably the true one, though some cases are undoubtedly pyæmic. Suppuration is not uncommon, and by making pressure on the gland or along the course of the duct the pus may be made to exude from the orifice in the mouth. Owing to the density of the parotid fascia and the anatomical relations of the gland, the pus is likely to burrow widely and deeply unless it is evacuated early. The prognosis in these cases is often grave.

The treatment must be prophylactic in the first place, and especial care must be taken of the mouth to keep it as sweet as possible by the use of antiseptic lotions. The teeth should be frequently cleansed by small swabs soaked in an antiseptic, and after food has been given all débris must be removed. Hot fomentations should be applied to the gland, and a careful watch must be kept for the formation of pus. This will be indicated by cedema and redness of the skin, with great tenderness on palpation. As soon as the pus is evident it must be evacuated through an incision sufficiently large to allow its free escape. The incision should be made in a transverse direction, so as to avoid damage to the facial nerve or its branches. When the pus is deeply placed the abscess cavity should be opened by inserting a pair of forceps with the blades closed and separating them parallel to the line of the incision. By this means the risk of injury to the facial nerve is reduced to a minimum. A large drainage tube is then inserted and the abscess is treated subsequently on the usual lines.

Tumours of the Parotid Gland may be innocent or malignant.

The **Innocent Tumours** are elastic, nodular, and often globular in shape. They have a

distinct capsule, and if allowed to grow to any size cystic degeneration usually occurs. The skin is not attached to the growth, which itself is movable on the deeper parts. They may extend deeply into the region behind the ascending ramus of the jaw. The facial nerve is not affected. Microscopically these tumours are of great interest on account of the great variety of tissues which may be present. Gland tissue, fibrous tissue, myxomatous tissue and sometimes cartilage may be found. The amount of cellular elements varies very much in different parts of the same specimen. By most pathologists they are placed in the group endotheliomata. If allowed to remain untreated, it is possible that the tumour may take on definitely malignant characters.

Malignant Tumours are sarcomata or carcinomata, but some are undoubtedly endotheliomata. They grow rapidly and soon involve the overlying skin, becoming also fixed to the deeper parts. They are frequently elastic from cystic or myxomatous degeneration. The neighbouring lymphatic glands are likely to be enlarged from infiltration, and the facial nerve is often implicated early, leading to paralysis of the muscles of the face.

The *diagnosis* of the two forms is not always easy till the tumour has been microscopically examined. Attention should always be paid to the question of the facial nerve being involved, but unless this nerve is infiltrated, paralysis will not occur even when a malignant tumour is present. Hence these tumours should always be removed at the earliest possible moment. A sebaceous cyst in the skin over the parotid, tuberculous disease of the lymphatic glands, and a lipoma may cause some difficulty in the diagnosis of simple parotid tumours. Gummata of the masseter are another frequent source of error.

The parotid region may be involved by extension of malignant disease of the pharynx and fauces, hence a careful examination of these regions should be made. It is always advisable to make a microscopic examination of the edge of the growth, because a rodent ulcer or ulcerating sarcoma is not uncommon and may closely simulate a breaking-down malignant parotid tumour, and because the two former affections are amenable to treatment by X-rays and radium.

The *prognosis* in the case of innocent tumours is favourable if the whole is removed. Any portion which is left behind will lead to recurrence. In malignant disease the outlook is hopelessly bad.

Treatment. (1) Simple tumours should be removed by making a transverse incision parallel to the branches of the facial nerve. If the tumour is large a curved transverse incision

is made and the skin raised as a flap. The tumour may often be shelled out, great care being taken that no portion of it is left behind. The separation must be effected by keeping close to the capsule. (2) Malignant tumours can sometimes be extirpated by removal of the whole gland. The facial nerve must be sacrificed. If operation is impossible, X-ray treatment or radium may be employed.

Salivary Calculi sometimes occur in the parotid, though not so frequently as in the submaxillary gland. They are most often present in the duct at its orifice; they may lead to inflammation in the gland and sometimes suppuration. The treatment consists in fixing the calculus and slitting open the orifice of the duct sufficiently to allow it to be squeezed out. If the calculus is arrested farther back and cannot be pressed forward, it must be extracted by an incision over it from inside the mouth.

The Submaxillary Glands.—The inflammatory affections of these glands are similar to those of the parotid, but are not so frequent. They are to be treated on the same lines. Injuries are not common, and owing to its deep position the duct is rarely involved: hence a salivary fistula is quite rare.

Salivary Calculi are not very infrequent and are composed of phosphate and carbonate of lime. Probably the greater amount of mucus in the secretion explains their greater frequency as compared with their occurrence in the parotid. They may be found in the deeper ducts in the gland substance; most commonly they are impacted in the duct, not far from its orifice in the mouth. They are oval or fusiform in shape. The obstruction to the outflow of saliva causes a good deal of pain during mastication and some swelling of the gland, which afterwards may subside slowly. The gland may, however, be permanently enlarged and hard from chronic inflammatory changes and increase of fibrous tissue. Suppuration around the calculus and consequent cedema of the floor of the mouth is not uncommon. Ulceration around the orifice of the duct may occur and produce an appearance closely resembling an epithelioma.

Treatment. When the stone is in the duct it can always be removed by cutting directly down on to it through the mucous membrane of the floor of the mouth. It is a good plan to fix the calculus from inside the mouth against the jaw by a finger whilst the thumb presses it from outside. The incision must be long enough to allow of its easy extraction, and no sutures are necessary. The bleeding ceases spontaneously, or after the application of a gauze plug. When the calculus is deeply embedded in the gland or if the latter is chronically inflamed the whole gland should be removed

through a curved incision below the horizontal ramus of the jaw.

Tumours of the Submaxillary Gland are similar to those of the parotid but much less frequent. Malignant disease of submaxillary lymphatic glands may involve the salivary gland, and it is always advisable to remove this with the lymphatic glands. T. P. L.

SURGERY OF THE NECK

Congenital Malformations

1. **Cervical Auricles.**—These are small pedunculated outgrowths along the side of the neck.



FIG. 1.—Cervical Auricles.

They generally contain cartilage and are the vestigial remains of the branchial arches. They are considered by some observers to have a

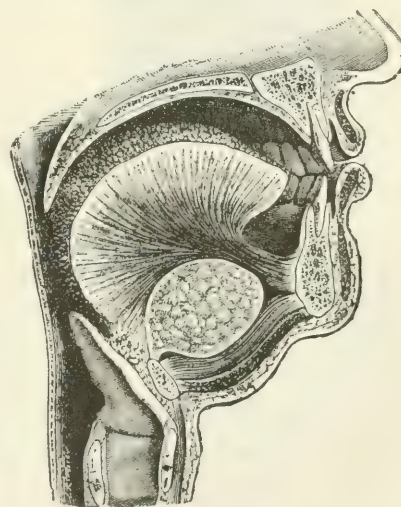


FIG. 2.—Thyreo-glossal Cyst deep in floor of mouth.

distinct tendency to malignant changes in later life and, therefore, their removal is strongly to be advised. It is quite sufficient to snip them off or to tie a ligature tightly round their pedicles.

2. Thyreo-Glossal Cysts.—These are cysts arising from the remains of the thyreo-glossal duct, which, it will be remembered, was originally an epithelial tube extending from the foramen cæcum at the back of the tongue, and passing downwards in the middle line of the neck behind the hyoid bone to end in the isthmus of the thyroid. A cyst may occur either in the tongue, above the hyoid, or below the hyoid. Diagnosis is easy, the only other tumour in this connection being a tubercular gland. The cyst

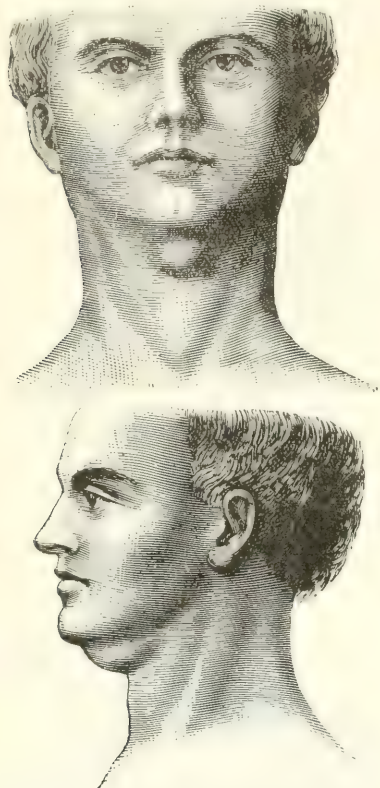


FIG. 3.—Thyreo-glossal Cyst—usual position above hyoid.

may rupture and cause a fistula in the middle line of the neck.

Treatment. Removal of the cyst is always indicated, but it must be admitted that this is no easy operation. In a cyst of any size there is nearly always a process which extends behind the hyoid and division of the hyoid in the middle line is usually necessary; moreover, it should be pointed out that the after-results of a removal are extremely disappointing, for these cysts have an extraordinary tendency to recurrence even when every trace of morbid tissue has been removed.

3. Lateral Fistulæ in the Neck.—These usually open immediately above the sterno-clavicular joint and may be found there close to the

anterior border of the sterno-mastoid; they do not often open in the upper part of the neck. They are usually unaccompanied by inflammation and secrete a small amount of clear mucus. The practitioner will be well advised to leave them alone; for a study of their anatomy shows that they are directed upwards along the sterno-mastoid muscle and close to the carotid sheath. At a higher level they run between the carotid arteries and above the hypoglossal nerve and they may open internally behind the posterior palatine arch. Thus they have intimate and important connections with the great vessels and nerves and the old methods of blindly scraping them or injecting irritant liquids are obviously undesirable; moreover, serious respiratory failure has been known after such treatment. It is questionable whether their removal is really justifiable at all. If it is undertaken it necessarily means a prolonged and difficult dissection and a long, vertical scar in the neck.

4. Cervical Ribs.—These fairly often occur owing to irregular development of the potential ribs in the seventh cervical vertebra. When small they usually are not diagnosed; when they are large the scalene muscles are attached to the abnormal rib and the subclavian artery and the lower trunk of the brachial plexus runs over it.

Symptoms. There may be none and the rib is only accidentally discovered by an X-ray examination. On the other hand, the rib may cause circulatory or nerve symptoms.

Circulatory. The subclavian artery may be raised in the neck and mistaken for an aneurysm. There may be pressure on the veins and even swelling of the arm.

Nerve Symptoms. These may be neuralgic or paralytic. The neuralgic symptoms usually consist of pain along the course of the ulnar nerve and this may be mistaken for neuritis of that nerve.

Paralysis usually involves the muscles supplied by the ulnar nerve and the inner head of the median. In particular there is wasting of the muscles of the thumb.

Treatment. In all suspected cases an X-ray photo will settle the diagnosis. Removal of the rib if present, and causing symptoms, should be undertaken. This is a difficult surgical procedure and not devoid of danger.

Wry Neck may be divided into acute or transient, permanent and spasmodic.

The *acute* form occurs suddenly, probably due to some chill. The sterno-mastoid is strongly contracted and the head as a whole is turned towards one side, the face being only slightly turned to one side. The affection is exceedingly painful, and the slightest touch on the side of the neck gives great pain. Fortunately it is

but a transient affection and passes off in two or three days.

Treatment is by local heat, an excellent method of applying this being a heated light sand pillow which is moulded round the head and neck. Aspirin is very useful for removing the pain.

Permanent Wry Neck.—This is due to contracture and fibrous inflammation not only of the sterno-mastoid but some of the other muscles on the side of the neck. The deformity is well known. The chin is rotated to the opposite side and the head turned towards the



FIG. 4.—Permanent Wry Neck.

affected side. The curious condition known as hemiatrophy of the face is nearly always present if the condition has been established for a length of time, and this is, of course, not usually recovered from—a point worth remembering when dealing with the patient. In the author's opinion, birth injuries and hæmatoma of the sterno-mastoid have little to do with the causation.

Treatment should consist in open division of the lower part of the sterno-mastoid as well as of any other contracted muscles or fibrous bands which prevent the head and neck being straightened. These may involve the operator in a rather extended and deep dissection, but by using the open method it is usually free from risk, and the resulting scar in a girl is either not seen at all if subcuticular stitching with fine silk has been employed, or can be easily hid by a necklace. Early movements of the head to the opposite side should be begun after operation and, if such movements are continued, no controlling apparatus is necessary.

Spasmodic Wry Neck.—A painful affection not only of the spinal accessory nerve but of the cervical nerves generally. The head is spasmodically twisted from side to side.

Treatment from a surgical point of view consists in resection of the spinal accessory nerve on the side towards which the head is mostly pulled, but in addition the posterior primary divisions of the first five cervical nerves of the opposite side must also be resected.

Injuries of the Neck. Hæmatoma of the Sterno-Mastoid.—This is a fairly common birth injury. It is said to usually occur after the use of forceps, and in cases of traction of the after-coming head, and to be most common on the left side. In the author's experience the latter statement is correct, the former incorrect. The parents complain usually of a hard lump in the child's neck after the first few days of life. This may extend up or down the muscle, but it has usually a rather rounded outline, and from its hardness and the general flaccidity of the rest of the muscle it is usually mistaken for a glandular tumour. Such a diagnosis is inadmissible; nothing else at all like hæmatoma of the sterno-mastoid is to be found in the neck in the first few days of life.

Treatment. The swelling will most certainly disappear and the only treatment necessary is to allay the fears of the parents. The statement is usually made that contraction of the hæmatoma subsequently results in wry neck. The author can only say that he has been able to follow twenty-eight cases himself for a period varying from three to six years, and in not one of these cases has wry neck resulted. The practitioner will do well to remember that many months may elapse before the swelling disappears.

Other injuries to the neck, except hanging, are usually the result of lawless violence. The practitioner should remember the following points. (1) There are often but few superficial signs of injury where the injury to the deeper parts may be grave. (2) Marks of fingers, etc., should be carefully noted at once; they disappear very rapidly after death. (3) There may be serious extravasation of blood in the deep parts of the neck. (4) Surgical emphysema frequently occurs and the rapid swelling of the neck may give rise to great alarm. It is, however, in itself not a serious condition.

Injuries to the neck may be complicated by fracture of the hyoid, thyroid or cricoid. In all such cases there is probably urgent need for tracheotomy, and the slightest sign of dyspnoea after injury to the neck is a sure indication that the performance of tracheotomy should not be delayed.

Cut Throat (Suicidal or Homicidal).—Suicidal wounds are usually from left to right and extend from below upwards. Here the main vessels usually escape injury, but the air-passages are usually opened up below the hyoid, the epiglottis in particular being most frequently

cut through. Homicidal wounds are usually transverse and the main vessels are usually divided—they are not likely to cause much trouble to the practitioner, at least from their surgical aspect.

Treatment. The patients are usually in the worst possible condition to withstand a serious injury from many causes, forcible control is probably necessary from the first, and it is well to remember that if there is any opening into the air-passages, early tracheotomy is probably the best treatment in all cases. Delay in performing it only adds to the risks. The wound in the neck should then be sutured layer by layer with catgut and a drain put in. The old treatment of leaving the wound open is no longer to be considered.

Diffuse Cellulitis of the Neck.—Known formerly as “angina Ludovici.” This much-dreaded complaint is now rarely seen. Formerly it was considered to be the result of any septic inflammation in the floor of the mouth or about the jaw. Its rapid extension in the fascial strata of the neck and the very great danger of asphyxia are to be remembered. Here prevention is the treatment. All cases of inflammatory swelling of the neck with brawny induration should be dealt with by early and free incision and drainage. If this be done, the classical angina is not likely to be seen. Should it occur, an early tracheotomy should be the rule with free incisions into the swollen part of the neck. It need hardly be pointed out that a septic mouth and septic teeth should be dealt with vigorously.

Actinomycosis.—The occurrence of actinomycosis in the neck should not be forgotten. Many spreading inflammations believed to be tubercular are of this nature. The swelling of actinomycosis with its various breaking-down areas and sinuses closely resembles that of tubercle. Actinomycotic swellings are, however, usually closely connected with the jaw from which they usually spring, whereas tubercular glandular masses are not usually so intimately connected. An examination of the pus by a pathologist will usually decide the question, and the importance of such an examination is to be remembered as surgical treatment is of little avail in actinomycosis and the removal of the mass not to be thought of. Iodides and local application of iodine should be the rule of treatment. On the other hand, in tubercle the usual methods of opening, scraping and draining should be adopted.

Glandular Swellings in the Neck.—These are (a) inflammatory or (b) malignant. Inflammatory glandular growths are, of course, extremely common in children and, in the author's opinion, are nearly always tubercular. With regard to their etiology, there is no doubt whatever that the tubercle bacillus is conveyed by unboiled

milk, and is bovine tuberculosis; it enters by chronically inflamed adenoids, chronically inflamed tonsils and carious neglected teeth. The carotid glands are then found to be slightly enlarged and at this time a doubt may be felt as to the nature of the glandular enlargement and the proper line of treatment. The glands are nearly always found to be tubercular, but the line of treatment to be adopted does not necessarily at this stage demand removal. If the source of irritation be removed and the child strengthened by cod-liver oil, phosphorus, etc., and, above all, by sea-air, the glands will frequently disappear. To this end, therefore, steps should be taken.

If, however, the glands continue to enlarge, become hard or show signs of periglandular inflammation, in the author's opinion they should be removed, and this removal should be absolutely thorough. I do not desire to minimize the difficulties of the operation, for there is no doubt that if properly carried out it is one of the most difficult and laborious in surgery, nor can it be denied that it has a certain amount of risk, but on the other hand, if carefully and accurately performed, it gives admirable results; it saves the continued drain on the health and the almost inevitable disfiguring results of suppuration. I would, therefore, suggest that the practitioner should advise in the above conditions the early removal of tubercular glands in the neck. It is no part of the present article to go fully into surgical details, but I would point out the following—

1. Incisions should be almost horizontal, or slightly curved in the natural folds of the neck.
2. With experience and skilled assistance the length of the incision can be greatly reduced.
3. The vein should be defined as early as possible, and, as a rule, the glands are more easily separated from the vein below. It is well to remember that wherever the main mass may be some tubercular glands will always be found in close relation to the vein.
4. Division of the sterno-mastoid and ligature of the vein (given patience) are neither of them except in very rare cases necessary. On the other hand, division of a few of the anterior fibres of the muscle greatly facilitates removal of the mass.
5. A small drainage tube through a separate opening far back and close to the hair-bearing part is probably advisable for from twelve to twenty-four hours.
6. The wound should be closed in tiers if possible.
7. Subcuticular stitching with the finest silk is quite possible in a curved incision; it leaves no visible scar, and should be the rule.

8. Vertical incisions, except behind the sterno-mastoid, are inadmissible.

Lymphadenoma.—This frequently occurs in the neck. Its diagnosis from tubercle is a matter of extreme difficulty and often can only be effected by the microscope and, even then, not with certainty as both conditions occur together. In the author's opinion, treatment should be thorough and effective removal, always provided that no other mass of enlarged glands is to be found in the axillæ, chest, groins or abdomen. In such cases surgical treatment is not indicated. It must be admitted that the results with regard to recurrence are very disappointing. Surgical treatment should be combined with medical and X-ray treatment; in all cases arsenic should be given for many months after the operation.

Malignant Growths.—These are usually secondary and consist of carcinomatous growths in the glands. One comparatively common cause may be noted, *i.e.* glands secondary to an unsuspected growth in the lower part of the pharynx or supraglottic region of the pharynx. They should be removed if there is a chance of the removal of the primary growth and if other conditions permit. Where this is impossible X-ray treatment and radium treatment may be advised.

Tumours of the Neck.—These are uncommon and usually cystic. They may be divided into branchial cysts, dermoid cysts and cystic hygroma. The treatment of branchial and dermoid cysts differs little from that of fistulæ; they have the same deep connections and are to be respected. The curious condition known as

remove the entire mass, which infiltrates the important structures of the neck. It is, however, to be remembered that partial removal has been followed by complete disappearance of the rest of the growth.

Solid Tumours.—These are rare, and are usually either circumscribed or diffuse lipomata. The condition known as branchial carcinoma deserves special mention. This occurs in men comparatively late in life, and it is indistinguishable from ordinary carcinoma occurring in lymphatic glands except that its course is slow, and that no primary growth can be discovered. This condition should not be forgotten as it does not give rise to metastases, and therefore in cases of doubt the patient should be given the benefit, and an attempt made to remove the growth from which he can be freed. The importance of a thorough examination with a view to finding presence or absence of primary growth cannot, therefore, be exaggerated.

J. K. M.

DISEASES OF THE THYROID GLAND

Inflammation of the Thyroid (apart from injury, such as that produced by injection) is a rare disease which does not often call for treatment. It may occur in the later stages of many acute specific diseases, such as typhoid fever.

In its earlier stages simple antiphlogistic treatment, local and general, such as hot fomentations and purgatives, are usually all that is necessary. If suppuration takes place, and it must be remembered that this may occur very insidiously—much more active treatment may be urgently demanded, on account of the fear that the suppuration may make its way into either (1) the trachea or pharynx, or (2) the cellular tissue of the neck, thus causing a very serious and probably fatal result. Whenever the presence of an abscess may reasonably be suspected, no time should be lost before cutting down upon it and seeking to evacuate the pus. This may involve a deep dissection into the lobe of the thyroid and be accompanied by much hæmorrhage. The wound should be drained and packed with gauze and allowed to heal only by granulation.

Care must be taken not to mistake the acute distension of the gland, which is especially common in young adults, for true inflammation. The absence of marked tenderness and of fever in the former will help in the diagnosis. It should also be remembered that some soft forms of malignant disease present a close resemblance to acute inflammation, from which indeed it may be impossible to distinguish them with certainty.

The more chronic forms of inflammation, such as tuberculous and syphilitic (both rare),

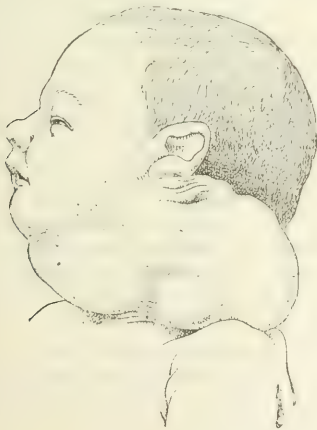


FIG. 5.—Cystic Hygroma of the Neck.

cystic hygroma occurs in children in the upper part of the neck. The recognition of the multiple cysts should make the diagnosis of the swelling clear. Radical surgical treatment may be advised, but it is often quite impossible to

require the general treatment suitable for those diseases.

Parenchymatous Goitre, a general and uniform enlargement, is the commonest disease of the thyroid gland. The vesicles are over-distended with colloid secretion, which does not escape freely into the lymphatics. Its treatment is as follows—

1. Ascertain and remove, if possible, the cause. This may be septic absorption from some local septic lesion, such as a carious tooth, an ulcer or a discharge from an unhealthy mucous membrane. Frequently it is due to absorption of some poison contained in drinking water, and especially is this likely to be the cause if the disease occurs endemically among many persons having a common water supply. Recent researches tend to show that this poison is an organic impurity, suspended, not dissolved, in the water.

Either the use of the suspected water should be given up entirely, some pure natural water such as Malvern, Perrier or Apollinaris or simple rain water being substituted, or the water should be boiled and filtered before being used. Mere filtering alone cannot be relied upon to remove the *materies morbi*.

2. *Drugs*. Of these the most valuable are iodine and its preparations (tr. iodi \mathfrak{m} v, with pot. iod. gr. v, may be given three times a day with plenty of water), liq. arsenicalis (\mathfrak{m} iii-iv, three times a day) and thyroid extract in one or other of its many forms.

Whichever drug be employed, it should be given in increasing doses for many weeks at a time, the administration being suspended at intervals, especially if unpleasant symptoms are produced. Laxatives are also useful in the treatment of simple parenchymatous goitre.

3. *Local applications*, such as painting the neck with tincture or liniment of iodine or inunction of mercurial ointment, sometimes do good. Not much is to be expected, however, from local applications unless they are applied in strength sufficient to blister the skin.

4. *Vaccines* have recently been recommended for the treatment of the softer forms of parenchymatous goitre.

5. *Operative Treatment*. This is rarely required for this form of goitre unless serious symptoms (usually dyspnoea) and the failure of simpler measures demand it.

It may, however, be urgently demanded for the rapidly growing goitres which sometimes occur in both sexes at or soon after the age of puberty. Such goitres often do not yield to medical treatment, and if situated low down in the neck and partly behind the sternum may easily lead to fatal suffocation. In young people the trachea is soft and easily compressed by the

enlarging goitre. In children below the age of puberty parenchymatous goitre scarcely ever demands operation. In the case of adults operation is demanded only if dyspnoea is really severe and medical treatment is ineffectual. For mere deformity operation is scarcely justifiable unless the swelling is very large indeed.

Severe and increasing stridor is the most important indication for operation in cases of parenchymatous goitre.

Encapsuled Tumours comprise both cysts and adenomata, the great majority of the former being produced by the breaking down of previously solid adenomata.

Medical treatment is of little or no use for these very common tumours. If they cause trouble in breathing, and even if they form a considerable disfigurement, it is right to remove them by enucleation, if the patient desires that this should be done. The only encapsuled tumours, however, that are dangerous to life are (1) those that are situated low down, in or near the upper opening of the thorax or within the thorax itself; (2) large, soft tumours into which sudden hæmorrhage is likely to occur. (3) bilateral tumours which have already caused considerable tracheal stenosis. It should be remembered that dyspnoea and stridor, however severe, are not contra-indications to operation for encapsuled tumours *wherever situated*, but, on the contrary, urgently call for it. Substernal and intrathoracic encapsuled tumours give the most satisfactory results.

The operator who embarks upon an operation for innocent goitre of any but the most trivial kind should be aware of the special dangers that are apt to occur and be fully prepared for them. The administration of an anæsthetic, especially if much dyspnoea is present, should be entrusted to a skilled anæsthetist only, or should be dispensed with altogether, local anæsthesia being used instead.

The most rigid asepsis throughout the operation is all-important. Exact hæmostasis is essential; the operator must, at all stages of the operation, be able to see exactly what he is doing or he is likely to get into trouble with large vessels or other important structures in the neck.

Except in the most trivial cases the wound should always be drained, but drainage will not usually be necessary for more than one or possibly two days.

Post-operative venous oozing is a very real danger which is apt to lead to very serious results, and the greatest care should be taken to guard against its occurrence by ensuring that all vessels, even small ones, are secured and tied before the wound is sewn up.

Post-operative hæmorrhage or suppuration,

should either of them occur, are grave complications which usually require speedy opening up of the wound if disaster is to be avoided.

Exophthalmic Goitre is a disease which is usually best treated by medical rather than by surgical measures, although there are undoubtedly cases in which the question of operation must be entertained. Of late years, operating for exophthalmic goitre has become in some quarters rather fashionable. It cannot, however, be said that operation offers as yet either a safe or certain method of cure for the majority of patients affected with this disease, even if it be performed by the most skilful of specialists.

The danger of the operation may be greatly lessened, however, by careful selection of the cases submitted to operation, by care in the choice of an anæsthetic, by dexterity, gentleness and speed in operating, and especially by the administration of large amounts of fluid either by mouth or rectum or subcutaneously, immediately after, or even during, the operation.

Most patients who have undergone an operation for true exophthalmic goitre are benefited, and some appear to be cured.

There is a considerable class of patients who have ordinary goitre, either parenchymatous, cystic or adenomatous, with one or more of the symptoms of Graves's, such as palpitation or tremor. These patients, who are often erroneously thought to be suffering from true Graves's disease, are very amenable to treatment by operation, which commonly effects a complete cure, and with risk that is little, if at all, greater than that of an operation for any other innocent goitre.

Malignant Disease of the thyroid is but seldom seen by the operating surgeon at a stage at which it can be satisfactorily treated by operation.

In earliest stages it may present itself in the form of a recent enlargement of a pre-existing innocent goitre, or as a small hard lump in an otherwise normal gland.

It is at first painless and may be freely movable with the rest of the lobe in which it lies. At this stage, and at this stage only, can it be removed with a reasonable prospect of effecting a cure.

Later, when the disease has penetrated the glandular capsule and begun to involve surrounding parts, dysphagia, pain and paralysis of a vocal cord, together with nodularity and fixity of the tumour, usually make the diagnosis only too plain and operative treatment wellnigh hopeless. Later still, urgent dyspnoea may demand the performance of a tracheotomy, often under circumstances of great difficulty and danger. Relief may sometimes be afforded in these distressing cases by linear incision of the growth.

J. B.

DISEASES OF THE ŒSOPHAGUS

Imperforate Œsophagus.—This congenital defect takes the form of either a sudden occlusion of lumen, the upper and lower parts being united by a fibrous cord, or the upper end enters the trachea or a bronchus; the latter is more usual. Vomiting, coughing and choking will usually be observed by the second day after birth. The diagnosis can be settled by endoscopic examination. Gastrostomy is the only possible treatment, and this fails when the lower end of the deformed gullet communicates with the air passages, as evidenced by regurgitation and the coughing up of milk.

Foreign Bodies Impacted in the Œsophagus.—In a large number of the cases reported as instances of foreign bodies in the gullet, they were really impacted in the post-cricoid pharynx above the mouth of the Œsophagus. If a foreign body passes the Œsophageal mouth it is rarely impacted in the gullet unless of such a shape as conduces to its catching in the mucosa, as in the case of dentures with hooks, the vertebræ of fishes, pins (especially safety-pins), needles and pieces of bone with sharp edges. Coins and large buttons form exceptions, as they tend to be caught in the collapsed cervical gullet and also opposite the constriction due to the projection of the left bronchus, and very rarely at the phrenic narrowing; large, soft bodies, *e. g.* vegetable masses, may, however, be impacted at the latter constriction; the writer once removed a piece of cabbage-stump impacted here in a child aged four years. When once a foreign body has reached the stomach it generally passes safely out at the rectum with only slight delay. A safety-pin in the stomach can often be and should be retrieved through a direct Œsophago-gastroscopic tube. Foreign bodies can generally be suspected from the history, together with the discomfort and often pain which occur, together with more or less dysphagia. The first thing usually thought of is an X-ray examination, when the body is of sufficient density to show on the screen, but the method has its limitations, and is usually unnecessary when an expert Œsophagoscopist is at hand. Blind use of bougies and the probang, however successful in many instances, are to be condemned on account of the unavoidable element of danger to the gullet. Blind instrumentation has been responsible for many deaths. The Œsophagoscope enables us not only to locate the foreign body but also to remove it with suitable forceps. Even a large denture impacted in the cervical Œsophagus can be safely retrieved with the aid of an expanding Œsophagoscope such as the writer's on the principle

of the glove-stretcher; the use of Moore's specially strong cutting pliers for breaking up a foreign body will rarely be necessary when the above instrument is at hand. An open safety-pin low down can be dealt with by a slotted endoscopic funnel. The impacted article should be removed without delay, for although dentures and coins have become embedded and have been retained in the gullet for months and even years with only slight inconvenience, on

Perforations of the Œsophagus.—Perforation may be due to external or internal traumatism, or to ulceration, more especially in connection with malignant disease and with the impaction of foreign bodies. The perforation may extend (1) into the mediastinal tissues, with or without emphysema; (2) into the air passages; (3) into the aorta or other large vessels; and (4) into the pericardium, or (5) into a pleural cavity:

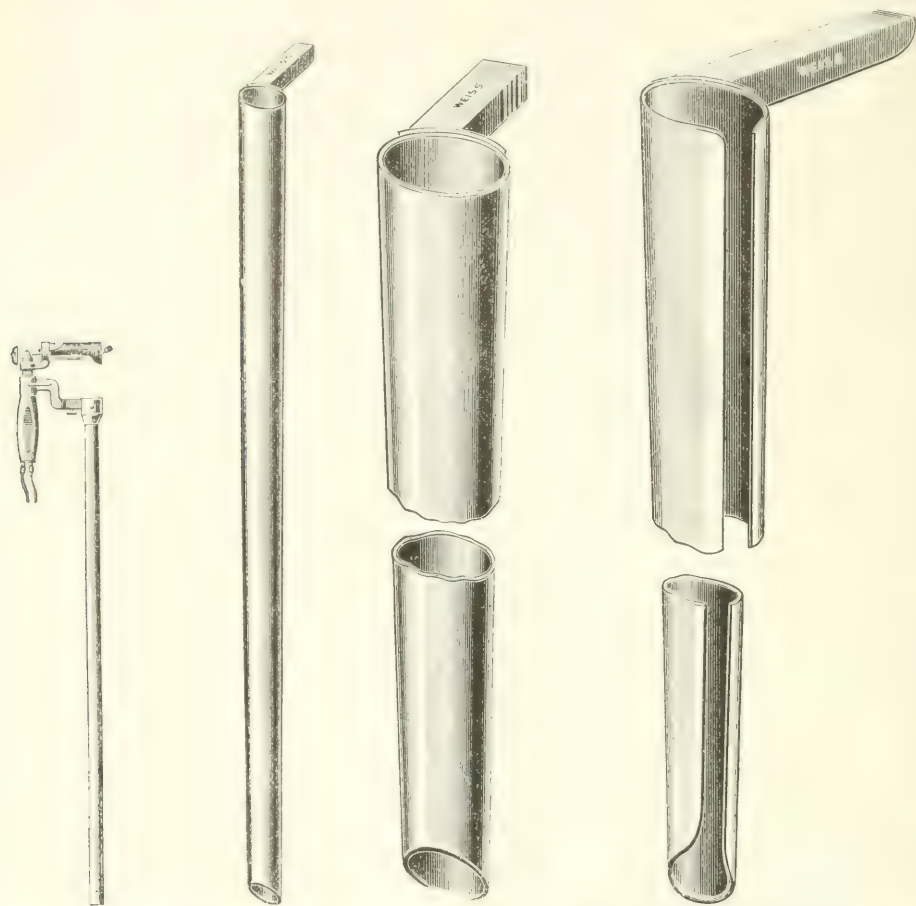


FIG. 1.—On the left Killian's Cylindrical Œsophagoscope with Brünings' Lamp attached to the handle. Hill's Complete and Slotted Endoscopic Funnels with bevelled ends are shown on the right.

the other hand fatal perforation, especially of the aorta, has occurred from within a few days up to four years. External œsophagotomy is by no means free from danger, and will rarely, if ever, be found necessary by an expert endoscopist provided with a suitable outfit. If there is seen to be much ulceration, or if there be evidence of wounding of the gullet and of emphysema after removal of the impacted article, an intubation apparatus should be worn for a week or two as a precautionary measure.

(3), (4) and (5) usually prove fatal. The treatment is intubation after careful endoscopic confirmation of the diagnosis.

Rupture of the Œsophagus and Traumatic Œsophagitis.—The healthy gullet may be either completely or partially ruptured across by—(1) external violence, as in run-over cases; (2) by penetrating wounds, *e. g.* from rapier or bullet; (3) by internal violence, as in the unskilful employment of endoscopes, bougies, probangs and coin-catchers; (4) by violent vomiting. In complete rupture from

vomiting or from trauma there is sudden onset of violent pain, aggravated by swallowing, cyanosis, hurried respiration and collapse. The administration of stimulants, which is nearly always resorted to, causes agonizing pain, as they pass into the mediastinal tissues or pleural cavity. In moderate ruptures the symptoms are not so violent, and may even be slight for a time, but later they frequently become aggravated, especially on drinking or vomiting, and there is then thirst, pain and

not readily be passed into the stomach. In a case treated by rectal injections alone, under the author, a longitudinal rent communicating with the left pleural cavity had healed sufficiently to permit of drinking fluids without leakage at the end of five days. An expectant anodyne line of treatment is usually adopted, but with conspicuous want of success in most cases, unfortunately, even as regards euthanasia.

Diverticula of the Œsophagus.—True pouch-



FIG. 2.—Deep Pharyngoscopy and the First Stage of Œsophagoscopy. The distal bevelled end of the endoscope is in the deep or post-cricoidal pharynx, thus enabling the region of the upper orifice of the gullet to be examined. (Drawn by the author.)



FIG. 3.—Second and Third Stages of Œsophagoscopy with Brünings' Apparatus. The tube spatula is passed into the upper part of the gullet, and the proximal end of the tube is then shifted to the angle of the mouth opposite the molar teeth; the extension tube is next inserted, and the gullet explored as far as may be necessary. The distal end is here seen near the upper end of a stricture.

often collapse, with frequently emphysema and pneumo-hydrothorax. In complete rupture with vomiting, treatment is generally useless in saving life, and is purely anodyne. In the less extensive wounds, where there has been little or no vomiting, the insertion of a temporary intubation apparatus by means of the Œsophagoscope should be attempted. This will enable fluids to be administered and saliva to be swallowed without passage into the mediastinal tissues. Its retention tends to prevent stricture in the event of recovery. Gastrostomy might afford relief where an intubation funnel or a styleted tube could

ing—that is, a localised ectasia, hernia or lateral sacculation of the gullet—is a rare disease, not often diagnosed or even causing symptoms during life, and generally found post-mortem. They are usually quite small and short traction pouches, due to adhesion of the external wall of the gullet to an inflamed bronchial, peritracheal or prevertebral gland undergoing shrinkage. A localised saccular ectasia is occasionally observed in general dilation of the gullet. True pressure pouches or diverticula such as occur in the deep pharynx are probably never found in the gullet, though true pharyngeal diverticula are usually described, even by the best

authorities, under the heading of Œsophageal Pouches from the fact that the swelling in the neck passes down by the side of the Œsophagus, causing dysphagia; and the confusion is also accounted for through hazy notions as to the anatomy of the parts.

Peri-Œsophageal Diverticula, or Pouches arising in the Deep Pharynx.—Pressure pouches occasionally arise from the deep or post-cricoid pharynx immediately *above* the lowest or fundiform fibres of the crico-pharyngeus (inferior

either as an Œsophageal or as a pharyngo-Œsophageal pouch or diverticulum. Such pressure pouches, however, do not arise from the Œsophagus, and are entirely pharyngeal in origin. They give rise to a reducible swelling in the neck and to dysphagia by pressure on the cervical Œsophagus. These large diverticula can be diagnosed by radiography with a bismuth meal, by endoscopy, and by the swelling in the neck which increases in size after food, and which can be partially, and



FIG. 4.—Hill's Expanding Œsophagoscope to facilitate the removal of dentures and other foreign bodies without wounding the gullet. The blades expand in one plane on the principle of the glove stretcher. ($\frac{2}{3}$ scale.)

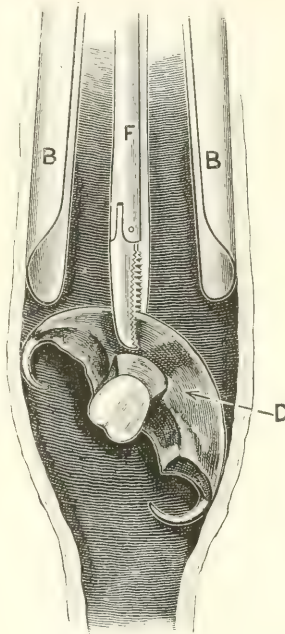


FIG. 5.—Showing the opened-out blades of the Expanding Œsophagoscope (full size), with impacted denture in the act of being loosened by Moore's strong forceps.

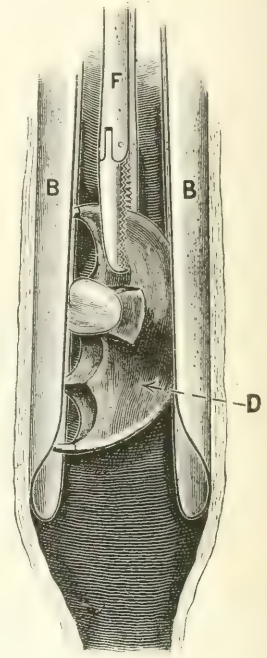


FIG. 6.—Showing the sharp points of the denture hidden in the grooved protecting blades of the Expanding Œsophagoscope. The denture, forceps and Œsophagoscope are withdrawn *en masse*.

constrictor); between this strong sphincter-like bundle of fibres and the oblique fibres above there is often an intersection filled up with weak cellular tissue; through this a hernia-like pouching of the pharynx sometimes occurs, which tends to get larger and larger with accumulations of food gulped down under pressure. The pouch or diverticulum is usually asymmetrically placed and extends slightly upwards but mostly downwards parallel to the Œsophagus. It is usually incorrectly described

sometimes completely, emptied by pressure or voluntarily regurgitated. The treatment is excision by a cervical dissection along the anterior border of the sterno-mastoid.

Paralysis and Paresis of the Œsophagus.—Functional paresis occurs in hysterical and in debilitated subjects, and may be the explanation of some cases of functional dysphagia. Secondary myopathic paresis is found in association with dilatation above a stricture, whether malignant or cicatricial.

Organic paralysis is not commonly diagnosed, but when present is almost invariably of central origin, *e. g.* hæmorrhage and tumours of the pons and medulla, bulbar paralysis,

is doubtful if the nerve tonic and anti-spasmodic treatment usually adopted in functional cases act otherwise than by suggestion. The mechanical stimulus is all

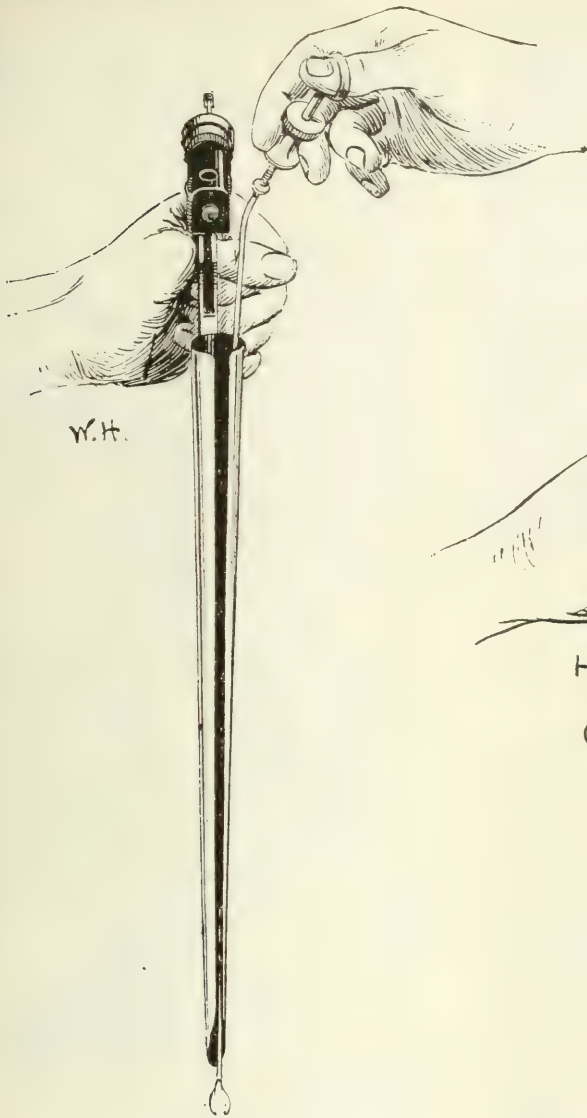


FIG. 7.

Hill's Slotted Endoscopic Funnel excentrically attached to Brünings' Hand-lamp, showing forceps in lateral position out of line of vision for dealing with some foreign bodies, *e. g.* an open safety-pin, the pointed limb of which can be drawn within the protection of the tube and the forceps then applied to the other limb.

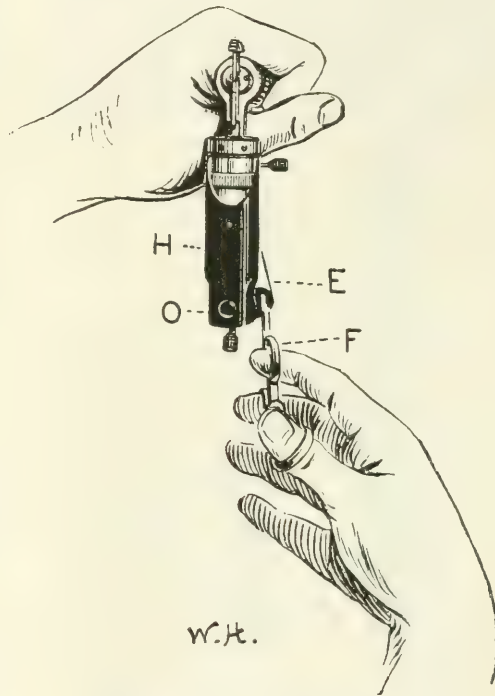


FIG. 8.

multiple sclerosis, locomotor ataxy, general paralysis of the insane—in short, any condition affecting the deglutition centre. Feeding by means of a tube may be necessary in organic cases. Where the disease is believed to be purely hysterical passage of bougies or of the œsophagoscope once may effect a cure. It

that is necessary and is probably not inferior to electrical treatment, which is less convenient. The faradic wave-current can do no harm, but with the constant current there is grave danger of causing electrolytic cauterization unless highly technical precautions are taken. Functional dysphagia is rarely due,

it must be remembered, either to paresis or to spasm of the gullet, but is usually a purely pharyngeal neurosis.

Spasm of the Œsophagus.—Spasm may be either paroxysmal and of short duration or long continued. The former occurs in a painful deglutitory cramp, and the latter is tetanic in character though often designated tonic or hypertonic. Clonic rhythmic spasms have not been observed. As a sequela of spasm an anatomic spastic contracture is alleged to occur at the cardia. Primary or idiopathic spasm, whether functional or organic, is often heard of but rarely seen; the writer, with an experience of hundreds of œsophagoscopic examinations, has never been able to verify the diagnosis of purely spasmodic gullet dysphagia. Spasm is almost invariably secondary, and is either due to some widespread spasmodic disease, *e. g.* tetanus, hydrophobia, or strychnine poisoning, or is symptomatic of a local lesion in or adjacent to the gullet causing stricture, *e. g.* the impaction of a foreign body, inflammatory stricture, polypus, malignant disease, peri-œsophageal abscess, mediastinal tumour, etc. In these conditions the spasm can be demonstrated by the X-ray screen on swallowing bismuth paste, the forward peristaltic contraction being followed by an oscillating rebound of the bismuth paste which, as has been pointed out by Hertz, Orton and Brünings, is not apparently of the nature of a true reverse peristalsis.

Spasm, however, plays quite a subsidiary rôle in the production of the dysphagia compared with the primary stenosing lesion. Functional dysphagia is usually due to *pharyngeal* paresis, the bolus of food not passing beyond the deep pharynx on account of paresis or of functional disturbance of the normal co-ordinated act of deglutition; occasionally functional dysphagia is due to pharyngeal spasm, and it is possible that functional spasm *may* occur in the gullet as a very exceptional phenomenon; but the practitioner should bear in mind that the tentative diagnosis of pure spasm as an explanation of dysphagia in any given case is almost sure to turn out to be wide of the mark as the organic lesion progresses. The X-rays are most useful in locating an organic stricture in the gullet, but useless for settling the question of the presence or absence of pure spasm; this can only be determined by direct inspection with the œsophagoscope with or without anæsthesia. Temporary or even permanent improvement under bougie treatment is no proof of the purely spasmodic nature of a stricture, for the passage of bougies is a recognized method of relieving organic strictures, and this with-

out inspection therefore has no differential diagnostic value. In women dysphagia *may* be purely functional from pharyngeal and possibly from œsophageal paresis also, but there will then probably be other hysterical symptoms present, but even so a certain diagnosis of functional dysphagia cannot be arrived at in the absence of direct endoscopic inspection. In dealing with males there is less tendency to assume spasm and a proneness to suspect malignant disease, but an œsophagoscopic examination is here none the less necessary, as the disease may turn out to be a remediable inflammatory condition, and neither functional nor malignant. The current view that spasm alone, whether continuous or paroxysmal, can produce such a degree of stricture as can lead to marked dilatation of the gullet is an unproved assumption. The writer has invariably found that cases of dilatation alleged to be due to cardio-spasm were usually cases of hypertrophic stenosis, but exceptionally of kinking or of paresis of the phreno-cardiac portion of the gullet.

Acute Œsophagitis.—This is probably never primary, but secondary to acute stomatitis and septic pharyngitis, thrush, or to gastritis, or continued bilious vomiting (two cases seen by the writer); it may be symptomatic, as in traumatic and escharotic œsophagitis and in ulceration from typhoid fever, smallpox and diphtheria. There is often fever, and nearly always burning pain, aggravated by swallowing, which latter is difficult. Stiffness and tenderness to pressure in the neck, profuse salivation and expectoration of frothy mucus were constant symptoms in the few recorded cases. The absence of marked attacks of spontaneous spasms in the pharynx and neck distinguishes it from hydrophobia, but it is not always possible to exclude peri-œsophageal abscess except by œsophagoscopy. Ice, cocaine and chloretone locally, and morphia and atropine hypodermically, abstinence from food by the mouth, and the administration of saline rectal injections, may give relief. Feeding through a stomach tube, or the wearing temporarily of an intubation apparatus, is indicated where swallowing is painful, and more especially if there is ulceration.

Peri-Œsophageal Abscess.—This may originate (1) in prevertebral glands; (2) in glands at root of lung; (3) in areolar tissue of gullet; (4) in vertebral caries. The pus tends to burrow upwards and form a swelling at the root of the neck; it is commoner in children than in adults; in the latter, abscess may form in malignant as well as in caseating glands, near the root of the lung; it is usually unilateral, and often chronic at first, but tending to become acute and pyæmic. Dysphagia and

pain on swallowing in the morning and stiff neck are the more prominent symptoms ; pressure on the trachea may cause dyspnœa ; cough is infrequent. Apart from a swelling at the root of the neck, which may extend up to the lateral pharyngeal region, unsymmetrical tumefaction can be demonstrated with the œsophagoscope, often extending down to below the left bronchus, and a discharging sinus is sometimes

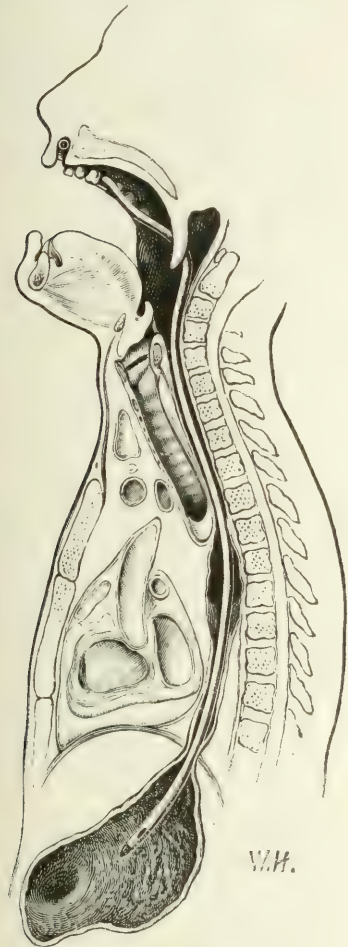


FIG. 9.—Hill's Œsophago-gastric Intubation Apparatus for stricture in situ ; the method of attachment to the teeth or to a denture is not shown in detail. (From a drawing by the author.)

seen. The abscess may burst into gullet or pharynx, with recovery. If presenting at the root of the neck a dissection should be made and the abscess opened ; when lower down an incision through the œsophagoscope is justifiable only when a skilled œsophagoscopist is sure of the diagnosis, which may entail the employment of a special exploratory aspirating needle ; this should be followed by intubation.

The prognosis is always grave, more especially when there is much constitutional disturbance.

Cicatricial Stricture of the Gullet.—This may result from any condition causing ulceration, for example, traumatism from unskilful instrumentation, ulceration resulting from impacted foreign bodies, from swallowing corrosive fluids, from syphilitic lesions, and also from general hypertrophic thickening in the phreno-cardiac portion of the gullet ; the latter is usually obscure in origin, but may have been preceded by definite œsophagitis due to diphtheritic lesions or to peptic ulcers in association with gastritis. Dysphagia is the most prominent symptom, with regurgitation of food, the amount and character of which varies with the degree and site of the superimposed dilatations ; œsophagoscopy measures will determine the site, degree and nature of the stricture, the amount of dilatation, and the length of the stricture being best shown by radiography in conjunction with a bismuth meal. When resulting from the swallowing of corrosive fluids the stricture may be so long and tight that endo-

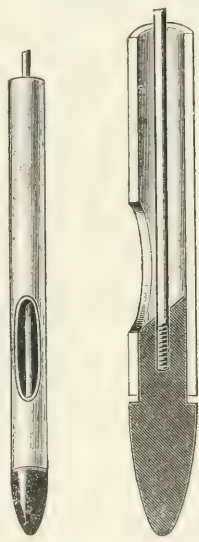


FIG. 10.—Distal Extremity of Hill's Oro-œsophago-gastric Intubation Apparatus ; showing flexible silver style screwed into vulcanite nose-piece, with sunken portion for attachment of rubber tubing and orifice for passage of fluids.

scopic dilation by bougies may be useless and gastrostomy may then be unavoidable ; in most cases, however, endoscopic dilation by bougies and the employment of Brünings' or Abrand's dilator, followed by temporary intubation, will afford relief for months or years, when these measures may have to be repeated.

Internal œsophagotomy performed through

the endoscope is rarely advisable or called for, is not free from danger, and is applicable only to very short, tight annular strictures; external cervical œsophagotomy is practically an obsolete method, and is more dangerous and less convenient for the patient than gastrostomy with digital dilation of the phreno-cardiac region. Lavage of the dilated gullet is always useful, especially where there has been erosion from continuous retention of decomposing foreign matter. Mercury and iodide of potassium are of course indicated in syphilitic cases, but such measures as fibrolysin injections and ionization are probably not worth the trouble involved in their employment.

Dilatations of the Œsophagus.—A general ectasia of the gullet occurs above any stricture which is of any duration, *e.g.* in cicatricial stricture, in long-impacted foreign bodies, and in cancer; congenital, idiopathic and spasmodic dilatations are described, but the evidence of their existence is, in the writer's opinion, based on considerable investigatory experience, unconvincing. In diffuse dilatation, when no anatomic narrowing of the phreno-cardiac gullet exists, the explanation is probably to be found either in kinking or in general paresis, with want of co-ordination of the act of deglutition, the cardia not opening up normally; the latter is better explained by paresis than by hypertonic spasm. True dilatations are usually either fusiform or globular, but in carcinomatous stricture the lower part of the ectasia may appear irregular in the X-ray photograph after a bismuth paste meal. Dilatations of the gullet are often associated with regurgitation (œsophageal vomiting). Palliative treatment consists in dealing with the stricture by dilation and with the paresis, if present, by lavage and the employment of the sinusoidal and faradic currents. Galvanism is dangerous in unskilled hands. [See also *Diverticula, Cicatricial Stricture, Malignant Stricture and Paresis.*]

Benign Growths of the Œsophagus.—These are extremely rare and are often unsuspected until found post-mortem. Occasionally they protrude into the deep pharynx from a long pedicle and can be seen by pharyngoscopy. Papillomata, mucous polypi, fibromata, adenomata, angiomas and myomata have been recorded. When dysphagia, whether slight or marked, is present, this should lead to an œsophagoscopy examination, when the presence of the growth will be revealed; it can scarcely be missed when pedunculated, on account of the rhythmic flopping movement synchronous with respiration. The treatment is removal with snare or forceps through the endoscope. Benign tumours in the deep

pharynx are often recorded as œsophageal growths, it being forgotten that the pharynx does not terminate at the level of the arytenoids, but that the pharyngo-œsophageal junction is at the level of the lower border of the cricoid cartilage, corresponding to the lower margin of the crico-pharyngeus (inferior constrictor) muscle.

Malignant Stricture of the Œsophagus.—Epithelioma is the commonest form met with, but spheroidal-celled carcinoma and endothelial sarcomas are met with; colloid cancer and true sarcomas are very exceptional. The disease may originate in any portion of the tube, but the constriction at the entrance to the gullet and opposite the left bronchus, at the phrenic constriction, where the tube passes through the diaphragm, and at the cardiac orifice are the favourite sites. Former traumatism, as from impaction of foreign bodies, the swallowing of a corrosive liquid, excess of ardent spirits, and the rapid drinking of very hot fluids are believed to predispose to gullet cancer. The *revealing signs* of malignant stricture are late; slight dysphagia is the earliest symptom; and this often appears suddenly, as after a piece of meat becoming impacted, the patient never afterwards being free from slight difficulty with solids, though liquids may pass freely for a time; the dysphagia is usually progressive and rarely intermittent; it may never interfere with the patient taking sufficient nourishment *per vias naturales*; on the other hand, complete aphagia may ensue, necessitating intubation or gastrostomy. Pain is very infrequent in the early stages and often absent in the late. In disease high up it shoots up to the ear: when lower down it may be due to peri-œsophageal abscess or extension to the pleura, or to vertebral invasion. Cough is common in cancer of the cervical and upper thoracic gullet, and there is often associated abductor paralysis. Violent cough and dyspnoea coming on half a minute or more after liquids have passed into the œsophagus generally points to perforation into the air passages; very severe pain on either side after food suggests perforation into the pleural cavity; perforation into the larger vessels causes sudden death. When the stricture is in the thoracic gullet dilatation occurs above it; swallowed saliva is frequently expectorated in large quantities as frothy mucus; and food tends to lodge, and is often regurgitated; occasionally when the dilatation is very large, as in cancer of the phreno-cardiac portion, œsophageal vomiting occurs, more especially when there is hiccough. Progressive emaciation, great muscular debility and attacks of faintness point to an

advanced stage of the disease, even though the dysphagia is quite moderate. Fœtor of the breath, a bad taste in the mouth and a distaste for food mark the stage of extensive ulceration. The patient is often able to locate correctly the level of the stricture from his symptoms, but this is not always so, indeed, it is frequently observed in stricture on the lower half of the gullet, where the diagnosis is beyond question as the result of œsophagoscopic inspection, that the food tends to stick behind the cricoid; this has been attributed to reflex spasm of the cricopharyngeus, but when obviously *not* due to a second malignant deposit, the writer's œsophagoscopic and radiographic investigations point to atony, *i. e.* paresis, as the true explanation. By radiography we can locate the level of the upper and lower ends of the stricture and its calibre to a certain extent, and also the amount of dilatation above the stricture, but it is only by a direct œsophagoscopic examination that the nature of the stricture can be determined with anything approaching certainty. This should always be resorted to; the writer has found on six occasions that the diagnosis of cancer, which was made by others, and seemed to be justified on clinical grounds, had to be abandoned after an endoscopic inspection had shown the stricture to be non-malignant and therefore treatable by endo-œsophageal means. The endoscopic inspection should also include an examination of the larynx, trachea and bronchi, as the presence of extension to these areas, before there are any obvious pulmonary symptoms, should influence not only the prognosis, but also the treatment for such conditions; for when present, whilst the employment of radium, for instance, is contra-indicated, intubation methods are especially suitable.

[Space does not permit of a description of the technique of radiographic and endoscopic examinations of the gullet, nor of the varied appearances met with.]

Invasion cancers—*i. e.* those not originating primarily in the gullet, but invading it by extension from the deep pharynx, from the larynx and trachea, from the thyroid gland, or from the stomach—present more the characteristic symptoms associated with diseases of the organ within which they originate. On the other hand, in cancer arising primarily in the gullet, but extending later to the pharynx, larynx or thyroid, the gullet symptoms usually predominate for a considerable period.

The treatment of primary gullet cancer is practically always merely palliative for the relief of dysphagia and pain. The only cases

in which operation has hitherto been successful were in all probability not instances of primary disease, but of invasion cancer from the pharynx, and in these instances Solis Cohen's and Gluck's types of operation, *viz.* total laryngectomy, together with partial excision of the deep pharynx and a small segment of the adjacent cervical œsophagus, have often been successful. (Esophagectomy alone, whether of the cervical œsophagus as first practised by Czerny, or of the thoracic, or of the abdomino-thoracic œsophagus by thoracotomy after the methods of Sauerbruch, von Hacker, W. Meyer and others, has no permanent or even temporary cure to its credit. With early recognition by means of the more general adoption of exact endoscopic methods of diagnosis with the œsophagoscope (Figs. 11 and 12), together with improvements in operative technique, an occasional successful œsophagectomy may be regarded as a matter of time. Killian has claimed to have diagnosed and successfully removed a small sarcoma of the gullet by endo-œsophageal measures through the œsophagoscope, but it will probably be long before another such cure is recorded.)

Palliative gastrostomy is the only external operation extensively practised; with the more general resort to intubation rendered possible by the recent adoption of endoscopic methods, the number of cases gastrostomized should be largely reduced. It is specially indicated where intubation is often too dangerous or impossible, as in long, tight strictures, more especially in the phreno-cardiac region. Gastrostomy should not be put off till the patient is in a thoroughly debilitated condition; on the other hand, some surgeons, in the writer's opinion, resort to gastrostomy at too early a stage, when intubation and other measures, if œsophagoscopically carried out, would be quite sufficient for the comfort of the patient.

Iodides, iodipin, fibrolysin, like serums, vaccines and enzymes, are not often even of temporary value. Of drugs acting locally spirit of ether breaks up frothy mucus in the gullet by reducing surface tension. Astringents, like adrenalin, cocaine and turpentine, are of little use; local anodynes, such as morphia, chlorotone and orthoform, are sometimes useful for pain in cancer high up; they rarely, however, enable one to dispense with hypodermic injections of morphia, atropine, etc., in very painful cases.

Lavage of the gullet, in cases of dilatation above a stricture, is the best means of removing decomposing substances, such as food residues and the products of ulceration, but glycerine of boric acid and of carbolic

acid, sanitas and similar preparations are also useful as disinfectants and deodorants. Peroxide of hydrogen is contra-indicated. Caustics are generally inadvisable, even when applied endoscopically to tight strictures, and diathermy, ionization and carbon dioxide

favour of endoscopic bougieing, which is a much safer and more efficient procedure in every way—but with intubation periodical bougieing is unnecessary.

Symonds' gum-elastic funnels are extremely useful when the gullet can be endoscopically

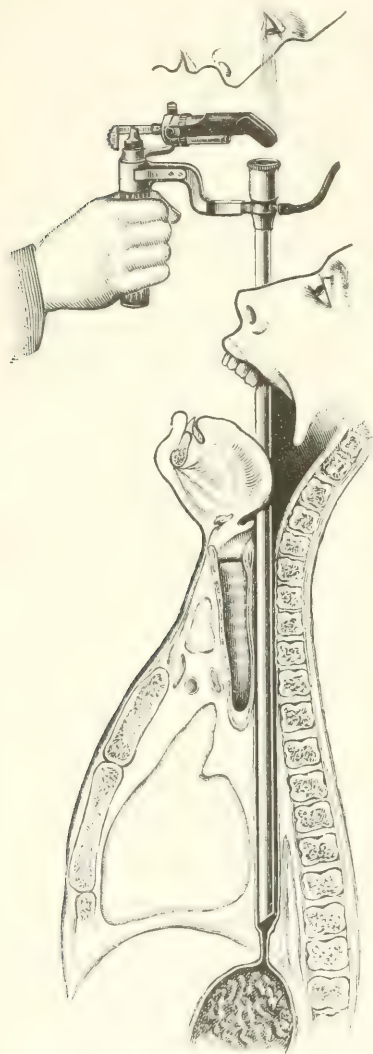


FIG. 11.—Hill's Direct-vision Inflating Œsophago-gastroscope; the end of the tube approaching the phrenic constriction.

snow have not as yet had any extensive trial. Relief of dysphagia by X-rays has been claimed in a few instances.

Blind use of bougies undoubtedly gives relief to dysphagia, but is not free from danger even in expert hands, and should be abandoned in

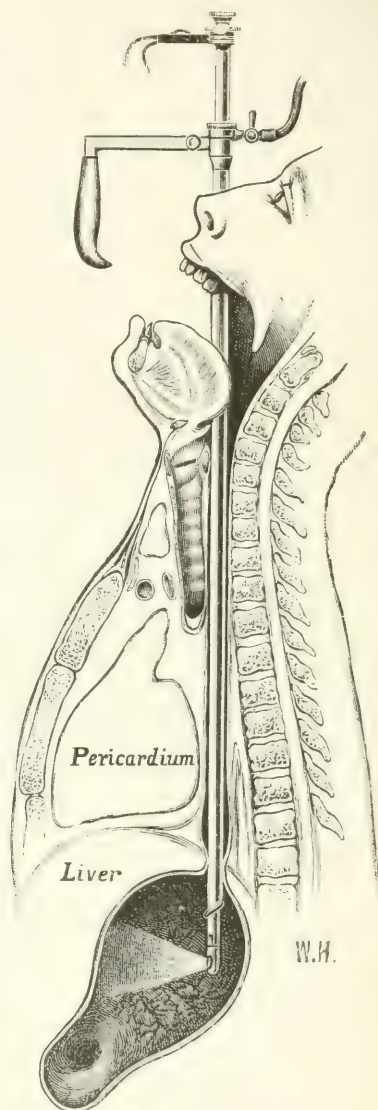


FIG. 12.—Œsophago-gastrosocopy by Indirect Vision. A periscope is seen inserted through the outer tube; examination of cardiac region to determine the extent and operability of a cancer at œsophago-gastric junction.

dilated up to a sufficient size to permit of their insertion. They are especially indicated in perforation into the air passages, but cannot be used in stricture near either end of the gullet. Berry's and Symonds' rubber tubes are also useful, but have been discarded after

much experience by the writer in favour of his styltettered oro-œsophago-gastric tube, which

temporary disappearance of all naked-eye objective evidence of disease. The writer

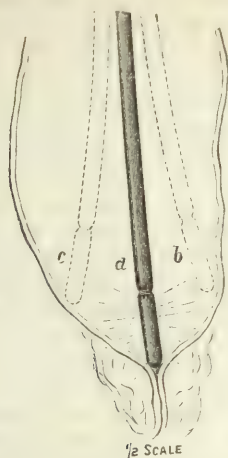


FIG. 13.—Showing faulty, inefficient positions of radium apparatus in dilated gullet inserted blindly without endoscopic guidance and without dilatation of the stricture by bougieing performed under direct vision.

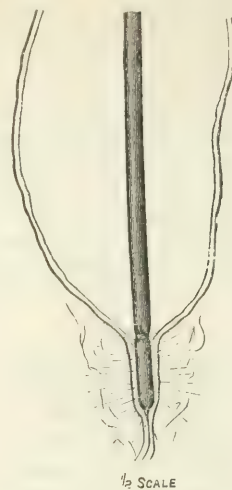


FIG. 14.—Showing radium tube in position of maximum efficiency in strictured malignant gullet, inserted through œsophagoscope and position checked by the X-ray screen.

can be fastened to the teeth and retained temporarily or permanently without any fear of being coughed or vomited up; it is inserted through the œsophagoscope after dilating up the stricture. The patient is first of all fed with liquids by a funnel through the tube, but later liquids and frequently solids pass readily by the side of the tube owing to the bougie effect on the stricture. This form of intubation apparatus is equally suitable for cases when the stricture is at the entrance to the gullet or well in the thorax; it must, however, be passed with caution in malignant stricture of the phreno-cardiac portion of the œsophagus, as the gullet here takes a marked curve to the left, and the lesser sac of the peritoneum has been more than once perforated by instrumentation in this region.

The most recent, and probably the most valuable, palliative measure which has been employed in cancer of the gullet is the application of radium salts suitably screened. The remedy is, like most therapeutic procedures, an uncertain one, but where the disease is not very extensive, and the radium tube can be accurately inserted into the stricture by means of the œsophagoscope aided by the X-ray screen, the results, though probably only temporary, are certainly often most effectual, not only in causing subjective relief of symptoms and temporary cessation of the dysphagia and expectoration, but also in bringing about widening of lumen, healing of ulcers, and sometimes even leading to the

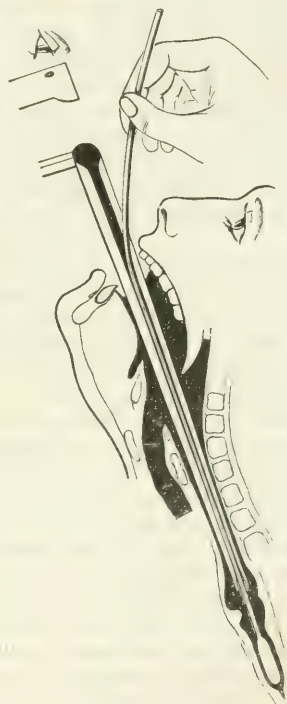


FIG. 15.—Diagram showing the author's Œsophagoscope, shaped like an elongated funnel with a lateral slot to facilitate removal of the œsophagoscope without disturbing the platinum capsule containing radium salt with its flexible silver style.

has employed this method in conjunction with Finzi in over thirty cases of gullet cancer,

using from 50 to 200 milligrammes of radium salt screened in platinum of 2 mm. in thickness, and the number of cases in which there was either remarkable or substantial improvement outnumbered those in which there was little or no benefit in the proportion of two to one.

The question of appropriate diet in various types of stricture is of great importance, but space does not admit of its adequate discussion. Milk, egg and milk, thickened soups, purees, minced tripe, calves' head and fat bacon, custards and ice creams can usually be swallowed in intubated cases *beside* the tube; liquids only should be given *through* the tube.

W. H.

SURGICAL DISEASES OF THE TRACHEA AND BRONCHI

Stenoses of the Trachea.—Cases of acute obstruction in the larger air passages, characterized as they often are by dyspnoea, which may rapidly prove fatal unless promptly recognized and relieved by appropriate measures, are amongst the most responsible with which the general practitioner has to deal, and they often tax his acumen and surgical resource to the utmost; moreover an irretrievable and deplorable failure to rise to the exigencies of the situation often leads to damage of reputation and to much personal annoyance and mental distress. The importance, therefore, of a first-rate grasp of the subject matter of this section, involving serious questions of life and death, cannot be too clearly emphasized and apprehended.

Lesions of the windpipe demanding surgical treatment are almost invariably characterized by more or less narrowing; this is commonly due to extrinsic compression and more rarely to intrinsic contractions, tumefactions, growths, or to the presence of foreign bodies. Although in the cadaver the tracheal diameter is usually given as varying from three-quarters of an inch to one inch, in the living subject, on account of "tonus," it is not much over half an inch in diameter. The lumen in chronic conditions can be *gradually* much diminished without causing marked symptoms, whereas acute stenosis of quite moderate degree, *e.g.* in traumatic and other forms of acute oedema, may give rise to very evident respiratory distress and stridor with spasmodic exacerbations.

The chief *extrinsic causes* of stenosis are included in the following table (modified from St. Clair Thomson)—

A.—Compression in the neck by—

1. Enlargements of the thyroid gland (including malignant degeneration and thyroid tumours). These are the commonest causes of tracheal stenosis in adults.

2. Enlarged glands (innocent and malignant).
3. New growths (innocent and malignant), other than those of the thyroid.

4. Traumatism, including cut throat, strangulation and violent contusions, fractures and ruptures; these also lead to endotracheal tumefaction.

B.—Compression in the thorax by—

5. Substernal goitre.

6. Enlarged glands (inflammatory or tubercular).

7. Extension of sublingual and cervical phlegmon and abscess; and mediastinal abscess.

8. Enlargement and abscess of the thymus.

9. Subcutaneous emphysema, passing into the mediastinum or arising therein from rupture of trachea, bronchi or gullet.

10. Mediastinal growths, which, however, first usually affect the bronchi.

11. Foreign bodies in, and tumours of, the oesophagus and peri-oesophageal abscess.

12. Aneurysm, which causes pressure stenosis at first, but may result later in perforation by absorption of the tracheal wall.

Intrinsic causes include—

1. Foreign bodies (usually inhaled).

2. Acute oedematous inflammation from diphtheria and specific fevers, sometimes leading to perichondritis and erysipelas spreading down from the throat, or spreading to the mucosa through a tracheal wound.

3. Acute inflammation due to injuries, wounds, corrosive fluids and the inhalation of noxious fumes.

4. Chronic cicatrices of traumatic, operative or inflammatory origin and frequently associated with adjacent laryngeal stenoses. *Post-operative lesions, e.g. from tracheotomy, laryngotomy and intubation, are the commoner causes of stenosis in children.*

5. Tertiary and more rarely secondary syphilitic lesions; and exceptionally tuberculomata, scleroma and leprosy. *Syphilitic contractures constitute the commonest stenotic lesions met with in adults.*

6. Post-tracheotomic granulomas and primary benign growths, which are of the same varied character as those met with in the larynx, though very uncommonly observed; malignant *primary* new growths are of the extreme rarity, more especially carcinomata.

7. Carcinomata are fairly frequently found as *secondary* invasion growths extending from the contiguous larynx, gullet or thyroid gland.

8. There may also be penetration into the tracheal lumen of caseous lymphatic glands, thyroid tumours and aneurysms.

Symptoms. The revealing signs of a narrowed lumen, either from external pressure or internal lesions, are late and of gradual and mild onset in chronic conditions, but rapidly developed

and early assuming a pronounced character in acute cases; they comprise in the latter obvious dyspnoea, sometimes amounting to cyanosis, and noisy respiration with continuous or paroxysmal stridor; inspiration and expiration may be stridulous, but, as in laryngeal obstruction, the former is more marked but has not so clear and metallic a character as laryngeal stridor. The inexperienced, however, often has considerable difficulty in deciding from symptoms whether the obstruction is tracheal or laryngeal, and many a high and ineffectual tracheotomy has been performed through not eliminating the question of laryngeal obstructions by means of the laryngeal mirror, a procedure which should never be omitted if time permits of its performance. The position of the patient's head and neck is often diagnostic, for in laryngeal stenosis the chin is extended and the head thrown back to elevate the epiglottis and open the vestibule of the larynx by drawing it upwards and forwards and preventing up and down movement of the larynx, thus nearly imitating the manœuvre adopted by anaesthetists. In tracheal obstruction the head and neck are fixed and the windpipe and larynx do not move up and down markedly with respiration; in acute laryngeal stenosis excessive movement is the rule, but in tracheal stenosis the patient does not extend the head, as in laryngeal stenosis, but holds it rigidly upright with the chin protruded, so as to avoid an upward tug of the trachea. Too great flexion of the head and neck towards the sternum increases respiratory embarrassment by compressing and producing an anterior curve and even a kink in the narrowed cervical trachea. In bad obstruction, in addition to cyanosis and increased stridor, often spasmodic and paroxysmal in character, there is often distension of the cervical veins and indrawing of the supraclavicular fossæ. Stethoscopic examination reveals feeble breath sounds in the lungs except in cases where the tracheal rhonchi mask all other sounds.

When obstruction comes on gradually, as in most chronic cases, there may be no marked symptoms with a degree of obstruction which would produce urgent symptoms and dangerous paroxysmal spasms in an acute case, thus conforming to what is observed in laryngeal stenosis. Three stages usually mark the progress of chronic obstruction: (1) Thus there may be no symptoms except on exertion, when respiration is laboured; this is observed in many other morbid conditions and is not diagnostic; (2) the stage of well-marked noisy respiration, the voice being often weak; (3) in the more advanced stage there are in addition paroxysms of dyspnoea with loud stridor.

Tracheal cases are sometimes mistaken for

paroxysmal asthma in those instances where there is usually very little noisy respiration and dyspnoea in between the not very prolonged attacks of spasm, stridor and respiratory insufficiency. In the more advanced stages, however, no such mistake should be possible. Cough may be absent, frequent or paroxysmal. All symptoms are apt to be more marked at night, and fatal dyspnoea has occurred from malposition of the head and neck taking place during sleep.

Diagnosis. When the above symptoms point to narrowing of the tracheal lumen an obvious possible extrinsic cause may be apparent on a cursory glance at the neck, *e. g.* goitre, enlarged glands, malignant disease or evidence of traumatism, or there may be a history pointing to either the possibility or probability of an impacted foreign body. Failing such a cause a thorough examination of the chest, including radiographic and œsophagoscopic inspection, may reveal one or more of the obstructing factors mentioned under heading *B*, p. 752. Radiography is especially indicated in cases where there is a history pointing to a foreign body (which will show on the X-ray screen), as a probable cause of the dyspnoea. Radiography would show whether the foreign body was really in the air-passages or causing tracheal stenosis by bulging the œsophago-tracheal wall when impacted in the upper half of the gullet; immediate œsophagoscopic removal would then be indicated. But before resorting to such measures it is not merely advisable, but usually necessary, to make an examination with the throat mirror, illuminated either by Kirstein's headlight or by reflection from a specially brilliant source of light from a forehead mirror; by this means we are not only able to exclude laryngeal obstruction, but in some instances the image of the source of tracheal obstruction, *e. g.* a foreign body or a tumour or an obvious constriction of the lumen, can be more or less plainly seen in the mirror.

Mirror tracheoscopy differs slightly only from indirect laryngoscopy, but as pointed out by Morell Mackenzie many years ago, "the patient instead of inclining his head backwards should hold it upright, or bend it slightly forwards, at the same time stretching the neck a little, but not throwing the chin up too much. He should sit rather higher than for laryngoscopy, so that the chin is just above the level of the observer's eye." The mirror must be held in a horizontal position and much farther forward against the palate than in laryngoscopy. Gleitsmann's or Horsford's epiglottis tractor is useful in some cases. The method, though often enabling the whole anterior wall and much of the lateral walls to be seen in healthy subjects,

and occasionally revealing clearly a tumour or foreign body high up in the windpipe, yet frequently fails in cases of tracheal stenosis on account of the intolerance of the patients when there is any considerable respiratory embarrassment. The only universally efficient diagnostic method is *direct-vision tracheoscopy* through an endoscopic tube with proximal illumination by means of either Kirstein's forehead lamp or of Brünings' handle-lamp, or distally illuminated by Einhorn's method, which

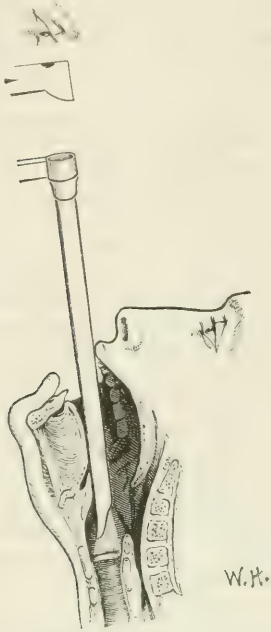


FIG. 1.—Passing Brünings' Tracheoscopic Tube through the Larynx; for bronchoscopy, after the tracheal tube has been passed well into the windpipe, a narrower extension tube can be inserted for exploring the lower air-passages.

is now almost exclusively employed by Jackson. The technique of peroral direct tracheoscopy is practically identical with direct-vision laryngoscopy (*quod vide*) as regards the preparation of the patient and anæsthetization—local and general—and insertion of the tube into the vestibule of the larynx. General anæsthesia is usually advisable for most serious work when, in addition to diagnostic inspection, endoscopic treatment is to be carried out. Skilled endoscopists can—in most instances—make a diagnostic examination in adults and youths, and often also in older children, under local anæsthesia alone, but, generally speaking, children require a general anæsthesia, as do some nervous females. Chloroform is ordinarily the anæsthetic of choice, with an injection of scopolamine in adults and atropine for children to reduce excessive secretion. Intravenous

ether or hedonal is a luxury which is of course much preferred by the endoscopist when an experienced anæsthetist is available, and it is specially indicated in debilitated subjects with weak hearts where chloroform is better avoided, and where the choice mostly lies between the intravenous method and open ether to begin with and chloroform or C. E. mixture later. Inhaled ether, especially by the closed method, so often irritates inflamed respiratory passages that it is best avoided. On exposing the glottis a swab saturated with a ten per cent. solution of cocaine may have to be passed between the cords into the upper part of the trachea in cases where previous cocainization has not sufficiently abolished spasm and irritation; the trachea itself is often fairly insensitive and quite tolerant to endoscopic examination, but in some cases further cocainization through the tube is necessary. The objection to forcing swabs any distance down the trachea is that pedunculated growths and foreign bodies may be detached and become impacted in a bronchus. Syringing or spraying cocaine through the tube is therefore exclusively used by some endoscopists, but I have found careful swabbing more efficient in irritable cases. The tracheoscope is gently insinuated between the cords during inspiratory opening of the glottis, and by slowly inserting the tube the diagnosis of anterior or lateral compression, deviation, tumefaction, granulation, ulceration, stricture, new growth, foreign body, etc., can usually be made with celerity and certainty by a skilled observer. There are occasional difficulties, especially in children, due to cough, spasm, excessive secretion, hæmorrhage, etc., which may cause delay.

Tracheotomy or lower tracheoscopy is performed through an already existing tracheotomy ostium, or through a longitudinal incision in the trachea, made *ad hoc*; this method is extremely easy, but should not usually be resorted to in the first instance for mere diagnostic inspection of the trachea, though lower tracheoscopic procedures are in some conditions those of choice in carrying out certain prolonged endoscopic methods of treatment, more especially in infants and younger children.

Treatment. This may include one or more of the following measures—

1. Surgical removal, as far as may be practicable, of the extrinsic causes of compression in the neck and chest mentioned elsewhere.

2. Emergency tracheotomy below the thyroid isthmus, with insertion of either an ordinary cannula or of König's long flexible cannula, or of a rubber tube, capable of reaching the bifurcation, when the stricture is intrathoracic and not due to a foreign body; the latter should of course be immediately removed under vision with forceps by

3. Emergency tracheotomic tracheoscopy, by means of a cylindrical or, better still, funnel-shaped endoscope, inserted through the cervical incision. Foreign bodies are sometimes ejected through the held-open tracheal wound, especially if aided by cough when lying on a couch in the prone position with head hanging lower, or on inversion.

4. Per-oral or upper tracheoscopy for removal of foreign bodies and limited new growths and granulomata; also for dilation of strictures.

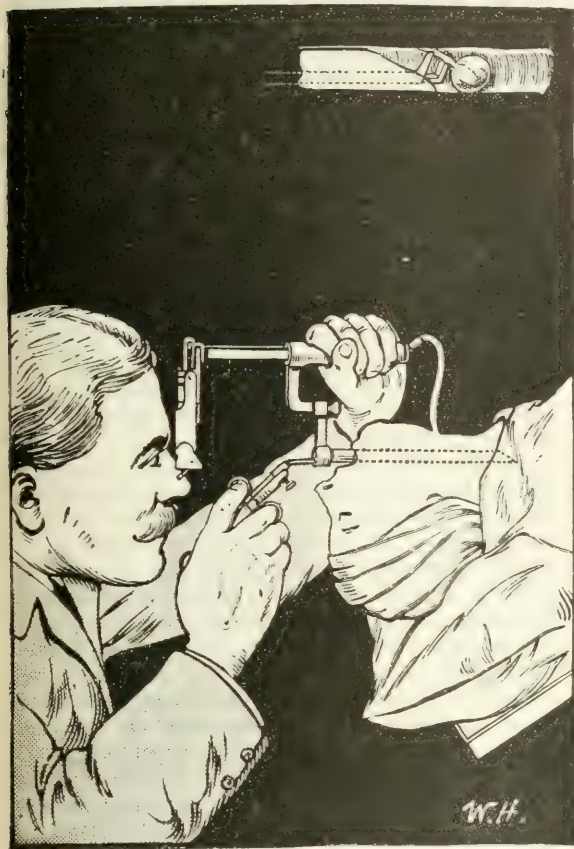


FIG. 2.—Removal of a Tracheal Polypus in a child of seven years, under chloroform, through a tracheoscopic tube, with Horne's forceps on Krause's handle. (Drawn by the author.)

In infants this method should never be prolonged beyond a few minutes on account of the risk of causing laryngeal stenosis; the lower method should usually be resorted to in children, more especially by inexperienced endoscopists.

5. Excision of growths and dilation of strictures through a cervical incision with or without the aid of the tracheoscope.

6. Long-continued tracheostomy by a long vertical fissure, the skin being sewn to the mucosa and the ostium kept open for months or years by means of Hope's winged rubber tube,

the lower end of which extends down beyond the stricture and the upper end as far as may be necessary within the larynx. By this method the stricture, after being dilated up or removed, can often be prevented from recurring, so that the ostium can be eventually closed by a plastic double skin operation. This tracheo-osteal fissure operation is usually carried out for post-operative tracheal stenosis in children involving also the larynx, and the incision usually includes laryngo-fissure as well. These operations aim not only at mechanically relieving the symptoms following on stenosis, but also at curing the condition. The treatment, however, demands a special technique, and is often protracted and not free from an immediate and remote mortality, so that in extreme cases many prefer to rely on more or less permanent tracheotomy cannulae, with or without an upwards dilating extension to the larynx (see *Tracheo-Laryngostomy*, under the head of *Laryngeal Stenosis*, *Throat Section*).

7. Partial resection of a short portion of the trachea for limited cancer, with end-to-end anastomosis, or of a larger exsection, with suture of the proximal open end of the lower unoperated-on portion of the trachea to the skin above the sternal notch.

8. *Treatment by drugs* administered by the mouth or hypodermically, or applied locally as pigment, sprays, inhalations, etc., is almost identical with similar measures as applied to laryngeal stenosis, to which section the reader is referred. Inhalations of chloroform or of chloral-chloroform or of oxygen are sometimes useful during paroxysms. After palliative relief of syphilitic strictures by a tracheal cannula, its employment can often be dispensed with after carrying out the modern treatment by salvarsan, reinforced by cervical inunctions of mercury. Iodides are liable to cause oedema, as in laryngeal obstruction, but are safe when a tube is worn (see *Treatment by Drugs of Laryngeal Stenosis*, *Throat Section*).

Tracheotomy and Tracheoscopy. *Emergency tracheotomy*—with or without insertion of an appropriate cannula (*tracheostomy*)—requires more detailed description in view of its frequent demand and the vital importance of its being carried out correctly and with the greatest possible celerity compatible with efficiency. When in a hurry inexperienced operators sometimes unthinkingly perform the easier operation of inter-crico-thyroid laryngotomy by transfixing the skin and then inserting a sharp-pointed pair of scissors curved on the flat through the cricoid membrane (Bond's method) and inserting a special cannula. This is unsuitable for even the majority of cases of laryngeal obstruction, excepting perhaps foreign bodies, and should be restricted mostly for

operations in the mouth and pharynx to enable the larynx to be plugged; moreover the cannula is unlikely to reach far enough down to relieve tracheal obstruction. In fact a high and even a medium tracheotomy is contra-indicated unless one is quite certain that the stenosis is in the larynx or limited to the upper third of the trachea. The routine method in tracheal obstruction of unknown position is a moderately low tracheotomy carried out below the isthmus of the thyroid. As, however, the higher operation is often the one of choice in laryngeal obstruction with slight extension to the trachea, it may conveniently be described here.

Emergency high tracheotomy should be performed under local anæsthesia (eucaine and adrenalin injected subcutaneously) if time permits; general anæsthesia often increases spasm and dyspnoea not only in tracheal but in laryngeal stenosis, and the tendency of the present day is to avoid even chloroform; ether, except by the intravenous method, is contra-indicated. In an emergency, however, to relieve asphyxia, from whatever cause, in laryngeal and upper tracheal stenosis, the windpipe has at times to be opened without a moment's delay, and then recourse to anæsthesia in any form is out of the question. No time should be lost in even attempted cleansing of the skin. The larynx is seized by the left hand, the thumb and second finger being forced downwards and behind it as far as possible; this tends to displace the trachea prominently forwards and upwards and tenses the skin and superficial tissues which overlie the trachea and facilitates their severance; if the nail of the index finger is at the same time made to press against the lower border of the cricoid it acts as a guide both as to the position and direction of the trachea and for the stab with a sharp knife, which is made about half an inch below this point straight through into the trachea; the knife is then made to cut through two or three rings of the trachea, either in an upward or downward direction according to the distance from the cricoid at which the stab has been made, and the incision in the skin and subcutaneous strictures is with the same cut slightly enlarged; the index finger-nail is pressed down to the slit trachea, the knife withdrawn and either a cannula inserted direct or else a dilator is first inserted, guided by the finger into the slit in the trachea, and the cannula subsequently introduced at leisure. Novices often succeed only in inserting the cannula in the deep tissues either over or beside the trachea, more especially in median and lower tracheotomy. Should there be much bleeding from wounding of the thyroid isthmus, the skin incision should, if necessary, be enlarged with the knife upwards and downwards and laterally by forcibly

digging in retractors and pulling on them; bleeding vessels are seized with forceps, and if the isthmus has to be dealt with a pair of partially open Spencer Well's forceps are forced down each side of the trachea, catching up the isthmus at two spots; which can then be severed in the middle and each half tied. It must clearly be understood that these somewhat rough but rapid procedures apply only to cases where the windpipe has to be opened with the greatest possible expedition to avoid impending death from asphyxia from whatever cause. When there is time to operate under either general or, preferably, local anæsthesia a longer skin incision and a deliberate vertical dissection can be made through the subcutaneous fat and fasciæ and muscular layers till the anterior aspect of the tracheal rings is exposed, prominent veins being either avoided or ligatured. The isthmus of the thyroid can be pulled down in the high operation, or severed and ligatured in median tracheotomy, or pulled up in the lower operation; the trachea should then be steadied by a sharp hook and the tracheal rings divided from below upwards at leisure after all serious bleeding has been checked. When a tracheotomy has merely been performed for a foreign body or growth the hole is not kept open by a cannula, but is allowed to close up.

Tracheostomy is the correct term to apply when, the trachea having been opened for whatever purpose, instead of closing it as in pure tracheotomy, it is desired to maintain (1) a round ostium in the trachea, either temporarily or for a prolonged period by means of an angular cannula (*minor tracheostomy*), or (2) a long, wide fissure kept open by means of a straight rubber laryngo-tracheal tube, with a view to overcoming extensive stenosis. This latter long-maintained state of affairs may be described as *major or fissure tracheostomy*, and when combined as it usually is with laryngo-fissure it is known either as tracheo-laryngostomy or laryngo-tracheostomy (see *Laryngeal Stenosis, Throat Section*).

In tracheostomy for acute disease the use of the cannula should be given up at the earliest possible moment.

Displacement tracheostomy is performed in connection with the operation of excision of the larynx for carcinoma; one or more rings are usually excised with the larynx and the rest of the cervical trachea is then carefully freed from the gullet and brought out through a separate hole in the skin above the suprasternal notch and attached by sutures. A cannula can often subsequently be dispensed with after the ostium becomes cicatrised and consolidated.

Surgical Diseases of the Bronchi.—Operations on the bronchi are almost entirely restricted to dealing with (1) foreign bodies, (2) papillomata and other benign growths, and

(3) with bronchial stricture in association with localised bronchiectasis. These conditions can be operated on in the same way as similar ones in the trachea by endoscopic means either by

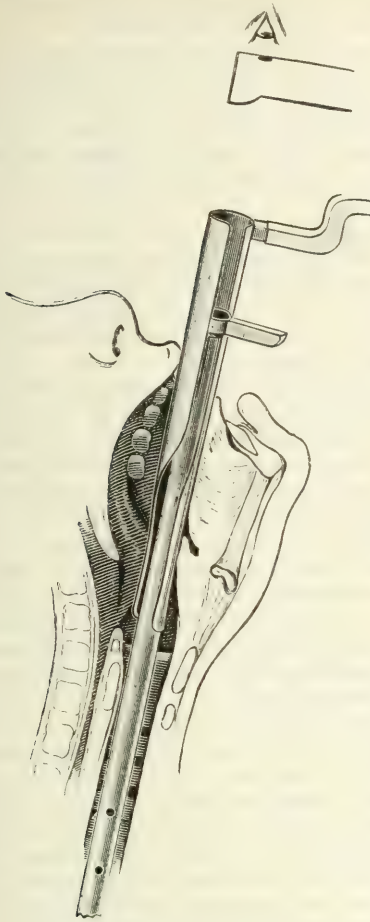


FIG. 3.—Diagram (by the author) designed to show the method of inserting a modified Killian tracheo-bronchoscopic tube in a child with the aid of Hill's large slotted direct-vision laryngoscope. The slightly bevelled distal end of the bronchoscope is not shown. The head of the latter instrument is smaller than in Killian's tubes to enable it to pass easily through the laryngoscope; the slot in the latter enables it to be removed after the tracheo-bronchoscope has entered the trachea. Brünings' handle-lamp is then shifted from the former to the latter.

per-oral bronchoscopy, an extension of upper tracheoscopy, the endoscope—preferably a Killian tube for the larger bronchi—being passed by an expert through the mouth, larynx and trachea into the bronchial tubes. For infants and younger children—and in older ones where endoscopic procedures are likely to be prolonged—the far easier method of *tracheotomic bronchoscopy* through an incision in the trachea is to be preferred in order to avoid the risk of

producing traumatic laryngeal tumefaction. It is, moreover, the more suitable for the inexperienced bronchoscopist in all cases. In order to reach the smaller branches of the main bronchi it is an advantage to employ Brünings' specially long form of bronchoscope with a short extension tube. In tracheotomic bronchoscopy it will be found easier to work with elongated endoscopic funnels with the handle lamp excentrically attached, rather than with the usual cylindrical tubes, as with the funnels much of the forceps lies to the right of the line of vision and one can often watch the jaws of the forceps more distinctly; moreover, a larger endoscope can of course be accommodated in the trachea without causing injury from mere pressure than is possible by the narrower per-laryngeal route, where endoscopic funnels are contra-indicated. In dealing with dense foreign bodies difficult to localise bronchoscopy should be performed on the X-ray table, the distal end of the endoscope being guided to the embedded foreign body by the aid of the screen (Tilley's

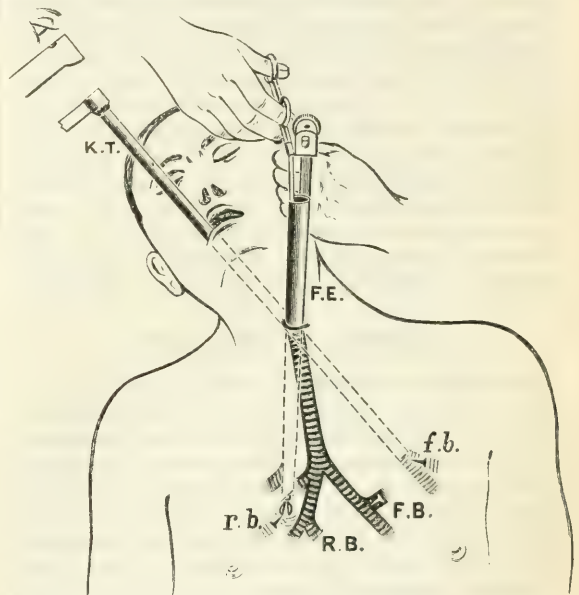


FIG. 4.—Author's diagram showing the two methods of Bronchoscopy. K.T. = Killian's tube passed through the mouth and larynx for removal of a foreign body in the first hyparterial branch of the left bronchus, which is straightened out by displacing F.B. to f.b., which the elasticity of the lung permits. F.E. = Hill's endoscopic funnel employed in per-tracheotomic bronchoscopy for removing a foreign body at bottom of right bronchus; there is only slight lateral bronchial displacement. Brünings' hand-lamp and Killian's forceps are shown in use.

method). Different forceps ends have to be employed according to the nature of the foreign body, and a strong suction apparatus, such

as *Señorans'*, serves not only to remove excessive secretions, but in some instances vegetable substances have been extracted by this means. For details of technique special monographs must be consulted.

In bronchiectasis the cavity can be emptied by suction and even washed out after the stricture above has been dilated, and such a stricture, even when cicatricial, has been successfully cured by the temporary retention of a gold *bronchial intubation apparatus*.

Further methods include thoracotomic operations, performed after a fairly large incision in the chest wall such as—

Digital palpation of the lung to localise a hard foreign body in a secondary or tertiary bronchus and expression upwards towards the end of the bronchoscope inserted through a tracheal incision. Sauerbruch's negative pressure chamber or a special inflating arrangement to prevent undue collapse of the lung is advisable.

Pneumotomy through a lateral thoracotomy has been successfully performed with Paquelin's cautery and the foreign body removed after being pushed as near as possible to the periphery of the lung by endoscopic means; the hole in the lung is then ligatured and the chest incision closed after the lung has been fully inflated.

Posterior mediastino-thoracotomy does not attempt to approach the bronchial passages through the lateral aspects of the pleural cavities as in the above operation, but, as the nomenclature suggests, from behind. It has hitherto always been attended with fatal results (see *Surgery of the Thorax*). W. H.

SURGERY OF THE CHEST

Diseases of the Chest Wall.—Most of the diseases of the chest wall are to be treated on the principles which guide us in the treatment of similar affections in other parts of the body, and require no special consideration here. Acute inflammatory diseases, such as abscess in the soft parts, or necrosis of ribs and sternum, must be treated by free incision and open dressing. Innocent tumours, such as exostoses, must be excised, either with or without a portion of the bone from which they spring. If a portion of a rib has to be excised, special care must be taken not to open the pleural cavity, the thin healthy pleura of such cases being easily wounded. Malignant tumours, such as sarcoma, if small and primary, may occasionally be treated by excision, as may also exceptional cases of recurrent carcinoma following removal of the breast. In many of these cases, however, the pleura will be found to be involved, and unless the operator is fortunate enough to be able to operate with the help of an intrapulmonary pressure apparatus, a pneumothorax

will be produced, and the operation will probably have done more harm than good. Tuberculous abscess of the chest wall connected with caries of rib or sternum is a common disease which generally requires very active treatment. The abscess must be opened, all caries portions of rib or sternum must be freely excised, and the whole of the suppuration area widely exposed and then treated as an open wound. Unless this is done very thoroughly suppuration will continue, fresh sinuses will form, and the case will eventually become incurable.

Wounds limited to the chest wall may be serious if they involve an intercostal or the internal mammary artery. In such a case the wounded artery must be freely exposed, if necessary by removing a piece of rib or cartilage, and then securely tied.

Recent wounds which involve the pleura, if quite small, may be treated by simple closure with an antiseptic dressing. If large, the edges of the wounded pleura must be accurately united with fine sutures. The contiguous ribs may have to be drawn together by stout sutures to facilitate the suture of the pleura. Any air that has already entered the pleura is usually quickly absorbed. If there is much intrapleural pressure the air may be removed by means of an aspirator. If serious sepsis has already occurred the pleural cavity may have to be drained later.

Still more serious wounds which involve the thoracic viscera and are accompanied by extensive hæmorrhage into the pleural cavity must be treated by freely opening the chest. The wound of the lung or heart must then be searched for, and closed by sutures passed deeply into the substance of the injured organ. In the case of a wound of the heart, interference must be prompt if life is to be saved. A large flap must be turned back, portions of ribs and cartilages removed, and the pericardium laid freely open. After removal of the blood from the pericardium the wound of the heart is to be sutured with stout catgut. The cut pericardium is then accurately sutured and the flap of thoracic wall replaced and sutured, preferably without drainage. Many wounds of the heart have thus been treated with success. To discover a wound in a collapsed lung is often a difficult matter, and in such a case the use of an intrapulmonary pressure apparatus, if available (which it seldom is), affords great help.

Pleural Effusions.—Large serous effusions into the pleura, unless showing signs of rapid absorption, must be treated by tapping with an aspirator. If a large pleural effusion is allowed to remain untreated, the collapsed lung becomes bound down by adhesions and

its re-expansion is rendered difficult or impossible. The aspirating trocar should be inserted in the middle of an intercostal space to avoid wound of the intercostal artery or its main branch, which lie close to the ribs. The treatment of collections of pus within the pleura depends upon the nature of the infection. In some cases of quiet empyema, such as tuberculous and pneumococcal infections, it may be desirable to treat the case by repeated aspiration without incision of the chest wall. In most cases, however, an empyema must be incised and drained. To drain the pleural cavity an intercostal space should be incised midway between the ribs, and care should be taken to tie all bleeding points securely, lest a serious and perhaps fatal hæmorrhage take place into the pleural cavity.

In many cases it is preferable to make the incision directly over and down to a rib. After ligation of all bleeding points the periosteum is rapidly and carefully stripped off the rib (a closed pair of dissecting forceps answers the purpose well in the absence of a proper periosteal elevator) and a portion of rib, usually one to two inches in length, is removed with bone forceps.

A perforated drainage tube of sufficient size is then inserted, and care must be taken either to use a tube with a flange, or else to fix the tube with a safety pin or some similar contrivance, to prevent it from slipping into the pleural cavity. (If a drainage tube has been lost, and a suspicion exists that it is in the pleural cavity, X-rays afford the best means of localising it.)

After the pus has been evacuated the wound must be dressed frequently with scrupulous antiseptic precautions to prevent further infection. Irrigation of the pleural cavity is not generally desirable except in very septic cases.

It must never be forgotten that a free opening into the pleura leads to collapse of the lung. At an early stage of the after-treatment steps must be taken to prevent this.

A good method is to fix a large square of thin gutta-percha tissue over the wound, so as to make the opening valvular. Air and pus are thus allowed to escape during expiration, while the entrance of air during inspiration is hindered by the gutta-percha flap.

In the later stages of the treatment expansion of the lung is favoured by blowing into a bottle and other respiratory exercises.

If in spite of the above precautions a pleural fistula persists and the cavity shows no sign of contracting, active measures must be adopted, before the lung is permanently and irretrievably bound down by adhesions.

If the lung cannot be made to expand and close the cavity in the pleura, the ribs must be resected over a sufficiently wide area to allow

the chest wall to fall in towards the lung. (Estlander's operation and modification of it.)

If these operations are to be of any use they must be extensive, and care must be taken to perform them quickly and to arrest all hæmorrhage as thoroughly and speedily as possible. It is often necessary to turn up a huge V-shaped flap of soft parts together with the scapula, and to resect the ribs from the second to the tenth. Such operations are generally very severe, but are nevertheless urgently demanded in really bad and intractable cases.

Localised Empyema.—Before operating upon a case of this kind, the fullest possible information as to the situation and size of the empyema must be obtained by careful physical examination of the chest. This examination should be made not merely by the physician, but also by the surgeon who is about to operate. It should be a rule that the chest is not to be opened in such a case unless the exploring needle has revealed the presence of pus immediately before the incision is made. Indeed the exploring needle should be left in situ to act as a guide. Unless the above rule be followed it is quite easy to miss a small collection of pus. To open the healthy pleura and to miss the empyema is a serious mistake.

The incision should be made as nearly as possible in the centre of the suspected area of suppuration. The subsequent steps of the operation are similar to those described for the more extensive empyema.

Freund's Operation of chondrotomy for pulmonary emphysema.—The object of this proceeding is to lessen the rigidity of the chest and so to favour respiratory movements. It is suitable only for those cases of emphysema which are believed to be due to a primary calcification of the rib cartilages. An incision is made on each side, a finger's breadth outside the external margin of the sternum, from the second to the sixth rib, down to the pectoral muscle. The fibres of the latter are then separated by blunt dissection, the perichondrium is incised and about half an inch of each costal cartilage is removed with bone forceps. It is not an operation that can strongly be recommended, but it is not a severe one, and appears to be beneficial in some cases.

Operations upon the Lung.—Apart from tuberculous affections, the principal diseases of the lung for which operation is demanded are *abscess*, *gangrene*, *bronchiectasis* and *hydatids*. In all these cases the most careful physical examination, including that by X-rays, should be made before any operation is undertaken, in order to obtain the most complete information as to the exact situation and size of the cavity which it is desired to evacuate.

The larger the cavity and the nearer it is to

the surface, the more easy will it be to open. Cavities at the base are naturally more satisfactory to treat than those situated in less accessible situations. The presence of adhesions between the affected area and the parietal pleura render the operation much safer, but as they are frequently absent, and even if present can seldom be diagnosed with certainty, it is generally best to proceed on the assumption that they are not present. To open a suppurating cavity in the lung through the non-adherent pleura, or through recently formed and slight adhesions, is generally to court disaster. The lung will recede from the chest wall, and the foul contents of the cavity escape and set up a septic pyopneumothorax which is only too likely to lead to the death of the patient. To avoid this catastrophe care must be taken to suture the lung to the chest wall before the pleura is incised. After removal of portions of one or more ribs, stout sutures of catgut or silk are passed deeply into the substance of the lung all round the area which it is proposed to incise. The lung is thus firmly anchored to the chest wall and cannot recede. The pleura and lung are then cautiously incised until the cavity is reached. A large drainage tube is inserted, and the cavity may also be lightly packed, if necessary, with iodoform gauze. Irrigation should not be done for fear of the fluid making its way into the bronchi and drowning the patient.

Bronchiectatic cavities are usually much less answerable to treatment by drainage than single abscess of the lung such as that which commonly supervenes after pneumonia. The former are rarely of large size and being usually multiple are not easily drained.

Hydatids of the lung usually require direct incision after suture of the lung to the chest wall. Aspiration of a hydatid is a dangerous practice, as it is likely to lead to sudden rupture into the bronchi and drowning of the patient.

Operations for Tuberculous Disease of the lungs are rarely required. They may be divided into two classes: (1) those whose object is to produce local collapse of the lung and thus encourage fibrosis and healing of the affected area, and (2) those which aim at draining a suppurating cavity.

1. Under this heading must be mentioned the *injection of nitrogen gas* into the pleural cavity. An incision is made down to the pleura. A trocar and cannula connected with a reservoir of gas is then carefully inserted into the pleural cavity and gas allowed to stream gently between the two layers of pleura. For the success of this proceeding it is essential that pleural adhesions do not exist and that the opposite lung be healthy.

Sauerbruch recommends that from 500 to

1000 c.c. of gas be injected. The proceeding must be repeated at first every few days, then every few weeks, and carried on for many months. At the first operation only is an incision necessary. The subsequent injections are made by simple puncture.

The other method of causing pulmonary collapse is by *resection of ribs*.

Portions of two or three ribs immediately overlying a cavity may be resected so as to allow the walls of the cavity to fall together. Or many ribs may be resected, with the object of inducing a more or less general collapse of the lung.

It is claimed for such operations that fever and expectoration diminish and that the general condition of the patient undergoes marked improvement.

On the other hand it need, scarcely be said that the proceeding is a severe one and involves grave risk to life from pneumonia, heart failure, or dyspnoea. As the affected portion of lung is usually the apex, it is the upper ribs that usually have to be resected, through an incision carried along the clavicle and down the sternum, thus permitting the turning outwards of a flap of soft parts.

Pneumonia is particularly likely to follow resection of ribs in this region. It is said, however, that if a resection of three or four of the lower ribs is first carried out as a preliminary proceeding the liability to this complication is lessened. In any case, however, the immediate effect of the operation is likely to be the production of dyspnoea and cyanosis and the patient may succumb.

2. *Drainage of phthisical cavities* is an operation which probably ought to be performed somewhat more frequently than it is at present. The conditions favourable for it are, however, not often met with. The cavity should be a single one of considerable size and the remainder of the lung should be fairly healthy. When there is much fever due to retention of pus in an ill-drained cavity the result of the operation is most likely to be beneficial.

The proceeding is very similar to that for draining a non-tuberculous abscess, but it is more likely that adhesions will be found, and there is consequently less risk of the supervention of pyopneumothorax.

Pneumectomy.—Removal of large portions of a lung, or even of a whole lung, is an operation that has been performed for tubercle, actinomycosis, tumour and other conditions. It is, however, a rare and, at present, scarcely a justifiable proceeding.

Operations upon the Mediastina—

Anterior Mediastinum. Substernal tumours, both cystic and solid, may often be removed

without much difficulty through a transverse incision at the root of the neck just above the episternal notch. Hydatids, dermoids and intrathoracic goitres have all been successfully dealt with by the author through such an incision. Tumours of the thymus gland, enlarged lymphatic glands and other solid growths deeply seated behind the sternum may be dealt with by direct incision through the sternum. The manubrium sterni may be removed by sawing the sternum transversely opposite the third intercostal space and cutting through the costal cartilages and sternoclavicular joints. Or the upper part of the sternum may be sawn through vertically in the middle line and the two halves drawn forcibly asunder, after transverse division of the sternum.

By either method free access is obtained to the mediastinum. The internal mammary arteries should be tied and care taken not to damage the phrenic nerves or to open the pleura.

Even if the tumour be found to be irremovable, temporary relief may be afforded by allowing the tumour to bulge forwards, thus taking off pressure from the trachea and bronchi.

Posterior Mediastinum. Operations upon the thoracic œsophagus have been performed through the pleural cavity, chiefly for the removal of carcinoma of that organ, but it can scarcely be said that such operations are as yet within the domain of practical and legitimate surgery. Without the help of a differential pressure apparatus, they are certainly not justifiable.

Access to the lower end of the œsophagus and cardiac end of the stomach may be obtained through a long incision in the left seventh intercostal space. The lung is pushed back, the pleura, and if necessary the diaphragm, incised, and the junction of œsophagus and stomach isolated and resected. The pneumogastric nerves must, of course, be dissected off before the resection is undertaken.

The upper portion of the thoracic œsophagus has been reached by way of the right pleural cavity.

An incision is made along the right clavicle and then downwards along the sternum to the third intercostal space and a flap of soft parts turned downwards and outwards. The clavicle is divided or dislocated outwards and considerable portions of the first three ribs and their cartilages removed. The pleura is then opened and the posterior mediastinum exposed. The upper part of the thoracic œsophagus is then dissected out and resected. The lower end is closed and the upper brought up to the surface at the root of the neck. The con-

ditions which justify the performance of such an operation must indeed be rare. J. B.

THE BREAST

I cannot refrain from recalling the words of a great surgical clinician, my old master, Sir George Murray Humphrey. They ran thus: "Eyes first and much. Fingers next and little. Tongue not at all." I venture to impress on the reader his words in the consideration of the Surgical Affections of the Breast.

Anatomy of the Breast

It is not within my scope to consider the general anatomy of the breast. I cannot better refer to it than in the words of my friend Mr. C. B. Lockwood as "a gland without a capsule." It is developed in the skin, of which it is a part, and has wide extensions. Two of these deserve attention. These are: (1) the *axillary* portion, which is nearly always present and is an offshoot prolonged over the anterior axillary fold and lying on the serratus anterior; (2) what I may term the "*epigastric*" portion, a similar offshoot prolonged downwards and inwards, and lying on the seventh costal cartilage, reaching very close to the interval between the seventh costal cartilage and the ensiform—recognition of these offshoots is most important, as I will show later. We naturally turn next to the lymphatic drainage of the breast. Here it is of importance to realize that a large number (but not all) of the lymph vessels of the breast run into a free plexus situated deep to and around the nipple. From the nipple and from the main breast tissue the lymph vessels run deeply, until they all reach the fascia of the subjacent muscles. Here on the surface of the fascia, and indeed incorporated with it, they run into a "fascial lymph tract" of the widest possible connection. The majority, as we know, run outwards to the axillary lymph glands, first to those situated along the lateral border of the pectoralis major, but also to glands in the axillary space itself, and *occasionally* to glands on the subscapularis in the floor of the space. It is necessary to emphasize the fact that the lymph vessels, *on their way to reach these glands, stick in the main to the fascial lymph tract.* From these glands lymph vessels lead to the glands along the axillary vein, and so to the subclavian lymph vessels and glands, and the right lymph duct. It is to be remembered, however, that this simple account is not wholly correct. Lockwood has shown, with others, that very often the lymph channels may be "short-circuited," i.e. run direct to some other glands; in particular it may be mentioned that they may tend to run to (1) costo-coracoid glands below the costo-coracoid membrane and close to the second part of the axillary artery and vein, (2) to bicipital glands

along the brachial artery as far down as the origin of the coraco-brachialis, (3) to glands which are situated to the lateral side of the first and second parts of the brachial artery and even behind the first part of these great vessels.

Turn now to the internal lymph channels—some of these run, as we know, along with perforating branches of the internal mammary artery to anterior mediastinal glands; but fortunately all these are but small anastomotic channels, where the flow of lymph is but slight. Another most important series of lymph vessels, —unconsidered until the work of Sampson Handley—pass from the epigastric portion of the breast through the linea alba; and by way the lymph vessels of the ligamentum teres make direct communication with the liver and general peritoneal cavity.

Malformations of the Breast

Polymazia (Multiple Breasts). These have been known to occur in all situations, but they are mostly internal and below the normal mammae. They are most common in males, and are usually associated with abnormalities in the pelvic organs in either sex.

Diffuse Hypertrophy. This is usually of fatty and connective tissue only; it is quite rare and usually bilateral.

Gynæcomazia. A hypertrophy of the breast in males; is very often associated with atrophy of the testes.

Affections of the Nipple and Areola

The main point of importance in dealing with all such affections is not so much the nipple itself, but the very free circular lymph sinus which underlies it, ready at all times to convey any infection of the nipple, be it septic or cancerous, to all parts of the underlying breast; it is an equally potent factor in conveying against the lymph stream the spread of cancer from other parts of the breast, and hence it is that the nipple and surrounding skin should always be removed in a radical operation on the breast.

Cracks and Fissures. For the same reason all cracks and fissures of the nipple are to be dealt with with the greatest care. During lactation the prophylactic measures described in the Obstetrical Section of this work should be carefully adhered to, for nearly all cases of acute mastitis arise through septic infection from this source.

Primary Chancre. This is fairly frequent, and for the same reason the sore is here followed rapidly by a typical shotty enlargement of the axillary glands and a positive Wassermann's reaction is usually obtained with ease. With regard to induration, as in the case of other extragenital chancres the sore is usually atypical,

but the occurrence of any sore in this region should always lead the practitioner to undertake the necessary pathological investigation.

Paget's Disease occurs between forty and sixty, first as a scaly eczema of the nipple which changes to a florid patch with little induration; changing later to "a bright red patch covered with a thin scale, which may be picked off, leaving a raw surface beneath." Whatever may be the view taken of its pathology, its ultimate malignancy is certain. Such cases should be dealt with by radical operation, unless the patient insists on the use of X-Rays or radium treatment.

Retraction of the Nipple, with or without the presence of a growth.—Always a cause of grave anxiety, but by no means infallibly an evidence of carcinoma, and certainly not an indication *per se* for an extensive operation.

Inflammatory Affections of the Breast

Physiological Engorgement. This is by no means a necessary source of inflammation; inflammatory changes probably do not occur in such cases unless by infection from the nipple; the temperature of the patient can readily reach 102° to 103° F. without any septic inflammation, but in such cases the pulse is not accelerated in proportion to the temperature. Treatment of such cases should consist in drawing off a small amount of milk; applying pressure to the breast and administering iodides and atropine in suitable doses.

Mastitis Neonatorum. This form of inflammation of the breast would not appear to be primarily due to infection, and it should strongly be urged that it should be left alone and treated with belladonna plaster and pressure, and that under such conditions it will usually subside. At the same time it cannot be denied that close attention should be given to the condition, and that should the skin be reddened it should be promptly dealt with by incision, as in the case of abscess. Such cases are invariably due to secondary infection, and treatment on the ordinary lines will give a satisfactory result.

Mastitis of Adolescents. Here the form of inflammation is of the same character, and the condition almost invariably yields to the same measures, to which may well be added the external and internal administration of iodine, preferably under the forms of iodox and the iodide of sodium.

Puerperal Mastitis. Having regard to the anatomy of the breast (see p. 761), the diffuse and rapidly spreading course of puerperal mastitis is not to be wondered at. It is invariably due to an acute infection, probably by the staphylococcus aureus in the first instance, by infection

of the gland through a crack in the nipple or areola, and the free communication of the lymph vessels of the nipple with the subareolar lymph sinus which, as we have said, freely communicates in turn with the lymph system of the whole breast. The condition should be observed early by noticing a marked change in the general condition of the patient; there is acute local pain, as distinguished from the mere discomfort of engorgement; there is very early involvement of the lymph vessels leading from the site of infection, which may be shown by bluish-red tracks radiating from the nipple, and there is a marked acceleration of the pulse with a rise in temperature; it should be added that these conditions almost invariably occur between the first and second months of lactation.

Treatment. If such be the condition the practitioner should insist on early and drastic treatment. In a few—very few—cases the inflammation is superficial and localised, but in the majority it is deep and diffuse, extending round the various lobules of the breast tissue. In such cases I would advise that early treatment should, above all, be decided upon. In no case should the practitioner wait for “superficial fluctuation,” for a moment’s consideration of the anatomy of the breast will show that in such cases there must be a widespread and deep infiltration of the breast tissues before superficial fluctuation is present. Therefore let there not be a moment’s delay—make a radial incision over the point where the inflammation or induration appears to be most marked, plunge a dressing forceps in deeply, and open it. If no pus appears, try again and yet again in different directions and put in a tube; in such a case no harm will have been done.

If pus is found the practitioner should be certain that effective drainage is made. Having in mind again the anatomy of the breast he should, after a *free* radial incision has been made, put his finger into the wound and break up freely all bands he may find and endeavour to turn the abscess cavity into a single one. In very many cases this will be impossible, and counter-openings will have to be made; such cases are certainly difficult, and it only remains to advise the practitioner that, having once interfered in a case of puerperal mastitis, the more counter-openings and drainage tubes he puts in, the more he opens up the deep parts of the abscess cavity, the better is the ultimate result likely to be—the *great danger in such cases is inefficient treatment in the early stages.*

Later Treatment of Mammary Abscess. If care be taken as above mentioned there will be little difficulty. Loose packing rather than tubes should be adopted; as the rule a tube or tubes should be inserted for the first twenty-four hours, these should be replaced after the first

forty-eight to sixty hours; after this *loose* gauze packing should suffice. The incisions should, if possible, be in the lower part of the breast, and an attempt may well be made to close an upper incision, provided that there is an effective lower counter-incision for drainage. In cases where there is but little attempt at healing, Bier’s methods (see *Special Forms of Treatment*) may be well employed. As a rule, provided that lactation is discontinued and free incisions made, these cases will soon come to a satisfactory conclusion.

Recurrent Cases. These must be dealt with according to surgical rules. Careful opening and packing of cavities, with drainage, will usually overcome the infection. It is to be remembered that complete removal of the breast in such cases, however easy it may appear to the surgeon, constitutes a grave risk to the patient. In all chronic suppurative cases great reliance is to be placed on the use of an autogenous vaccine.

Retro-Mammary Abscess. This is usually a cold abscess with, possibly, tubercular ulceration of the skin; necrosis of a rib will usually be found to be the cause; the whole should be dealt with on ordinary surgical lines. It should be noted that a suppurating carcinoma is extremely rare, but, on the other hand, that carcinoma may occur in a chronic abscess or sinus.

Acute Specific Mastitis—after mumps—is fairly common and never suppurates.

Abscesses due to Actinomycosis. Extremely rare, only to be diagnosed by pathological examination of the pus.

TUMOURS OF THE BREAST

“A fig for theory—give me ocular demonstration.”
—*Roderick Random.*

These are of an infinite variety. Quite apart from pathological classifications one outstanding fact should first be noticed—and that a terrible one: “*Seventy-five per cent. of all tumours of the breast are malignant in origin.*” To this well-known statement I would venture to add three others: (1) “No tumour of the breast can be diagnosed with any adequate degree of certainty by clinical or even naked-eye examination only.” (2) “No tumour of the breast should be allowed to remain in an adult; it should be removed, its microscopic constitution most carefully examined at the time, and on such examination the later surgical procedure should always be based.” (3) If there is a reasonable suspicion that a breast tumour is malignant in character, a proper removal of the breast, together with all its lymph tracks, should be at once undertaken.

These statements I propose to qualify later.

Simple Tumours of the Breast. These, be it again remarked, are in the minority, and I would impress on the mind of the reader that we know but little of the constitution of all these tumours, but this little with certainty; "that all abnormal growth in the breast, whatever be its nature, does not necessarily remain as it is, and in the course of its variations is most liable to cancerous degeneration." Thus, in the author's opinion, the treatment of every tumour in the adult breast should be the same—that is, removal and immediate microscopical examination, according to the method to be subsequently outlined. Let it be again remembered that such a removal ought to be a comparatively small operation, and that all innocent tumours of the breast can be removed by a submammary incision which, with subcuticular stitching, leaves no scar at all. By such means the patient is left with the great comfort of a definite opinion as to the nature of the growth in her breast and without mutilation.

Clinical Characters of Benign Tumours of the Breast.—These may be taken shortly, but again emphasis is to be laid on the fact that not one of the characteristics now to be noted can finally divide these from malignant cases or from those benign growths in which malignant changes are already beginning.

Inflammatory—

Chronic Abscess. Usually near the nipple; the history is most uncertain, but it may be found to date from a lactation; the tumour may be elastic, but may appear to be solid, and cancerous degeneration is often present.

Tuberculous Disease, except as a submammary abscess, is very rare; it usually occurs as a single abscess, the diffuse form is extremely rare; it is most often found in young women; an examination of the wall of the abscess will usually give evidence of the cause and the best treatment is excision of the breast.

Actinomycosis. Very rare; similar to tubercle, treatment the same.

Non-Inflammatory—

Chronic Mastitis.—A fibrous growth in the breast associated with increase of the alveoli of the glands which are caught in the fibrous tissue. The cause of the fibrosis is unknown, it is often associated with uterine disease, and there is no doubt that it is closely related to cancer, how closely it is impossible to indicate, but it is definitely a pre-cancerous state, and in my opinion should be at once treated as such. Clinically, it has been said to consist in "chronic and indefinite hardnesses." Emphasis may be perhaps laid on two facts: (1) that these indurations are often very painful and tender to the

touch, whereas cancer is not, and (2) that retraction of the nipple very often occurs. But far more important is the fact that it cannot be diagnosed from the early stages of cancer—of which indeed it is a precursor—therefore microscopical diagnosis is here again essential.

The complete removal—and it should be complete—of all breast tissue in a case of chronic mastitis is the wisest course; it is not an easy matter, but with patience it can be effected through a submammary incision; fortunately these fibrotic breasts are as a rule by no means vascular.

Fibro-Adenoma merges at times very closely into chronic mastitis, but here as a rule there is a more regular growth formation, both of glandular and fibrous tissue. The growth or growths are usually freely movable and circumscribed; these qualities are held to distinguish them from carcinoma—a most dangerous fallacy.

I well remember exploring an apparently freely movable and circumscribed growth, the size of a billiard ball, which was not adherent to the skin. The microscope at once proved it to be carcinoma. Note may be made of a few clinical characteristics of fibro-adenoma.—Fibro-adenomata may be soft or hard and are often cystic. They are usually hard in unmarried women of between twenty and thirty. They are cystic and often proliferous in older women; here their growth is more rapid and they are to be regarded with grave suspicion; they are often situated marginally in the breast.

Treatment. On precisely the same lines as in the case of chronic mastitis.

Cystic Disease and Cysts of the Breast

Cysts are found in connection with almost all breast tumours. They may be—

1. *Primary Degenerative.* As in malignant disease, especially sarcoma.

2. *Galactoceles* or milk cysts. Their origin usually dates from pregnancy; they are usually near the nipple, give rise to no pain and are not associated with retraction of the nipple.

3. *Involution Cysts.* These may be serous or lymphatic, the first variety being due to an obstruction of ducts at the menopause. They are frequently multiple, and are often situated at the periphery and deep surface of the breast; they are usually mistaken for solid tumours.

4. *Hydatid Cysts.*

Cystic Disease.—This term is usually reserved for those cases where there are many cysts, with more or less fibrosis of one or both breasts. The cystic character of the tumour may easily escape recognition; the growth is usually noticed about the menopause and it is painful. Retraction of the nipple is rare and accurate clinical diagnosis usually impossible.

Treatment of Cysts and Cystic Diseases. Here, again, there should be no middle course. All cysts are very liable to papillomatous degeneration, which if not itself actually malignant is a very close precursor of true malignant disease. For this reason, even if a cyst is diagnosed it should be opened and examined by the microscope, while the old method of aspirating and injection of a cyst has obvious disadvantages.

Glandular Enlargement.—It will be observed that no mention has been made of glandular enlargement in the diagnosis of "benign" tumours of the breast. In the light of our present knowledge it should be of but little moment, it may occur in all cases, and this occurrence may be merely a matter of coincidence. The microscope should be the sheet-anchor in diagnosis—if the growth shows suspicion of malignancy in the primary growth, the glands must of necessity be removed and much more than the glands only; while if the growth is non-malignant the glands can be ignored.

Malignant Disease of the Breast

"Seventy-five per cent. of all tumours of the breast are malignant in nature"—an appalling statement.

Malignant disease may be roughly—and very crudely—divided into (1) sarcoma, (2) carcinoma. No notice is here taken of the transitional forms between the so-called "benign" and malignant tumours, for reasons already advanced. Amongst these, however, a word must be given to *Duct Papilloma*. These tumours usually occur near the nipple and there is usually a blood-stained fluid discharged from the nipple. Treatment should be on radical lines.

Sarcoma may be dismissed in a few words. It forms about three per cent. of all cases of tumours, occurring usually in persons between thirty-six and forty years of age. Diagnosis is most difficult; it usually appears as a sudden and rapid growth in a previously quiescent fibro-adenoma, forming a soft and painless swelling, without retraction of the nipple, and of curiously irregular and rapid growth. The axillary glands are usually not affected and the tumour is often encapsuled. The patient's temperature is often irregularly raised. The after-results of operative interference are usually very bad. Rather is the lesson of early prevention to be advocated.

Carcinoma occurs at all ages and in all degrees of malignancy. It is extremely rare in males. Its most usual time of occurrence is in middle life, after the menopause, but it is to be remembered that it can occur at any time, and when appearing in early life—as in one patient of twenty-one seen by the author, and originally diagnosed on sight,

and even after removal, as fibro-adenoma by a distinguished surgeon—its malignancy is appalling.

For its histological features, as well as its supposed causes, the reader is referred to the article on *Tumours*. It will only be necessary to here mention certain clinical types.

1. "*Scirrhus*" Cancer. Hard, firm and fibrous; the usual form; very common in the outer and upper quadrant of the breast.

2. *Encephaloid*. Acute, soft form; occurs in early life, about aet. 30. Very rapid course; there is often a rise of temperature and rapid brawny infiltration of skin.

3. *Colloid Cancer*. A degenerative form not to be distinguished clinically from the above; considered by some to be of a low degree of malignancy, but this is very doubtful.

4. *Atrophic Cancer*, "Cancer en Cuirasse." The type usually found in the aged—marked induration and slow spreading in the skin.

5. *Duct Carcinoma*. Arising from papilloma of nipple, a duct. Here there is a tumour near, and usually a blood-stained discharge from, the nipple; its malignancy is comparatively low.

6. *Encapsuled Carcinomata*. These curious forms are rare; they are soft and rapidly growing, and may involve the skin early; they break down early and are very liable to be confounded with chronic abscess.

7. *Inflamed Carcinoma*. Any of the above types are liable to become inflamed. There is an erythematous blush over the skin, and the neighbouring lymph vessels usually stand out prominently. Such carcinomata are usually most virulent.

Scirrhus Cancer. Of all these varieties the scirrhus form is of course by far the most common. Unhappily scirrhus cancer in its early stages, when alone it can be dealt with with good prospects of lasting success, is a painless affection. A small hard lump is accidentally discovered in the breast, and at an early stage its close connection with the skin and the nipple is observed; there may be retraction of the nipple and a pitting of the skin, especially the so-called "pig-skin" appearance. Early though these signs may be discovered, remember that they are already evidence of the ever-widening infection of the tumour. The later course of such a growth is only too well known. Next follows the infiltration of the skin; the involvement of axillary glands; the fixation of the whole growth—ulceration, intolerable pain, multiple secondary growths, visceral and much more rarely thoracic growths, spontaneous fractures from secondary growths in the bones, until death ends the scene.

Spread of Cancer. Whatever be our theories of the origin of cancer—for which the reader is referred to the article on *Tumours*—we are

at any rate likely all to be in agreement that the best treatment in the present state of our knowledge is the early and complete removal of the growth and (if possible) *all tissues infected by its dissemination*. Thus we should all know how cancer is disseminated from the breast and along what channels.

It is impossible to overrate in this connection the importance of Sampson Handley's work, which may well be recommended to the reader who takes a sincere interest in the subject. A résumé of the author's conclusions is all that space will here permit.

1. Cancer does not spread through the blood, *i. e.* by particles entering the blood stream and being conveyed to distant parts (embolism), but rather such cancerous cells, when they do get into the blood stream, are there rapidly destroyed. On the other hand, no such wholesale destruction of cancerous cells takes place in the lymph vessels.

Blood embolism is rare and lymphatic permeation is by far the most important in breast cancer.

2. Breast cancer always spreads centrifugally (*i. e.* the forearms and legs are almost invariably untouched); it does not spread along the skin, but, in the first instance, along the natural lymph channels.

3. The lymphatics of the breast tissue do not "drain direct into the nearest axillary glands," but drain first into the great fascial lymphatic plexus in and on the fascia of the pectoralis major, *rectus abdominis* and *serratus anterior*. From this fascial plexus some lymph vessels make connection with the subjacent muscles, others with the skin.

In this fascial plexus cancer spreads, and Handley has shown that cancerous lymph vessels are to be found in this plexus long before the growth has become adherent to the fascia.

4. Cancer spreads in two different ways—

(a) *Infiltration*, or direct and slow extension of the growth through the neighbouring tissues. This can be easily observed by the naked eye. It is of late occurrence and of but little practical importance.

(b) *Permeation*, or slow growth along the fine lymph vessels, *is the essentially important process*, and in describing this I cannot do better than to quote from Sampson Handley. "The cancer cells spread slowly along the lymphatics in the fascial plexus, both against and with the lymph stream. Round the cancerous cells a small round-cell infiltration forms. This rapidly gives rise to a perilymphatic fibrosis, a defensive process by which the cancer cells are destroyed, except where certain isolated nodules of growth gain the day—this perilymphatic fibrosis explains the contraction and the early puckering

of the skin far from the primary growth. But at the same time, though no permeated lymphatics can be detected, yet there is a *region beyond the remotest visible naked-eye metastasis*, and often lying far from the primary growth. *Here the microscopic growing edge of the carcinoma will usually be detected by careful microscopic search.*" This microscopic growing edge is to be sharply distinguished from the infiltrating edge of the primary neoplasm. Where interstitial invasion of the surrounding tissues is occurring at the peripheral microscopic growing edge there is no interstitial invasion of the tissues, but the principal lymphatic plexus of the part—the plexus which lies upon the deep fascia—is found permeated throughout, that is to say, its vessels are obstructed by the growth of lines of cancer cells along them." In fact, to use Handley's words again, "*the growing edge extends like a ripple, in a wider and wider circle, within whose circumference healing processes take place.*"

5. Visceral metastases arise from cancerous permeation along the numerous fine anastomoses of lymph vessels which pierce the parietes and make connection with the serous plexuses of the pleura and peritoneum and the mediastinal and portal glands. Once the cancer cells get into the serous cavities they may escape free into them and cause new growths by "implantation."

Infection of the Thorax. Here, very fortunately, the lymph vessels are not free afferent vessels, but only minute anastomotic channels. Hence is to be explained the comparative rarity of infection of the mediastinal glands.

Infection of the Abdomen takes place, according to Handley, "by epigastric permeation" along the lymph vessels, which pass through the upper part of the rectus abdominis and connect at once with the portal lymphatics by way of the ligamentum teres. The importance of this observation is very great, and it at once leads us to the essential importance of removing the fascia over the upper part of the rectus abdominis in all cases.

Infection of the Bones. Bone metastases are not due to blood infection, but are the result of centrifugal growth along the deep fascial lymph plexus; in the femur the region of the great trochanter is attacked and in the humerus that of the deltoid insertion. The bone is first attacked where it lies nearest to the deep fascial plexus.

Early cancerous pachydermia is due either to obstruction of the deep fascial lymph plexus by very extensive cancerous permeation or to actual destruction of the lymph vessels of the fascial plexus by the perilymphatic fibrosis already referred to.

And, lastly, it is to be remembered that there is always a process of repair going on in cancer,

and "the progress of a cancer is normally accompanied by retrogressive or curative processes." The two opposing forces would seem

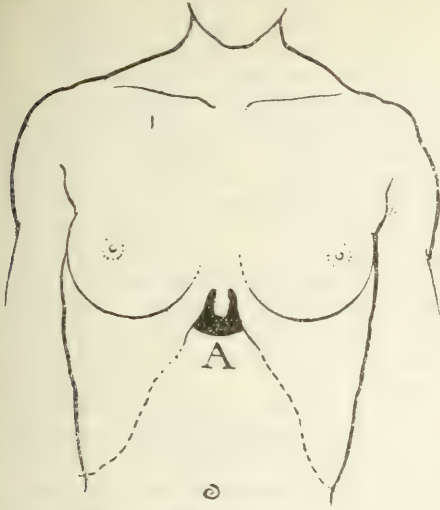


FIG. 1.—The area, A, of epigastric invasion in breast cancer. Its lower level is a purely artificial line. This area might not inappropriately be called the dangerous area in breast cancer. (Sampson Handley.)

to be most nearly matched in atrophic carcinoma, and the diminished malignancy of recurrences in the old can well be considered with the defenceless and hopeless state of the youthful sufferer from encephaloid carcinoma.

Operative Measures. A consideration of the foregoing will show that the modern operation for carcinoma of the breast must necessarily be a formidable proceeding, for it must aim at complete removal of the growth and all its permeated area. The following are the essentials—

1. And most important—a very extensive undermining of the flaps so as to remove all the fascial lymph plexus which could possibly be permeated by the growth; this necessarily includes: (a) the removal of the upper part of the fascia over the rectus abdominis; (b) crossing the middle line and removing the fascia from the opposite side of the sternum and intercostal spaces; (c) removal of the fascia over the lower half of the serratus anterior.

2. Removal of a sufficiency of skin. Handley recommends a circle of ten inches diameter having as its centre the middle portion of the growth.

3. Removal of the pectoralis major and minor muscles, and some part of the serratus anterior (not so much because they may be infected, but in order to give access to the deeper glandular structures).

4. Removal of the entire glandular filter-area. The tissues behind and external to the

first part of the axillary vein are especially to be remembered.

5. Last, and most important of all—every operation for a growth in the breast should be conducted with the co-operation of an expert pathologist, who by means of microscopic examination will be able to give an immediate opinion on the nature of the growth and perhaps as to the condition of the area of permeation.

Never lose sight of the fact that surgical triumphs do not lie in heroic operative measures, with removal of supraclavicular lymph glands, and perhaps incidentally of the whole upper extremity (!) in advanced cases, but rather in the scientific examination and effective treatment of early unsuspected cases—"Eyes first and much."

Inoperable Cases of Cancer. It will be admitted by all reasonable persons that little though we know of the origin and causes of cancer, the first essential in treatment, where possible, is complete removal.

In the case of recurrences removal may well be undertaken where, as is frequently the case, such recurrences are single, small and of apparently decreasing malignity.

A primary growth, in my opinion, where possible, should be removed unless the operation

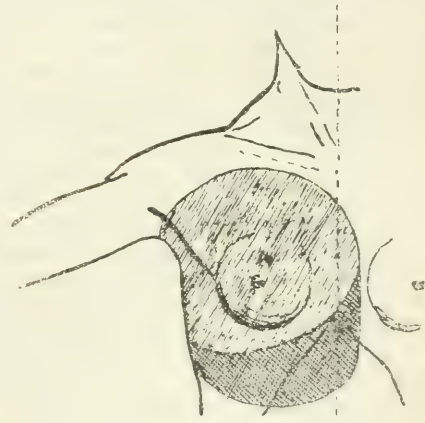


FIG. 2.—The lightly-shaded area represents the extent of deep fascia removed in the operation of excision of the breast as at present usually performed. The darkly-shaded area represents the additional extent of deep fascia which should in future be removed to ensure that the circle of invaded fascia shall be carefully circumscribed and not intersected below. The line surrounding the whole shaded area represents the extent to which the skin-flaps should be undermined for that purpose, assuming that the primary growth is situated beneath the nipple. (Sampson Handley.)

entails great danger to life, for recurrences will not give at all the same suffering as an ulcerating primary growth.

In cases where operation is manifestly im-

possible what are we to do? Here it is well to bear in mind and weigh impartially two facts.

1. Little though we know, we do know this, that there is a continual resistance of the forces of our body to the spread of cancer. It is by no means an inert process, but rather is the spread a constant struggle between rival forces and the vanquished—unhappily usually our countrywomen.

2. It is admitted by all observers that in rare cases recovery takes place in undoubted and authenticated cases of carcinoma.

If this be agreed upon, it must be further admitted that any reasonable steps should be taken to relieve sufferers from advanced degrees of cancer. Innumerable have the so-called cancer cures been. I shall content myself with only advancing those which I have any personal knowledge of—

1. Injection of Coley's fluid and methods of scraping and application of escharotics, such as chloride of zinc. These aim at local destruction, but, as we have seen, this is of secondary importance and they cannot longer be recommended.

2. Application of X-rays. This gives marvellous results—at times almost incredible—in cases of secondary growths in the skin, but the rays have little power of penetration and are useless in deep growths. The same holds good for radium, so far as I am now aware.

3. Methods which it is hoped will increase the resistance of the body. These aim at producing a general lymphocytosis. To this end nuclein, etc., were first used. Lovell Drage has studied this aspect very carefully and worked on the effects of various compounds of cinnamic and coumaric acids with marked success. The latest product he advocates is a mixture of the ortho-coumarate of soda with fibrolysin, adrenalin and novocaine. The local injection of this compound is painless, it undoubtedly raises the body's powers of resistance and aids in the removal of fibrous tissue, and the results of treatment are good. I have myself seen four cases where injections of this mixture were used. In all there was a marked decrease in the size of the growth; but I am not able as yet to give the result after a length of time.

After-Treatment of Cases operated on. I would urge that a few exposures to X-rays be regularly given and that the metabolic processes of the body be kept as low as possible, *i. e.* a very restricted meat diet and no stimulants.

J. K. M.

TREATMENT OF INOPERABLE CANCER OF THE BREAST

The treatment of cancer by the administration of the ortho-coumarate of sodium is

assisted by the addition of thiosinamine and adrenalin when it is desired to treat the growth in situ. In cases where there is dissemination the adrenalin can be omitted. The addition of novocaine diminishes the discomfort arising from subcutaneous injection, which should always be effected with a long needle.

It is recommended that Tylmarin (acetylsalicylic acid) should be exhibited by the mouth in five-grain doses, or cinnamic aldehyde in one-drop doses after food.

The only case in an early stage of mammary carcinoma which has at present been so cured is not only alive but the patient has been continuously at work for ten years. The growth can be felt, but is quiescent, and in view of the fact that the age is now fifty, some hope may be entertained that quiescence will be maintained.

In no case treated by this method has death been caused by sepsis, and it is probable that the relief afforded to patients, of whom many have been in advanced stages, is due to the fact that pyrexia has been absent, and that distressing influences arising from the factor of foul discharges have been conspicuous by their absence. Many more cases in the early stage must be treated before operation has been resorted to, if further advance is to be made in the medicinal treatment of cancer. There is no doubt that carcinoma can be treated in such a manner as to produce quiescence, and the fact of the tumour remaining need not necessarily entail harm to the patient, because there are no symptoms arising from the mere presence of carcinoma in any part of the body. Symptoms only arise when the growth, either by pressure or by interference with the function of important organs, causes their appearance.

L. D.

THE IMMEDIATE MICROSCOPIC DIAGNOSIS OF TUMOURS AT THE TIME OF OPERATION

It is the aim of all surgeons to make an accurate diagnosis of every diseased condition with which they have to deal; this aim, however, is not always attainable. Any help they may be able to command from others in arriving at a diagnosis is their duty to obtain. Fortunately, owing to the advance made in the science of pathology, there are many means of investigating disease, and one of them it is proposed briefly to describe and illustrate below.

The preparation of a microscopic section of a tumour or other tissue is a long and tedious process in the ordinary way, but there is a method by which a section can be obtained in a few minutes while an operation is being performed. Briefly the procedure is as follows:—

As soon as the patient has been anæsthetized and the surgeon has explored the region affected, a piece of the tumour or diseased tissue is given to the pathologist, who at once freezes it and cuts sections. A section is mounted, stained and examined under the microscope. A diagnosis is made and the surgeon is informed as to the nature of the tumour. The time occupied by the process is usually about five minutes, sometimes less. The following case will serve as an example of many in which the surgeon has to decide whether malignant disease is present or not. A tumour was present in the breast of a lady; its physical characteristics were those common to carcinoma and chronic mastitis. It was explored and a piece removed for microscopic examination. This proved to be carcinoma. The surgeon then proceeded to remove the whole of the breast, together with the pectoral muscles and axillary glands. Formerly the method of procedure in such a case was to remove the mass locally and have a microscopic section prepared after suitable hardening and preparation of the tissue. If the condition found was simple inflamed breast tissue or an innocent tumour, well and good; but if carcinoma was demonstrated then a second operation was necessary. This should not happen, it is most unfair to the patient, as well as damaging to her mental state to have to wait in suspense for some days and then have to go through all the preparation necessary for a second operation; and then there is the great risk of dissemination of the growth owing to the opening up of lymphatic channels by the incomplete removal of the tumour. This risk far outweighs all the other objections. It can be entirely obviated by having the diagnosis settled at once by means of a fresh microscopic section.

There are many cases in which the diagnosis of malignancy of a tumour can be made at once by naked-eye inspection—such as an ulcerating or fungating carcinoma of the breast or tongue. Others in which the same diagnosis can be arrived at directly an incision is made into the growth. Lastly, there is a group of cases in which an accurate knowledge of the malignant or innocent nature is not possible without a microscopic view of the section. The last group is the one in which a rapidly prepared section is of the greatest value.

The delay in the course of an operation is short and fully compensated for by the accurate knowledge gained as to the nature of the condition present. This method is particularly indicated in such regions as the breast, abdomen, etc., where it is found necessary to give an anæsthetic in order to explore. Where a piece of tissue can be removed without an anæsthetic—i. e. from the tongue, lip, cervix uteri—a section

can be prepared at leisure, and the delay is not so serious. But even in these cases a fresh section is often advisable. Fresh sections can be obtained which show the structure of tumours and tissues quite as plainly as those which are prepared by the slower and more elaborate paraffin method. A certain amount of practice in cutting frozen sections and experience in interpreting them is necessary. This experience should be cultivated by all who wish to be of service as pathologists.

Brief particulars may now be given of some cases in which a fresh section and immediate diagnosis has helped the surgeon in his treatment of the condition found.

CASE I.—An irregular ulcer was present in the gum, covering the lower jaw of an elderly gentleman. It was fixed to the molar region and floor of the mouth. The edges were hard and nodular. These appearances suggested that the lesion was an epithelioma. A piece was removed which proved to be simple inflammatory tissue. This case serves to illustrate several important points. When a patient is under the influence of an anæsthetic a large piece, or several pieces, of tissue can be removed for microscopic examination. A large piece is more likely to show the true nature of a diseased structure than a small piece. On the other hand, small pieces from ulcers in the mouth sometimes show only inflammatory tissue superficial or adjacent to the malignant tumour. This point should be remembered by those who “snip” or “peel” off a small scrap of tissue from the edge of an ulcer and then ask for a diagnosis. A pathologist may justly report on such a specimen as innocent in nature, although, as a matter of fact, the tumour might be carcinoma.

It is impossible to say from these clinical signs whether the tumour is a mass of chronically inflamed breast tissue or a carcinoma. On exploring the mass its true nature is in many instances at once apparent to the experienced observer's eye, but there are many cases in which a definite diagnosis cannot be made in this manner even at this stage of the operation. These are the cases in which a microscopic section is of the greatest value. The following case is instructive to illustrate this point.

CASE II.—A large tumour was felt in the breast of a lady. Its physical character, as felt through the skin, would serve for those of a carcinomatous mass or a chronic mastitis. The mass was removed and an incision made into it. The structure appeared to be that of a chronically inflamed breast. A microscopic section revealed, however, the presence of carcinoma, together with much inflammation in the surrounding breast tissue.

Cysts of the breast are notoriously hard to diagnose, even by the most experienced clinicians. These cysts usually have a smooth lining and are surrounded by inflamed breast tissue. Sometimes, however, when a microscopic section is made through the latter early carcinoma is discovered.

CASE III.—A smooth-walled cyst was removed from a breast. At one part of the wall a small patch of blood-stained tissue was discovered. A microscopic

section of this tissue proved it to be carcinoma; a complete operation was then performed. The naked-eye appearances of this specimen suggested a hæmatoma into the tissue about the cyst wall, but the microscope disproved this.

Another type of cyst is not infrequently met with; in this variety a growth is present in one part of the wall of the cyst and projects into its cavity. The cyst also contains blood-stained fluid. A microscopic section will sometimes reveal well-marked carcinoma invading the tissue outside the cyst, and at others a papillomatous growth confined to the cyst wall. It is an important point one has to settle in a case like this, because, in the first instance, where a carcinoma has developed it is necessary in the interest of the patient that a complete operation should be performed, whereas in the second case amputation of the breast only is necessary.

One often meets with a tumour of the breast which appears to be composed of inflamed gland tissue on naked-eye inspection of its cut surface. A microscopic section in many cases confirms this diagnosis, and the surgeon is satisfied by local removal of the mass. Sometimes tiny growths are seen in cyst-like spaces in the midst of an indurated patch of mammary gland; they may be partly lifted out of the cysts with the point of a knife, and then are found to be attached to the wall by a small pedicle. A microscopic section will show that these growths are epithelial in nature and that the epithelium of the acini and ducts in the neighbourhood is actively proliferating. If the epithelium and epithelial growths are confined within the dilated acini and ducts one may assume that the condition is as yet innocent in character. This can be proved by the microscope.

Exploration of a breast tumour by means of a trocar and cannula has been practised by some as a means of diagnosis. From what has been said above it will be granted that even if a cyst be present and fluid obtained through the cannula, the presence of carcinoma in the cyst wall cannot be excluded. On the other hand, if no fluid is obtained, and the tumour is thus assumed to be solid, the distinction between carcinoma and chronic inflammation only cannot be made.

An immediate microscopic diagnosis is of great service in cases of uterine carcinoma. A small piece of tissue can be removed from the cervix without an anæsthetic and examined at leisure, but it is different with lesions in the cervical canal and body of the uterus. Sections can be prepared at once of the small pieces removed with a curette from the wall of the cervix and body while the patient is under the influence of the anæsthetic. In most cases which one examines the uterine scrapings prove to be simple in nature and no further operation

is necessary. But now and then malignant disease is disclosed by microscopic sections.

In the following case a general thickening of the cæcum and lower part of the ileum was found. The swelling looked very much like a new growth, and the surgeon thought it would be necessary to remove it; but a fresh section showed that the condition was inflammatory. In this case the microscopic examination saved the patient from the risk of an unnecessary enterectomy, which it seemed advisable to do on the ordinary naked-eye evidence of the condition, which was very suggestive of new growth.

It is sometimes very difficult to determine the nature of a thickened gall bladder, and it is extremely useful to get a definite microscopic diagnosis. An inflamed gall bladder may be left, or at most removed locally, but a malignant organ requires a wide and complete removal if it is possible to do so.

Further, it is difficult in some cases to make a correct diagnosis of swellings and ulcers affecting the limbs. A gentleman had a warty growth on one of his fingers, and it was proposed to amputate the finger if the growth should turn out to be malignant. A section proved it to be innocent, and therefore the local removal performed was sufficient and the wound sewn up. In another case a growth in the sole of the foot proved on microscopic examination to be a sarcoma; this justified amputation of the foot.

Sarcomata of the limbs can be demonstrated by sections made at the time of exploration, and should always be done before removing an arm or a leg. Cases of "quiet" necrosis of a piece of bone with inflammatory thickening around occur occasionally and closely simulate new growth.

The following case illustrates the value of co-operation between the surgeon and pathologist.

A swelling of the lower end of the femur was diagnosed by means of an X-ray photograph as a new growth. It appeared to be confined within the shaft of the bone—*i. e.* an endosteal sarcoma. If the tumour should prove to be a sarcoma, and of the myeloid or "giant" celled type, as is usually the case in the endosteal form of growth, amputation through the thigh was contemplated. If, on the other hand, it should prove to be an example of the more malignant type of sarcoma—*i. e.* round- or mixed-celled sarcoma—then it was thought better to amputate the limb at the hip joint. A piece of the soft tissue within the bone was removed and a microscopic section prepared. The section showed the structure of a mixed round- and spindle-celled sarcoma. The more severe operation was then performed.

Method of Cutting Frozen Sections of Fresh Tissues.

The method may be divided into two parts.

1. Arranging the apparatus to be used. The

microtome must be fixed on a firm table and all the instruments arranged in a convenient manner. A mental survey of the freezing, cutting, mounting and staining of a section is then made, in order to make sure that everything is present and in its proper place. This ensures that no time will be wasted when once the process is begun.

2. Preparation of the microscopic section.

(a) The selected piece of tissue received from the surgeon is placed on the brass disc of the freezing microtome, and is surrounded by gum solution.

(b) The tissue and gum are frozen and sections made by a razor on a carrier.

(c) The sections are transferred to a dish of cold water, and after separating them with a glass rod a suitable section is lifted out.

(d) It is dipped for a moment into pure methylated spirit, and

(e) Then placed into another larger dish of cold water; the currents set up by the spirit in the water cause the section to spread out flat.

(f) A glass slide is dipped in the water under the section, and the latter is lifted out as the slide is slowly drawn up out of the water again.

(g) The water is drained off the slide and a few drops of stain (Loeffler's methylene blue) are allowed to fall directly on to the section.

(h) A thin cover-glass is placed on the stain and section after several seconds; it is lightly pressed down, so as to drive out excess of stain; this is then blotted off, and the specimen is ready for examination under the microscope.

E. H. S.

ACUTE PERITONITIS

Acute Peritonitis is an infective disease, and one so extremely fatal that treatment must be undertaken immediately. Indeed the earlier the treatment is started the better the patient's chances of life; and, conversely, the longer the disease progresses without treatment the worse for the patient. Although the diagnosis may be made by the physician, the treatment of peritonitis is surgical. This dual responsibility in the case of peritonitis between physicians and surgeon frequently leads to much delay, which may result in the death of the patient.

Operation is the first step in the treatment of all cases of peritonitis. The operation should be done as quickly as is feasible with good work, the source of the peritonitis should be removed, and the abdomen drained. The causes of peritonitis are very various, but in the young the appendix is almost always the cause.

The causes of acute abdominal disease as seen at St. Thomas's Hospital may be given, as

they show the various common origins of peritonitis in their clinical perspective—

Intestinal obstruction	39 per cent.
Appendicitis	37 " "
Perforations of the Alimentary Tract	11 " "
Inflammations of the Pelvic Viscera	6 " "
Peritonitis of unknown origin	2 " "
Unclassifiable causes	5 " "

This table shows the enormous proportion of cases of acute peritonitis which are dependent on disease of the appendix.

Treatment before Operation—

1. Place the patient in the semi-erect Fowler position (to try and limit the infective processes to the lower part of the abdomen, whence absorption is slower).

2. Avoid giving food by the mouth, substituting rather a small amount (a few ounces) of saline per rectum every two or four hours. (The object of this is to limit and prevent the diffusion of the infective processes by the vermicular movements of the intestine.)

3. Avoid giving morphia, if possible, as its use gives a general and false feeling of security and lowers the powers of resistance of the patient.

4. If necessary, wash the stomach out with bicarbonate of soda (twenty grains to the ounce).

The Operation.—This should be done as quickly as is consonant with good work. Its object should be to remove the cause of the peritonitis (*e.g.* the appendix) and all obvious infective material, the remainder being left to the patient's own resources. The surgeon must never waste time attempting to cleanse the peritoneal cavity; a patient who has the power to recover does it far better by himself, without the surgeon's further aid.

An incision through the lower part of the right rectus should be made first, as it allows the appendix and the pelvis to be inspected; if the cause of the peritonitis is in the upper abdomen, it will be needed for cleansing the pelvis. It is always wisest in peritonitis cases to drain the abdomen with a tube surrounded by a gauze plug for forty-eight hours.

With regard to the anæsthetic, let the anæsthetist choose whichever anæsthetic he gives best, and, under the circumstances, that will be best for the patient also. Thus chloroform is much given, but "open ether" is better; and, in selected cases (particularly children), spinal anæsthesia is excellent.

After Operation.—The patient is returned to a warmed bed, placed in the Fowler position, and the continuous administration of saline

commenced. This administration of saline per rectum is the most important item in the treatment of acute abdominal disease which has been introduced of recent years. It requires considerable attention, skill and care for its proper administration, and *its failure should be construed to mean its improper administration.*

The Continuous Administration of Fluids per Rectum (Proctoclysis).—As the patient is sitting up in bed, a solid tube must be used to introduce the fluid into the rectum, otherwise the tube will get kinked. A tube one foot in length and half an inch in diameter, made of pewter, with a slightly bulbous extremity, answers well and is easily introduced into the bowel. At the end and on all sides of this bulb holes are pierced so that fluid can pass through them and at the same time flatus can escape. If only a single aperture is present in the tube, it is apt to be blocked by faecal matter; but when there are many openings the rectum is equally distended above the sphincter and the obstruction of the flow of fluid by faeces does not occur. The tube is introduced into the rectum for about two to three inches, and is bent sharply at the anus so as to lie easily on the bed. To the outside end a long rubber tube is attached, which leads to the source of supply at the bedside. The most convenient vessel to hold the saline solution is an "infusion flask" (Sahli's pattern). This is triangular in shape, has a large base, and holds from three to four pints; its neck is closed by a rubber stopper, which has three openings; the one admits a glass tube, which at one end reaches to the bottom of the flask, and at the other is attached to the rubber tube leading to the rectum; a second admits a thermometer, and the third tube acts as an inlet for air. The whole flask is immersed in a bath of hot water, beneath which a spirit lamp burns, so securing a constant temperature of the saline solution. The best temperature is from 100° to 102° F.; if the fluid is hotter than this it is not retained well. This temperature, when it reaches the rectum, is probably three or four degrees lower than that shown by the thermometer. When the tube has been introduced into the rectum and the flask attached, the latter should be elevated so that its base is from three to six inches higher than the rectum. The saline begins to flow, and continues flowing, at the rate of about one pint an hour. It is not desirable to introduce more than one and a half pints, or at the most two pints, during the first hour; subsequently, a rate of one pint in the hour should be maintained. The rapidity of the flow is altered by raising or lowering the flask, and should be regulated by the patient's feelings. If a sense of tightness or distress is caused, the flow is too rapid. As a rule, no discomfort is felt till about five pints have been

introduced. Then it may be necessary to stop the flow for half-an-hour or an hour. Provided the rate of flow be regulated properly, and the temperature of the fluid not altered, from seven to ten pints can be introduced without interruption. Flatus reaching the rectum can escape by the tube. If, as rarely happens, the fluid introduced acts as an enema, the tube may be replaced as soon as the bowels have acted. Care and almost constant attention on the part of the nurse are necessary to ensure a successful administration.

The largest quantity of fluid taken by any patient during the first twenty-four hours was sixteen pints; the largest quantity administered was twenty-nine pints, extending over three days. These quantities were borne quite easily, without any distress whatever. The change in the appearance of a patient who absorbs fluid so rapidly is very remarkable. If the case is one of acute general peritonitis, when the patient looks livid, with sunken eyes, skin moist and cold, mouth so parched that his tongue can hardly move, he begins in a few hours to look ruddy and clean, his mouth grows moist, his eyes bright, and all his aspect is one of comfort and contentment. The pulse gains volume and improves steadily in character, urine is passed in large quantities, and the skin keeps moist. Not a few patients say that they feel very hot, and some of them perspire freely. It is a question, perhaps, as to how far one should carry this treatment in patients whose kidneys are defective.

Some are of opinion that in cases of acute peritonitis the fluid causes a reversal of the current of the lymph in the peritoneal lymphatics, so that instead of absorption taking place from the peritoneal surface, the mouths of the lymphatics pour out fluid, bathing the peritoneum with this free discharge, which then escapes by the tubes; that, in fact, the peritoneal cavity is flushed out by the fluid.

Various devices have been tried to simplify the apparatus necessary to maintain the saline at the right temperature, such as Paterson's, which requires that electricity is available, or Dewar's flask. The latter is small and has been found experimentally to lose two degrees of heat in half-an-hour.

Vaccines.—Vaccines are likely to be useless in the treatment of acute peritonitis. But all must have seen cases which apparently benefited from them. None have seen vaccines do harm. So that, whenever it can be done, a pathologist should take cultures and make coverslip preparations from the peritoneal exudate and, whilst waiting for the cultures to grow, a dose of a stock vaccine should be administered.

Serum Treatment.—The serums are given

hypodermically. No serum can be trusted to give a reliable result. Anti-colon serum in twenty-five cubic centimetre doses has certainly improved the conditions of some patients. It may be given at the time of operation, and daily afterwards, should disquieting symptoms remain or arise. This action is readily understood, as the colon bacillus is by far the most numerous and frequently present organism in peritonitis.

Anti-streptococcus and anti-staphylococcus sera have done less obvious good.

Artificial Leucocytosis.—To increase the number of leucocytes would appear to increase the numbers of the patient's army fighting the attacking organisms; hence, it should do good. Clinically, this is difficult to prove, though such a leucocytosis is easily produced by a hypodermic injection of a nuclein, such as that sold commercially as phagocytin.

The dressings should be changed as often as necessary, and the drains withdrawn and replaced in twenty-four hours, an anæsthetic being given if necessary. A many-tail bandage, the tails of which are long, holds the dressing in position.

Morphia and opium are to be avoided, if possible, for the reasons already given. If they must be given, let small doses be used and repeated if necessary. *Pain and anxiety may do more harm to the patient than a small dose of morphia.*

Stimulants, such as adrenalin (M x) and strychnine (M v), should be given without hesitation. One often repents not giving them when, after a temporary improvement on the first day after operation, the heart "falls to pieces" on the next day. I have repeatedly given ten minims of strychnine every four hours for a day or two. A patient in a dangerous state can take an enormous dose without harm. A simple (or turpentine) enema may be given on the same day or the next day after operation; or a long rectal tube can be passed to relieve abdominal distension.

Purgatives are better withheld, if possible, until all sickness has ceased, when they are given repeatedly in small doses, *e.g.* $\frac{1}{6}$ gr. of calomel every hour until the bowels act. After two grains have been given it is better to administer an enema to commence the action of the bowels. An enema in acute abdominal disease should always be given with a tube and a funnel; never with a syringe.

Repeated Sickness is best treated by washing out the stomach with a tube and a funnel, or making the patient wash it out by drinking glasses of hot bicarbonate of soda solutions (twenty grains to the ounce).

Abdominal Distension should be treated with hot dry flannels, an enema (or rectal tube), and

gastric lavage if necessary. Only two drugs are of use in relieving it, both given hypodermically, eserine salicylate, every two hours in doses of $\frac{1}{60}$ gr., and atropine sulphate, in doses of $\frac{1}{80}$ gr. every three hours. The injections are discontinued if the patient is relieved and shows constitutional signs of their action. Injections of pituitary extract may be given and repeated. Like the above drugs, sometimes they succeed, sometimes they fail.

In severe and intractable cases, where the distension is embarrassing the heart's action, it is sometimes necessary to open part of the wound and do a temporary ileostomy on a distended coil of small bowel.

Hiccough is one of the most distressing symptoms which one may be called upon to treat in cases of peritonitis. The pathology of the condition is obscure and composite. It is often associated with a dilated stomach; hence, it is best treated by gastric lavage, bicarbonate of soda (twenty grains to the ounce), and a mustard leaf to the epigastrium. Massage to the epigastrium and neck may also help. Other drugs, such as cocaine, nitroglycerine, bromides, turpentine, musk, etc., may be given, and at times seem to do little good, but it is true that the symptom may wear itself out, cease or ameliorate when they are being used. At times morphia must be given to give the patient sleep and temporary rest from the hiccough. A purgative or enema is sometimes beneficial. Before saline was administered per rectum, it was needful to treat after operation, restlessness, thirst, foul mouth, and similar clinical features; now the need has entirely disappeared. Such points resolve themselves and do not require special attention.

In a similar way the *feeding* of the patient merely demands the use of ordinary intelligence. Very great importance is attached by the patient's friends, and sometimes by the patient, to the amount of food given. It is useless to attempt to give much in the first twenty-four or forty-eight hours after operation. Liquid and easily digestible food is given in small doses, *e.g.* milk and water, milk and soda, in doses of one ounce every hour whilst the patient is awake. Food in the stomach often distresses the patient unless relief is found by vomiting; hence it is better to give the patient very little by mouth and to rely on rectal infusion to maintain his strength.

After the bowels have acted it is desirable to increase the amount of food taken by mouth; and more particularly so as the rectal infusion is discontinued. In some patients the stomach remains dilated and irritable; if so, it is harmful to press the increase of food, and it is better to avoid altogether "made-up" or seasoned foods, champagne, etc., on account of their containing

elements which will irritate the stomach and increase the patient's distress. The desire to suck ice is frequently met with in this disease. It is almost invariably associated with a dilated and irritable stomach, which conditions are wrongly attributed to the ice. Ice is certainly an uneconomical method of taking water, but it is certainly not responsible for the harmful results attributed to it; still, it should be checked and discontinued as soon as possible.

Appendicostomy has been done instead of appendicectomy in certain cases of appendix peritonitis, the appendicostomy offering a simple means of administering saline solution.

Intravenous infusion during the period after operation for peritonitis is only capable of "pulling the patient's pulse together" for a few hours. Saline injections (O ss) may be used instead.

Particularly in children, peritonitis may be accompanied by acetonuria, acetonæmia, acetone in the breath, etc.; the conditions being called post-chloroform poisoning and treated by the free administration of glucose, sodium bicarbonate and saline solution by mouth, rectum or subcutaneously. The saline can be given intravenously.

Special Forms of Peritonitis

Pneumococcus Peritonitis.—Peritonitis due to a pneumococcus is a very fatal form of infection. The peritonitis is practically an incident in pneumococcus septicæmia. In over half the cases there is another gross pneumococcic lesion; in some cases, a general involvement of serous membranes such as the pleura, pericardium, peritoneum and dura mater; hence, the mortality is very high. Pneumococcus peritonitis is more common in children than in adults, in boys than in girls. It is seldom diagnosed before operation, when it is suggested by the greenish pus, the widespread distribution, and the absence of any recognizable cause of the peritonitis. Excepting the loculated and more chronic forms the prognosis is bad. The treatment follows the general lines laid down under the treatment of peritonitis. Special treatment by a serum or vaccine has not led as yet to hopes of improved results.

Streptococcus Peritonitis.—In streptococcus peritonitis the peritonitis is an incident in streptococcus septicæmia; hence it is a very fatal form.

Staphylococcus Peritonitis.—The staphylococcus pyogenes albus has often been isolated from cases of peritonitis, and seems to be an auto-infection on the part of the patient. Its presence is by no means a forerunner of a fatal termination.

The staphylococcus aureus gives rise to a very serious form of peritonitis, but not so

fatal a form as that due to the streptococcus pyogenes.

Colon Bacillus Peritonitis.—This is the ordinary infection in cases of appendix peritonitis; hence it is to the anti-colon serum that we look to give improved results in these cases.

Gonorrhæal Peritonitis.—Gonorrhæal peritonitis is in reality a name given to peritonitis arising from the genital organs. Naturally, it is more frequent in women than in men. It is most often found in young women, but may be found in young girls and even in female babies.

The diagnosis is made by the presence of peritonitis without obvious cause and the presence of a vaginal discharge. The treatment consists of laparotomy, sponging away the fluid and draining the pelvis, by the vagina or by the rectum for preference.

The prognosis to a great extent depends on the organisms present, and has already been discussed.

E. M. C.

APPENDICITIS

Appendicitis, or inflammation of the vermiform appendix, is always an infective disease. The infecting agent may be a streptococcus, a staphylococcus, or the colon bacillus in the common acute or chronic forms, while in the rarer forms are found the actinomyces, and the tubercle or the typhoid bacillus. These last-mentioned affections are rare and differ considerably from the commoner types.

Infective Appendicitis.—This is the common form of the affection to which the term "appendicitis" is usually applied. It is often divided into the acute and the chronic form; some writers speak of relapsing appendicitis. It is not uncommon to see the affection termed variously suppurative, perforating, fulminating or gangrenous appendicitis, according to its clinical course. It is, however, simpler to look upon appendicitis as an infective disease of the appendix which may run a variable clinical course and terminate in one of several ways.

Since the symptoms and gravity of the disease vary a good deal according to the position that the vermiform appendix occupies within the abdomen, it is well to remember that this process has no fixed position. It is undoubtedly oftenest found hanging down over the brim of the pelvis, but it may be directed somewhat upwards and to the left towards the spleen, while it is also quite common to find it lying in the right iliac fossa, sometimes passing round the caput cæci to reach the back of the cæcum, and lying between it and the lumbar wall. Lafforgue (quoted by Murphy, *Keen's Surgery*, vol. iv.) gives the following as the relative frequency of these positions—

	per cent.
Appendix hanging into pelvis . . .	41.5
„ pointing towards spleen . . .	26.0
„ resting on iliacus muscle . . .	17.0
„ retro-cæcal . . .	13.0

The blood supply to the appendix, which is chiefly through a fairly large branch of the posterior ileo-cæcal artery called the appendicular artery, but also near the base through the cæcal branch of the posterior ileo-cæcal, is fairly abundant, but the mobility of the appendix and the peculiar shape of the meso-appendix render the organ very liable to become kinked, when the blood supply is at once endangered and widespread gangrene may result; the gangrene, however, is probably more often due to an infective process starting from the mucous membrane.

The disease is met with at all ages, but is rare in infancy and old age. It is said to be more frequent in males than in females. It is more prevalent in certain countries, such as America, in certain families and at certain seasons of the year. What determines these facts we do not know, since we are ignorant of the factors determining the infection of the appendix. It is perhaps due to the spread of intestinal catarrh from the cæcal mucous membrane to that of the appendix. Catarrhal conditions of the mucous membrane of the large bowel are undoubtedly on the increase under modern conditions of life and feeding.

Symptoms. There are certain symptoms which when combined enable appendicitis to be diagnosed with certainty; when one or more of them is missing the exact nature of the case must be somewhat doubtful. These symptoms, and especially the order in which they occur, should always be present in the mind of the surgeon when examining a suspected case. They are pain, nausea or vomiting, local tenderness and pyrexia. It will be well to say a few words as to the principal features of each of these cardinal symptoms.

The *pain* is nearly always worst about three to six hours from the onset of the disease and is somewhat colicky in nature. It is nearly always referred to the epigastrium at first and is usually associated with localised flatulent distension of the ascending colon and cæcum. It gradually subsides and then the characteristic appendix pain is complained of—viz. a fixed pain referred to the appendix itself, which is very tender on pressure. The position of this true appendix pain should always be noted carefully, as it is often an excellent guide to the situation of the appendix, which may be a point of considerable importance should an operation become necessary. Thus when the appendix occupies its usual situation the pain will be referred to McBurney's point, when it

is retro-cæcal it will be in the loin or the gall-bladder region, and when it hangs down into the pelvis no tenderness may be experienced until a rectal or vaginal examination is made. This appendix pain, like the distension pain of the first stage, subsides gradually. In the case of either pain its sudden cessation generally means complete gangrene or perforation of the appendix or rupture of an abscess.

The *nausea or vomiting*, like the pain, occurs at two distinct stages of the disease and is due to different causes. *In the early stage* it resembles the nausea due to renal or hepatic colic and is due to distension of the appendix, *in the later stages* it is due to peritonitis. Vomiting in the later stages is therefore a symptom of serious import.

The *abdominal tenderness* varies considerably in degree and, like the two preceding symptoms, may be divided into early and late. In the early stage the tenderness is diffuse and there is no rigidity of the abdominal muscles. Later on the tenderness becomes limited to the appendix area and is associated with muscular rigidity. It is worthy of note that if the area of tenderness increases in size after it has once become localised, and especially if there is vomiting associated, this is strong presumptive evidence of perforation. Local tenderness is always present in all cases of appendicitis, but it is well to remember that, before it can be declared to be absent, all points from which the appendix might be reached must be examined. Hence a rectal examination should never be omitted, as that may be the only way of eliciting the tenderness due to a terminal enlargement of a long appendix lying in Douglas's pouch.

Pyrexia is always present in cases of true appendicitis, and no case should be looked upon as diagnosed with certainty unless this symptom is present. The range and duration are very variable, but there is always some rise in the first thirty-six hours, and the patient's temperature should always be taken at the commencement of the attack, for it is just at this period that it is certain to be raised and may thus prove a most valuable guide in the differential diagnosis.

In the usual typical case the temperature remains raised for three or four days, gradually falling to normal. Should it fall suddenly, especially if it has previously been over 101° F., it is strongly suggestive of perforation or gangrene of the appendix. On the other hand, if the temperature remains about 99° after the fifth day there is very likely to be pus present. A secondary elevation of temperature, after it has remained normal for a time, is always of serious import and generally calls for immediate operation. The range of temperature, however, is no certain guide to the presence or absence of

pus. Many cases are met with in which there is a thick-walled abscess but no pyrexia at all; presumably there is little or no absorption of toxins taking place.

A localised *tumour* may be present either in the right iliac fossa, the loin or the pelvic cavity. Experience shows that a tumour is felt more often than it is actually present, the explanation being that a contraction of the rectus muscle over the tender inflamed appendix is often mistaken for a tumour. When a definite tumour is present it generally indicates pus, although not necessarily so. The chief part of the tumour is composed of adherent omentum. The size of the tumour has little bearing on the amount of pus present in the abscess. There is only fluctuation in the advanced cases where the abscess is large.

Leucocytosis is generally present from an early stage, but never leucopenia.

Besides the above symptoms, which go to make a typical case of appendicitis, there are a few others that may be of importance in a given case. *Frequent micturition* is a common symptom of those cases of chronic appendicitis in which the appendix lies in Douglas's pouch and is adherent to the bladder—or in some cases matted to the ureter. *Dyspepsia* may be very marked. Indeed the term "appendix dyspepsia" has been applied to the condition. Occasionally *dysmenorrhœa* occurs from involvement of the ovary or tube on the right side; conversely appendicitis may be secondary to ovarian or tubal inflammation.

The above are the chief symptoms met with in appendicitis, but they vary immensely with the acuteness of the symptoms and the termination of the case. In a typical case the history is as follows:—The patient, generally after feeling "out of sorts" for a day or two, is suddenly seized (not infrequently after a heavy and indigestible meal) with acute colicky pain in the epigastrium, rapidly increasing in severity and accompanied after an hour or two by nausea and vomiting. The patient is generally flushed, the pulse-rate is increased and the temperature is raised (generally 100° to 102° F.). The pain soon leaves the epigastrium and by the end of twenty-four hours is referred more definitely to the right iliac fossa, where examination shows the cæcum distended and the section of the rectus over the appendix very rigid; should the appendix be retro-cæcal, however, the pain will be mainly deep-seated in the loin. Occasionally there is no iliac pain but diffuse hypogastric tenderness, and this is generally due to the appendix lying in Douglas's pouch—when there will be frequent micturition, pain on defæcation and a tender lump felt per rectum.

From this point the patient may either get well slowly or rapidly, or complications may

ensue. *If the condition clears up* the pulse rapidly becomes normal, the sickness ceases, the temperature falls in a day or two to normal, and a few days later all tenderness over the appendix has disappeared. Resolution may occur in spite of the formation of a definite lump about the appendix; this generally is palpable at the end of twenty-four hours, but it gradually disappears along with the tenderness.

When an abscess forms the chief alteration in the symptoms is a maintenance of a suppurative temperature, quickened pulse, dry foul tongue, constipation and the formation of a lump at the seat of the appendix, which is very tender on pressure and gradually increases in size until eventually it is opened or bursts into the adjacent bowel, the bladder, the peritoneal cavity or through the skin. There is marked leucocytosis.

When gangrene occurs the symptoms are often very puzzling. In almost all cases the temperature falls quite early to normal or below normal, and an erroneous view of the case may be taken owing to the sudden cessation of pain and pyrexia; the patient may even feel temporarily much improved. There soon set in, however, two of the worst symptoms in these cases, viz. a steadily rising pulse-rate and the abdominal *facies* that is such an unmistakable index of severe peritoneal toxæmia. Vomiting begins, and with it is seen a gradual distension of the abdomen, beginning generally below the umbilicus and associated with severe constipation. Pus gradually collects in the pelvis, where it can often be felt on rectal examination, and subsequently becomes diffused all over the peritoneal cavity. When gangrene occurs in a retro-cæcal appendix the toxæmic symptoms are often very pronounced from an early stage and the pain is referred to the loin or the gall-bladder area.

When perforation of the appendix occurs the symptoms are very similar to those just described. As a rule, however, they do not set in quite so early and there may be more acute inflammatory symptoms immediately succeeding the event. There is generally a violent and rapidly spreading peritonitis with formation of pus between the intestinal coils. Sometimes perforation of the appendix may take place over a faecal concretion without any previous symptoms of appendicitis, and then the case assumes the characters of acute perforative peritonitis from the first and requires much care to discriminate it from perforation due to a duodenal ulcer (*q. v.*). The acuteness of the gangrene depends to some extent upon the infecting organism; thus it is slower with the colon bacillus than with the streptococcus.

In the chronic form of the affection there may be persistent pain referable to the position of

the appendix, with tenderness on deep pressure over it, or merely dyspeptic conditions with occasional inconvenience in the cæcal region. At intervals there may be attacks of acute infection, any of which may assume the characters of one of the forms described above.

Diagnosis. This is of primary importance, particularly in the acute stage. Early diagnosis enables the acutely inflamed appendix to be removed before pus has formed, while in the gangrenous or perforated conditions it is practically the sole chance of saving life.

When the cardinal symptoms mentioned above are all present—and no definite diagnosis of acute appendicitis should be made unless they are—there is very little room for error. The only conditions which may simulate acute appendicitis so closely as to deceive even very experienced observers are, luckily, of such a nature as to demand immediate laparotomy. They are ruptured pyosalpinx, perforated duodenal ulcer and acute cholangitis. Even in them, however, careful examination will remove all doubt in the large majority of cases. In the case of rupture of a pyosalpinx the seat of the lesion is obviously pelvic and a vaginal examination will probably reveal the source of the mischief, while in the case of a ruptured duodenal ulcer the history of the case, the intense and persistent epigastric pain and rigidity, the greatly increased rate of respiration and the profound preliminary shock should set all doubt at rest. The most difficult cases, as far as accurate diagnosis is concerned, are the cases of acute cholangitis, especially when they are seen some little time after the onset of the attack. The tenderness over the gall-bladder region may be so great as to negative any accurate definition of the pain area, and the case is suspected to be one of acute suppurative appendicitis. Here also, as the appropriate treatment is operative, the patient only runs the risk of an unduly large incision as a result of the mistake in diagnosis.

It is, however, in children that the chief difficulty in diagnosis occurs. In them, however, the acute attack is generally of a severe type and the abdominal rigidity and often a tumour are well marked. In this connection it should never be forgotten that the onset of pneumonia or pleurisy in children may be ushered in by a severe reflected pain in the right iliac fossa and may lead to a wrong diagnosis.

It is when we come to the diagnosis of the true chronic appendicitis that the real difficulty is encountered. Calculi in the right kidney or ureter, mobile kidney, inflammations of the right ovary and tube, mucous colitis, biliary colic, early spinal caries, and tuberculous affections of the appendix, cæcum, peritoneum or mesenteric glands may all present symptoms

that they share in common with chronic appendicitis. It is impossible here to go at length into the differential diagnosis; suffice it to say that in all cases of suspected chronic appendicitis the surgeon should approach his patient with the idea that the symptoms may be due to some other cause, and that he should not pronounce the case to be appendicitis until he has eliminated all other possible causes.

Treatment. Appendicitis is purely a surgical affection and is amenable only to surgical measures. To attempt to treat it by drugs is futile; drugs can only treat symptoms, which they often mask, while the disease itself progresses unchecked. There may be much doubt and difficulty in diagnosing the existence of appendicitis, but when once the diagnosis has been made there is but one treatment—that is, by operation. This applies to the acute and chronic cases alike; when once a patient has had an attack of true appendicitis, characterized by the four cardinal symptoms mentioned above, developing in their due order, there is no true safety either immediate or remote until the diseased appendix has been removed. Unless there be some constitutional condition present which would make the operation more hazardous than the risk of leaving the affection to run its natural course, any medical man who advises against operation makes himself responsible for any evil result that may ensue. It is well that this position should be recognized, and that if operative interference is not practised it should be because of the decision of the patient and not because of the advice of the medical man.

While, however, there can be no doubt as to the advisability of operating upon every case of diseased appendix, the question as to the exact period at which operation should be performed requires more extended consideration, as does also the further question as to what form the operative interference should take. Thus, in some cases immediate operation is imperative, in others it is highly advisable, while in others it is not necessary. Again, in some cases the appendix must be removed at the primary operation, in others its removal is of questionable value, while in others it should certainly not be removed, at any rate until a later period.

In order to get a clear idea as to the right course to pursue, it is well to distinguish sharply between the two great classes of appendicitis met with in practice. The first class has been termed “acute appendicitis,” and includes all those cases marked by definite signs of septic absorption, of which pyrexia and increased pulse-rate are the most important symptoms. This class includes many types, which have been variously named perforating, fulminating, gangrenous, suppurative and relapsing appendicitis.

On the other hand, the true chronic appendicitis possesses no such train of symptoms. There may be kinking, thickening, stenosis or adhesions of the appendix, but the symptoms these lesions produce are local, or at least are confined to such trivial constitutional symptoms as dyspepsia, colitis or constipation. These cases may, of course, become acute at some subsequent period, but until they do they form a separate class by themselves.

In all cases of acute appendicitis immediate operation should be urged; and by immediate operation is meant operation as soon as possible after the patient is seen by the surgeon who makes the diagnosis. This, of course, may be within the first few hours of the illness, or not until some days have elapsed since its onset. For gangrenous and perforating appendicitis it is admitted on all hands that operation at the earliest possible moment after the patient's affection is diagnosed offers the only hope of a successful issue, but as to the other cases of acute appendicitis there has been some divergence of opinion in recent years as to the advisability of immediate operation in all stages of the disease. Thus it was held by some that whereas immediate operation is indicated in all cases if seen within the first thirty-six to forty-eight hours, it is advisable to withhold operation if they are seen after that period until some definite evidence is obtainable as to the presence of pus or whether resolution is going to occur, and then either the abscess was opened or an operation for removal of the appendix was performed in the "quiescent" period. Others held that in all cases an immediate operation should be performed. At the present time few will be found to uphold any but the latter view. Immediate operation has the following great advantages. In many cases it is the only means of ensuring the patient's safety. From a consideration of what has gone before it must be realized that the symptoms present in any given case are by no means a sure guide as to what is taking place in connection with the appendix, and that the only safe way is to look and see. It is quite common to find that a subsidence of the acuter symptoms actually coincides with perforation or gangrene of the appendix, and that, short of this, it is impossible to tell in the vast majority of cases whether pus is present or not. In every case operation either renders the case easier to deal with or materially shortens the convalescence. If pus has formed, the abscess is smaller than it would be at a subsequent period, and the chance of identifying and removing the appendix safely is much increased, while if pus has not actually formed, the patient is cured in a much shorter time than would be the case were a quiescent interval waited for;

moreover, those disastrous cases in which an apparent amelioration of symptoms coincides with a surgical catastrophe are avoided. No surgeon of experience has ever regretted operating early; few have failed to regret being led into postponing operation.

The second important point, and one about which there is still some discussion, is what form the operation should take—or, in other words, *should the appendix always be removed.* In certain classes of cases the answer must be in the affirmative. In all cases of gangrene or perforation, or of inflammation unaccompanied by suppuration, the appendix should be removed without doubt; the questionable cases are those in which an abscess is present. Of these it may be said that when the abscess is large, and the patient is obviously suffering from the effects of severe toxæmia, no attempt should be made to find and remove the appendix. Doing so only opens up areas from which fresh absorption can take place and breaks down the protective adhesions which shut off the abscess cavity from the general peritoneal cavity, with the result that the toxæmia is increased and a fatal result may ensue. Most surgeons have had cases in which death can be justly attributed to such injudicious surgical heroism. The minimum disturbance of parts is here the right course to pursue, and simple incision of the abscess with provision of free drainage the ideal course. The appendix should be removed at a much later period, and at the same time any ventral hernia can be repaired.

When, however, the abscess is only small it is easy to pack off the surrounding peritoneal cavity, mop up the pus as it escapes, define, separate and remove the appendix without infecting neighbouring parts, and then pack off and drain the infected area with the practical certainty that no spread of the infection will occur.

After all these operations there are certain points that should be attended to. The patient should be propped up in bed in the sitting position—the so-called "Fowler position"—in order to prevent any discharge gravitating upwards into the upper abdomen, and the free use of continuous saline proctoclysis should be practised if there be signs of severe toxæmia or operative shock. Moreover, if there be profound septic poisoning spinal analgesia should be used in preference to a general anæsthetic.

F. F. B.

HERNIA

Hernia.—Under this term only those conditions will be referred to here which are due to protrusion of the abdominal viscera through weak spots in boundaries of the abdomen

without any external wound. Other internal protrusions are purposely omitted as more properly belonging to the subject of "Intestinal Obstruction."

Hernia is one of the commonest affections seen in general practice. This is owing to the fact that in all persons of both sexes and of all ages there are certain spots in the abdominal walls which are anatomically weak, and that in any congenital deficiency of muscular or tendinous development these points are often the first to manifest the weakness. For there can no longer be any doubt that all herniæ are predisposed to by some congenital imperfection, just as flat foot, piles and other varicose veins depend upon a congenital deficiency of development. Incidentally, it may be remarked that these last conditions are often associated with hernia in the same individuals and in families. There can be any degree of congenital defect, from the patulous ring with its flimsy boundaries to the simply imperfectly developed tendon and fascia, which are able to retain the abdominal contents for weeks or years after birth, until the increasing weight of the viscera or some abnormal strain overcome their resistance and they yield to the force from within. This should never be forgotten in these days of "Insurance against Accident."

Herniæ are most common at the two extremes of life. In infancy the tissues around certain spots (*e.g.* umbilicus and inguinal rings) are as yet imperfectly formed, and uncontrolled crying, coughing or other form of forcing, subject them to more constant strain than later on in conscious life, and when educated reflexes tend to self-protection. In late life tissues begin to degenerate, while the weight of the abdominal viscera increases, coughing and constipation become more common and provoke intra-abdominal pressure, and the weak spots in the parietes yield.

That herniæ are still frequently overlooked in spite of our great progress in medicine and surgery, the records of all our large hospitals prove. And that such an oversight is a very grave matter needs no emphasis in view of the well-known serious complications arising from partial or total strangulation. The dangers of this are not only those of the local condition, but the obstruction induced, if not early relieved, will, as is now well recognized, soon lead to a state of toxæmia fatal in itself and most adversely influencing any operation undertaken for its relief, whether under general, local or spinal analgesia.

All medical men, therefore, should see to it that in every case of sharp pain, in any of the weak spots to be referred to severally, following on strain, and especially if accompanied by sickness, a careful examination of the abdominal

walls should be made for hernia. A patient's word that there is nothing wrong in suspected regions should never be taken. The practitioner must see for himself, and must be prepared to exercise all his persuasive powers in some cases to obtain permission to do so, especially in dealing with women.

The weak spots which should always be kept in mind in any suspected case are as follows: (1) The mid-line of the epigastrium; (2) the umbilicus; (3) the several inguinal rings; (4) the femoral rings; (5) the obturator rings. They may also occur in either flank or in the perineum. Ventral hernia independent of scars is occasionally met with as the result of subcutaneous rupture of muscle fibres due to sudden overstrain.

Epigastric Hernia is fairly common. It arises in the *linea alba* at any point between the ensiform cartilage and the navel, and is due to the stretching of the interlacing fibres of the structure. The opening is usually very small, not more than a quarter to half an inch. It is round and has a very sharp, hard edge. The contents of the swelling (which is never large) consist first of subperitoneal fat pushed out before the bulging serous sac, and this will usually contain some omentum or a small knuckle of the colon. I have never seen small intestine in an epigastric hernia.

Diagnosis. The importance of the condition is due to the symptoms referable to it. These are a sharp dragging pain at the affected spot, with tenderness on pressure, and at times a peculiar reflex cough. The pain is caused by the stretching of the peritoneum over the sharp ring, and disappears on reduction of the protrusion.

Treatment. Such herniæ cannot be relieved by any form of truss, and are easily and safely cured by operation. The procedure consists in exposing and returning the protrusion, after removing the subperitoneal fat and closing the small ring with a couple of strong stitches of silk or linen thread.

Umbilical Hernia is most frequently seen in infancy and late middle age. In the first it is of minor importance, as it has a distinct tendency to disappear as the child develops if supported by a pad of cork secured by a broad strip of rubber plaster. In later life it is a source of the greatest risk and discomfort, ever increasing as time goes on.

The *diagnosis* of umbilical hernia is as a rule simple. It is only likely to be confounded with fatty tumour. And yet I have been called in to treat a supposed malignant tumour of the abdominal wall which was obviously a strangulated, livid, umbilical hernia, and proved to be so when I operated. The age of the patient, the resonance on percussion of the

mass, with the sense of slip of omentum, or gurgle of gut if it is reducible, will guide the diagnosis.

The *treatment* should, in mature and middle life and under modern conditions, be always operative, unless contra-indicated by some general disease such as albuminuria or diabetes, etc. The results of radical cure are excellent, and eliminate many risks for the future. But in later life, with broken-down patients and probably large herniæ, a very careful selection of cases is necessary in view of the risks of anæsthetics, and particularly of the embarrassment to breathing due to the reduction of bulky viscera into an abdomen long unaccustomed to their presence. In many such cases suspensory bandages to relieve the dragging weight of the tumour are all that we can offer our patients.

In **Inguinal Hernia**, one of the commonest affections among males, less so among females, the old classifications into oblique and direct, etc., are becoming of less and less importance in general practice, except when the application of a truss is in question, inasmuch as radical operations, in the great majority of cases, are now taking the place of palliation by truss. The operator will, of course, give due weight to these details in the course of his work.

The *diagnosis* is based upon the history of a sudden giving way in the groin, followed by more or less pain of a dragging, sickening character, aggravated by extension of the thigh, by coughing, sneezing or other strong effort of the abdominal muscles. Fulness is also felt at some spot in the groin when standing, and may be palpable unless very small. If the patient lies down, as he usually does at the onset, and flex the thigh, the protrusion almost invariably soon slips back spontaneously and all the symptoms disappear. As a rule, it is helped back by the fingers of the patient. In such a case the doctor may find nothing palpable; but if the patient stand up and cough, an impulse will be felt by the finger placed in the ring and more or less pain will return. If reduction does not readily take place, strangulation almost necessarily follows, owing to venous engorgement in the protruded viscus below the constriction. Hence the responsibility of early diagnosis.

Strangulation is recognized by the history of the onset, the presence of a tender tumour below the rings, resonant as a rule on percussion, by constipation and absence of the passage of flatus, and in the later stages by vomiting of foul matter and a rapid pulse.

The *treatment* of non-strangulated and strangulated hernia under modern conditions should always be the same, except under very exceptional circumstances. An operation should

be at once performed. Nothing is gained by waiting for clear symptoms to develop, and much is lost in many cases by delay. The radical cure, which can always be done with safety, even with early strangulation, cannot be undertaken without great risk when strangulation is advanced. *The only reasons against the routine treatment of all herniæ by operation are to be found in certain general morbid conditions, contra-indicating all procedures under general anæsthetics.*

Femoral Hernia, very common among women and occasionally seen in men, is certainly more difficult to recognize than inguinal, for the reason that it is, as a rule, deeply seated in the thigh, and is usually smaller than the inguinal variety. Its onset is usually more sudden than that of inguinal hernia and occurs often during pregnancy.

Diagnosis. It is recognized by practically the same history and train of symptoms as in inguinal hernia, but the initial pain is, if anything, acuter, owing to the tightness of the more rigid femoral ring and consequent greater stretching of the parietal peritoneum on which the pain depends. For the same structural reasons strangulation sets in more rapidly and is more dangerous than in the inguinal variety. Any suspicion, therefore, of femoral hernia should lead to a most careful examination for tumour or tenderness below Poupart's ligament. Enlarged and tender glands in the saphenic opening due to acute infection are sometimes associated with vomiting, and may therefore simulate femoral hernia. But the presence of some point of infection in the leg and the absence of intestinal symptoms will differentiate them as a rule.

The *treatment* is in all cases operative now-a-days. Nothing is gained by waiting, and much may be lost. The radical cure is easy and effectual, and forestalls many dangers.

Obturator Hernia, although very rare, has always to be kept in mind in every case of sudden onset of intestinal obstruction. It can never be diagnosed *with certainty* without operation, although strong suspicion of its presence has been proved to be correct by operation.

Diagnosis. Sudden onset of obstructive symptoms, with pain below the groin running down the inner side of the thigh to the back of the knee, together with tenderness and possibly a small swelling in the upper part of the saphenic opening, all ought to arouse suspicion of obturator hernia. But inasmuch as the best way of gaining access to and dealing with it is now recognized to be the abdominal route, no time should be lost in refinements of diagnosis, and the abdomen should be opened either vertically in the middle line or above and in the

direction of Poupart's ligament. The command of the small involved knuckle of intestine from this incision would always be greater than through a deep dissection in the thigh, even if diagnosed. Moreover, if the bowel is gangrenous, the necessary measures for its removal can be much more effectually and safely undertaken through the abdominal opening.

Perineal Hernia, in which gut is forced down external to the anus, owing to defects in the pelvic fascia, is exceedingly rare. Nevertheless it must be kept in mind in all cases in which a tumour appears in the perineum which has an impulse on coughing or straining. It may occur in males or females. It is most likely to be confounded with a cold abscess or fatty tumour, and I have seen this difficulty arise, only cleared up when I had cut down into the ischio-rectal fossa and removed a large fatty tumour. The presence of resonance on percussion or gurgling on reduction should settle the question almost with certainty.

It is difficult to imagine any form of radical cure of such a hernia, and a pad and bandage are all that can be offered to the patient.

Lumbar Hernia, apart from those occurring in the wounds of accident or operation, are extremely rare. They have, however, been seen above the iliac crest, external to the iliac origin of the *latissimus dorsi* muscle. The only difficulty likely to arise in their diagnosis is from the possible presence of a lumbar cold abscess or fatty tumour. Resonance or percussion and gurgle on reduction ought to distinguish them. But I have known chronic abscesses of the loin to contain gas and to be tympanitic.

A. E. B.

THE STOMACH

Injuries of the Stomach.—The stomach may be ruptured by a blow upon the abdominal wall such as a kick, or by a severe crush, as in a buffer accident, or it may be wounded by the penetration of some sharp instrument such as a knife or a bayonet.

Rupture of the Stomach is rare except when the organ is distended by a recent meal, owing to the comparatively sheltered position of the empty stomach. The accident is accompanied by extravasation of the stomach contents, which usually occurs freely, as there is a large rent produced when severe violence is applied to a full stomach. There is intense and prolonged shock and the liver dullness is lost immediately after the injury. The patient vomits, bringing up a varying quantity of blood, and before long—usually within twelve hours—there may be definite evidence of the gravitation of free fluid into the most dependent parts of the

abdominal cavity, varying with the position assumed by the patient. As the symptoms of shock pass off those of acute general peritonitis develop.

Penetrating Wounds of the Stomach are marked by similar but much less marked symptoms. Indeed, if the wound has been caused by a stab with a small-bladed instrument there may be much doubt as to whether the stomach wall has been penetrated or not, as the mucous membrane may prolapse through the hole in the sero-muscular coat and prevent all but the slightest leakage of the gastric contents, and the effect of this is often to make the observer think that the viscus has not been injured. Under these circumstances the occurrence of blood in the vomit is of great importance as indicating a penetrating wound of the stomach.

Treatment. A rupture of the stomach should be treated by immediate laparotomy, with the object of sewing up the rent in the viscus by a double row of sutures (the deep row taking up all the coats and the superficial one taking up only the sero-muscular coats, both being continuous) and removing the contents extravasated into the abdominal cavity. Removal of the extravasated contents is best done by mopping with dry aseptic swabs, and in performing it as little disturbance of the viscera as possible should be practised, the coils just being held aside as the mop is inserted between them. If large masses of food are present in the abdominal cavity it may be necessary to have recourse to the douche of sterile saline solution at a temperature of 100° F. During the operation every effort must be made to subdue shock.

A penetrating wound of the stomach should be treated in an exactly similar manner. In all cases in which there is a penetrating wound of the abdominal wall and a wound of the stomach is suspected the wound in the abdominal wall should be enlarged without delay and that in the stomach sought for and sewn up. Even should it turn out that there is no such wound in the stomach no harm will have been done, as the wound in the abdominal wall will be disinfected and sutured.

Foreign Bodies in the Stomach.—Small foreign bodies, such as beads, marbles, buttons, etc., are very often swallowed by children and pass along the intestinal canal without giving rise to any untoward symptoms. But foreign bodies of a larger size or more dangerous nature are also often swallowed either by accident or design. By accident such bodies as hairpins, nails, toothplates or coins often get into the stomach, while lunatics and would-be suicides may swallow the most varied articles, such as knives, spoons or stones.

Symptoms. These foreign bodies may give

rise to few symptoms, if any. It is only when they are large enough to block the lumen of the bowel or sharp enough to ulcerate their way through its wall that they will cause more than slight pain or mild gastritis. When, however, they are either large enough to be unable to pass the pylorus or the ileo-cæcal valve, or when their shape is such that they are sure to lodge somewhere along the alimentary canal and ulcerate the mucous membrane, they must be removed by a laparotomy through the left linea semilunaris, the stomach wall being incised directly over the foreign body, which is then extracted and the incision closed and the stomach replaced. When the body is small, smooth and calculated to pass through the alimentary canal without doing damage no treatment is required. It is usual to feed the child on stodgy farinaceous food, but it is difficult to see what good that can do. X-rays should always be used (if the foreign body be opaque to them) so as to locate the position of the body and detect any change of situation.

Hair-balls in the Stomach.—In children and some women the practice of chewing the ends of the plaits into which the hair is arranged is not uncommon, while in lunatics the practice may reach such a degree that the patient will tear out her hair and swallow it deliberately. The result of this is that the hair, when it reaches the stomach, becomes churned up into a ball, which soon gets too large to pass the pylorus, and so goes on increasing in size by the addition of the hair as it is swallowed until it may form a ball of such a size as to fill the stomach entirely and form a cast of it, the food finding its way between the hair-ball and the mucous membrane as a thin layer of fluid.

It is astonishing how little discomfort even the largest of these hair-balls gives rise to. The appetite often remains good; at most there is a little dyspepsia.

Treatment. This, of course, is immediate removal by gastrotomy, followed by suture of the stomach. The incision, which may have to be a very long one, should run horizontally about midway between the two curvatures.

After recovery it is well to keep the patient's head shaved until the habit has become corrected.

THE STOMACH

Acute Gangrenous Gastritis from Corrosive Agents

Strong acids or caustic alkalis are not infrequently swallowed either by accident or design. When swallowed by design the quantity taken may only be small, and the acute spasm set up by the action of the caustic upon the fauces and œsophagus will cause ejection of it and none of the corrosive will reach the

stomach. When taken by accident, however, a large quantity is often swallowed, and then the fluid will reach the stomach, where it exerts its caustic action upon the mucous membrane—generally along the lesser curvature and at the pylorus—giving rise to the most intense gastritis, with great collapse, agonizing gastric pain, and continuous vomiting of blood-stained mucus. If the patient survives, the gastritis is extremely severe, and sloughing of portions of the stomach wall, followed by perforation or extensive ulceration, will ensue. Finally great cicatricial contraction of the stomach and pylorus will occur. There is always stricture of the œsophagus accompanying this.

Treatment. The first thing is to attempt to neutralize the poison. Then the patient should be put upon morphine and treated for the severe shock. As soon as this is recovered from it will be advisable to take means to secure perfect rest for the stomach. For this purpose probably nothing is better than a temporary jejunostomy, which allows the patient to be fed and at the same time avoids the necessity of any food passing by the mouth, œsophagus or stomach. It can be closed when the resulting gastric ulceration has ceased, and a gastro-jejunostomy may then be done if there is pyloric obstruction—as there probably will be. The acute gastritis consequent upon the action of the corrosive should be treated upon the lines indicated for the severer forms of gastritis, with suitable sedatives.

Cardio-Spasm

It is uncertain whether this is an affection of the stomach or of the œsophagus. In it there is dysphagia, combined with great dilatation of the œsophagus, so that food, instead of passing into the stomach, collects in the lower end of the œsophagus and is subsequently vomited in large quantities. This vomiting is never due to rejection of the stomach contents; the vomited matter shows none of the properties of the gastric juice. It is not definitely ascertained whether the affection is due primarily to spasm of the cardiac orifice of the stomach or to mere atonic dilatation of the œsophageal wall.

The condition is only met with in neurotic subjects and generally comes on in more or less acute attacks which may last for a few hours or even several days. The attacks may occur at intervals throughout a long lifetime, with the result that the patient wastes and comes to believe that she can take little or no food for fear of bringing on an attack. At first there is very great pain on swallowing, but in the chronic cases this may be very little marked. Not infrequently the patient can swallow fairly

well in between the acute attacks, but she always has to be careful not to eat too rapidly, or in too large a quantity, for fear of bringing on the attack.

Diagnosis. This is fairly easy when the presence of the condition is suspected. The appearance of the patient, the history of the recurring attacks, the non-progressive nature of the case, the inability to swallow either fluid or solid at one time and the ease with which both are taken at others, make a functional spasm suspected at once. This is borne out by finding that while a bougie fails to pass at one time, at another it passes quite easily. The spasm may pass off under sedatives. A bismuth meal shows the characteristic dilatation of the oesophagus, while an examination of the oesophagus by means of the oesophagoscope reveals no organic lesion present.

Treatment. It is advised to stretch the cardiac sphincter in the hope of preventing recurrence of the spasm, but it is difficult to see how this can act in any but a psychological manner. It is done by passing a special oesophageal bougie with an outer rubber tube which can be inflated when the bougie has been passed through the cardiac orifice and thus made to stretch the latter freely. The patients will generally require treatment for neurasthenia. A feeding tube will often need to be passed.

Fibromatosis of the Stomach.—The chief interest in this affection lies in the fact that it may readily be—and no doubt very often has been—confounded with gastric cancer, and a hopeless prognosis given after an exploratory laparotomy. It is probably the condition present in the cases, so frequently described in the past, in which advanced malignant disease of the stomach has disappeared after a simple exploratory laparotomy.

The cause of the condition is probably extensive fibrous infiltration due to an extensive gastric ulcer. Alcohol and syphilis are both said to play a part in the causation of some of these cases, and occasionally undoubted tuberculosis of the mucous membrane is present.

The *symptoms* are those of chronic gastric ulcer, especially of the type associated with pyloric stenosis. There may be a definite tumour felt which simulates gastric cancer, but often the characteristic appearance of the stomach—the so-called “leather-bottle” stomach—is only apparent when the abdomen—and possibly the stomach itself—is opened. This appearance is due to the induration of the stomach walls, so that the viscus is distorted in shape and its walls are so rigid that it does not collapse when it is cut open. There is generally some area where the infiltration is so great as to give rise to the appearance of a new growth. When the stomach wall is incised,

however, it is seen that there is merely an inflammatory thickening of the various coats—chiefly the submucous—but no infiltration with new growth.

Treatment. As an exploratory laparotomy is necessary for the diagnosis of these cases, it is well to go on to the performance of a posterior gastro-jejunostomy if there is any interference with the pyloric outlet and if the anatomical conditions allow of its being done. F. F. B.

DUODENAL ULCER

Although at one time considered a rather rare affection, ulcer of the duodenum has now become recognized as being certainly not less frequent than true gastric ulcer; according to W. J. Mayo the preponderance is considerably in its favour. It is much commoner in men than in women (four to one) and generally occurs in those of middle age—viz. thirty to forty—although it may be met with through a much wider range of years.

The exact cause of the ulceration is not quite clear, but it is probable that there is always some degree of hyperchlorhydria present during the attack, and therefore anything that may give rise to the condition of hyperchlorhydria may be looked upon as being a cause of duodenal ulcer. The fact that the ulcer generally occurs on the anterior surface of the duodenum, within two inches of the pyloric orifice, appears to bear out the view that it is often due to the direct action of the highly acid gastric contents which are ejected from the stomach through the pylorus directly into the region of the ulcer. It is most frequently met with in neurotic individuals who are accustomed to work for long periods at a stretch and are in the habit of taking scanty meals at irregular intervals. Prolonged mental worry, especially when combined with irregular meals, appears to be very frequently associated with the onset of the complaint. *Pyorrhœa alveolaris* is often present in patients suffering from duodenal ulcer, and some writers attribute importance to it as a causal agent, but no direct connection is demonstrable. Duodenal ulcer has been well known for many years as a complication of extensive burns.

The ulcer is usually single and has all the characters of a chronic gastric ulcer, with which it is occasionally associated; in such cases the diagnosis is very difficult. It is said that, unlike gastric ulcer, it is not prone to become the seat of malignant disease. It commonly extends right up to the pyloric ring, so that at an exploratory laparotomy it may at first be difficult to say upon which side of the pylorus the ulcer is situated. For this reason, and quite apart from its known tendency to perforate, duodenal

ulcer must always be looked upon as a very serious condition for, even should the ulcer heal, the contraction following cicatrization must necessarily cause stenosis of the pylorus, with its attendant gastric dilatation and stasis.

Besides this tendency to pyloric stenosis these ulcers possess two other grave risks, viz. *perforation* and *hæmorrhage*, which they share in common with gastric ulcers. Of the two complications perforation is far more common than serious bleeding, although occasionally the latter may be very severe. When perforation occurs it is nearly always from an ulcer on the anterior aspect of the first part of the duodenum and extravasation takes place direct into the general peritoneal cavity. Occasionally, however, the perforation may occur into the retro-peritoneal tissues, and the ulcer then is generally on the posterior aspect of the gut, and a right-sided subphrenic abscess is formed. In the ordinary intraperitoneal extravasation the gastric contents may be discharged in large quantity and bathe the whole of the abdominal viscera; generally, however, the escape is less rapid—often owing to the smallness of the opening in the base of the ulcer and a protective spasm of the pylorus—and then the extravasated material nearly always finds its way into the right loin along the upper surface of the transverse meso-colon until it fills the right kidney pouch and extends into the region of the appendix. If the patient survives this gives rise to one of the forms of the so-called perinephric abscess.

Hæmorrhage from a duodenal ulcer may be obvious, but often requires careful search for its detection. In the bad cases the blood generally comes from one of the pancreaticoduodenal arteries, and the patient may die of it. Usually it is comparatively slight.

Symptoms. As a rule the symptoms are most characteristic, so that the disease can be recognized very easily. Sometimes, though rarely, they are so slightly marked that no notice whatever is taken of them, and the onset of perforation or severe hæmorrhage may be the first indication of anything wrong. In a typical case the patient complains of pain coming on at varying intervals after food, lasting for a certain time and, in the early stages at any rate, always relieved by taking more food. The interval after a meal varies from half an hour to six hours or more, and is influenced to some degree by the nature of the food taken; with a fluid diet it appears sooner than with a solid one, with a digestible one quicker than with an indigestible. With the ordinary meal the pain comes on in about three to four hours after it has been taken, and hence has been called by Moynihan the "hunger-pain," as it comes on when the patient thinks he is beginning to feel

hungry. At first the pain usually follows only one meal—the heaviest—in the day, but after a time it follows every one. In the early stages, also, it is arrested immediately upon taking food or upon the administration of an alkali, and most patients get to recognize this for themselves. Such persons may lead the medical man astray by saying they have no pain after food; on the contrary food makes them better. In the later stages of the disease the pain may be constant.

This characteristic "hunger-pain" is always deep-seated and referred to the epigastrium, generally a little to the right of the middle line. It does not often go through to the back, but it may do so. There is often associated with it a definite tenderness on pressure over the situation of the ulcer and—when the latter becomes deeply excavated—by rigidity of the superjacent segment of the rectus. There is often some gastric distension and pyloric spasm, which is much relieved by eructations. A bismuth meal shows that the activity of the stomach is much increased and the passage of its contents hastened (Moynihan), except, of course, when there is organic stricture of the pylorus. Hyperchlorhydria may or may not be present; it is generally found when the attack is acute. Examination of the feces and gastric contents will often show blood—either in quantity or occult—when the ulceration is marked. Vomiting is rarely present—in contrast to cases of gastric ulcer—except when there is cicatricial contraction about the pylorus.

The symptoms of *perforation* are usually quite characteristic. Some little time after a meal the patient is seized with acute epigastric pain, followed by intense shock and all the symptoms of perforation. These resemble those due to a similar condition following gastric ulcer, but are referred rather to the right side of the middle line; and may even simulate perforation of the appendix. A useful diagnostic symptom is that in perforation of the duodenum there is often extremely hurried breathing from irritation of the diaphragm; the shock is also more profound than in perforation of the appendix. *Bleeding* betrays itself in the milder cases by the presence of blood in the stools in varying quantity. In bad cases there may be hæmatemeses and tarry stools; in these cases there is often a history of a sudden feeling of distension in the region of the pylorus, followed by faintness and all the symptoms of a large loss of blood. Then later there may be hæmatemeses and melæna. The symptoms of chronic obstruction from cicatricial contraction of the pylorus are given elsewhere (see *Stricture of the Pylorus*).

Treatment. In all except the early stages of duodenal ulcer surgical interference is called for.

Even when the more formidable complications such as hæmorrhage or perforation do not occur, stenosis of the pylorus is certain to follow cicatrization of a chronic ulcer of long standing, and therefore it is of the utmost importance to recognize the disease early while medical treatment may still avail.

Medical measures are often surprisingly successful if employed in the early stages of the first or second attacks; later on, or when the attacks have become very frequent, they are of little use. Among the most important measures are a thorough change of surroundings and relief from mental worry, combined with careful and regular diet and the administration of alkalis a short time after food. If the symptoms are severe when the case is first seen, it is well to insist upon confinement to bed upon a milk diet for the first three or four weeks; otherwise the patient may get about, but should be restricted to a very easily digestible diet. Bicarbonate of soda in doses of twenty to forty grains may be taken in hot water half an hour to an hour after food.

Should the symptoms persist in spite of this treatment, carefully carried out for six weeks or two months, should the case be one in which there have been several previous attacks, or should there be manifest or occult blood in the contents of the stomach or in the fæces, an operation will be called for. This will take the form of a posterior gastro-jejunostomy.

Should perforation occur, an immediate laparotomy, followed by suture of the perforation and the establishment of a posterior gastro-jejunostomy, is called for. Time is of the greatest importance. Patients may die within twelve hours from the shock of perforation, and the chances of recovery decrease with every hour that passes. After twenty-four hours the outlook is very grave even after the most careful operation, and it therefore behoves the practitioner to be on the look-out to recognize the earliest symptoms of perforation and to lose no time in affording relief by means of surgery.

The treatment of severe hæmorrhage in cases of duodenal ulcer resembles that of the similar condition complicating gastric ulcer. During the hæmorrhage itself complete rest must be enjoined, an icebag should be applied over the duodenum, and opium and gallic acid given by the mouth. When the acute symptoms have passed off, and the patient is well enough to stand the operation, the abdomen should be opened and a posterior gastro-jejunostomy performed. The ulcer does not necessarily require any special treatment, but in cases in which there has been very alarming bleeding it will be as well to tie the main branch of the vessel obviously supplying the ulcer. F. F. B.

THE INTESTINES EXCLUSIVE OF THE DUODENUM, SIGMOID AND RECTUM

The Intestines.—The surgical affections of the Intestines exclusive of the duodenum, the sigmoid and the rectum, include some interesting conditions which are important because their existence may be overlooked, sometimes on account of their rarity, sometimes because they give rise to such ill-marked symptoms as to make it difficult to believe that the patient is suffering from serious abdominal disease.

Intussusception.—Intussusception comes first in frequency amongst the abdominal conditions which need the instant help of a surgeon. It occurs most often in children, and as an acute condition, rarely in young adults, very rarely in the middle-aged. It is not uncommon in old people, acutely as the result of an injudicious use of enemata in persons of relaxed fibre, more commonly as a chronic condition associated with malignant disease of the bowel.

Cause and Varieties. The acute intussusception of children is due, according to Mr. A. J. Walton, to a small portion of gut becoming spasmodically contracted, owing, perhaps, to local irritation. The contracted part then acts as a fixed point over which the lower and distal part is drawn by the action of the longitudinal muscular fibres of the bowel. The intussusception may begin in the immediate neighbourhood of the ileo-caecal valve—the commonest place,—in the small intestine—the most dangerous form,—or in the large intestine—the rarest variety. The intussusception may involve the whole segment of the bowel, or it may begin at one part only, as is often seen when a pedunculated polypus has been the cause, or when a single sacculus of the cæcum has first become invaginated. In some forms—which must be looked upon as pathological curiosities—the whole intussusception may itself be engulfed by a fresh portion of bowel, in others the vermiform appendix may be turned inside out within the cæcum, whilst in yet other cases two or more intussusceptions may be present. When the intussusceptions are multiple, one of them is always in the large intestine, and is usually in the reverse direction.

Signs and Symptoms. Acute intussusception in children generally occurs about the time of the first dentition, though it is sometimes seen in babies of a few weeks old and occasionally in children of eight or ten years. Boys are more often affected than girls, and the child has often been considered especially strong and healthy. Without any assignable cause or after a change of diet or a slight attack of bowel disturbance, the patient is seized with sudden collapse, in which it appears to faint or have a slight convulsion. This is followed in many cases

by vomiting, by an evacuation of the normal contents of the bowel, or by a screaming fit which is clearly associated with abdominal pain. The pain passes off and the baby can be quieted, but sooner or later a fresh paroxysm rouses him, and the passage of "blood and slime" by the bowel may clear up the diagnosis.

Diagnosis. The diagnosis is not difficult in the earlier and in the later stages, but it is by no means easy in the intervening period when the initial shock has passed off and the inflammatory processes in the bowel have not yet begun to cause toxic symptoms. To make a correct diagnosis it is necessary to discard the idea that an abdominal swelling is necessarily felt in every case of intussusception, as well as the teaching that the abdominal walls are usually kept rigid. The signs of a sudden abdominal catastrophe in a child who was previously well should put the surgeon on the alert. A rectal examination should be made at once, and preferably under an anæsthetic, permission having previously been obtained to proceed to an operation if it is found necessary. The most difficult cases to recognize are those in which the child is not seen until the initial shock has passed off, for it is then difficult to believe the history and to realize that the child lying placidly in its cot is suffering from so serious a condition. Fortunately, however, these cases are usually associated with a large ileo-colic intussusception, and it is usually possible to feel the tumour through the abdominal walls or even to find the apex by rectal examination. But even in these children the sunken eyes which have lost something of their lustre, and the apathetic manner, tell their own tale to those who are accustomed to study sick children.

Differential Diagnosis. Apart from the ordinary attacks of enteritis, the differential diagnosis has to be made from acute infective colitis, Henoch's purpura, the acute colic which often attacks children and the perforating appendicitis from which they sometimes suffer. In acute infective colitis the pain is as sudden in its onset as in intussusception, but it is more continuous and less spasmodic in character. There is passage of blood and mucus by the bowel, but less initial shock, and the temperature rises at once instead of remaining normal or becoming subnormal.

In Henoch's purpura the pains in the joints and the vomiting of blood will help to establish the true diagnosis even in those cases in which the visceral symptoms appear before the characteristic spots.

The acute colic of infants differs from intussusception in so many respects that a very short period of watching should prevent any mistake.

The acceleration of the pulse, the rapid rise of temperature, the local tenderness on the right side, and the early distension of the abdomen, all point to appendicitis in its worst form.

Prognosis and Treatment. The prognosis of intussusception depends almost entirely upon the speed with which the intussusception is reduced. Early operation followed by rapid reduction, is usually attended with satisfactory results. Whilst preparations are being made to open the abdomen the bowel may be irrigated with normal saline solution at a temperature of 105° F., delivered into the rectum through a funnel and tube held not higher than two feet above the body. It is certain that some children who presented all the signs of intussusception have been relieved by this procedure, but it should not be allowed to replace operation unless the surgeon is satisfied that the patient is cured. The principles of operation are diminution of shock, rapidity of manipulation, and thoroughness of reduction. The value of spinal analgesia in these cases is very great, especially if the practitioner is called upon to operate single-handed and in the unfavourable surroundings incident to these cases of extreme emergency. The intussusception is reduced by squeezing the distal end of the swelling along the large intestine until the bowel is completely released. This can often be done intraperitoneally, but if there is any difficulty, it is better to make a sufficiently large abdominal incision, and to complete the reduction of the intussusception by drawing the tumour out of the peritoneal cavity, rather than waste time in unavailing attempts at intra-abdominal reduction. The utmost gentleness should be employed, and the surgeon should remember that death usually follows any complicated operative measures. The abdominal walls should be brought together by sutures passing through the whole thickness, and the line of incision may be sealed with cotton-wool and collodion. The gauze dressing should be put on as a binder and not as a cut dressing, and the whole should be kept in place by a double spica bandage of linen.

After-Treatment. The intestinal wall in the neighbourhood of the intussusception is thickened by inflammatory products, and there is, consequently, very small likelihood of any fresh invagination taking place if it has been completely reduced. The child may be fed, therefore, as soon as it has recovered from the anæsthetic, and the bowels may be opened, if necessary, on the evening of the second day after the operation, either with castor oil or calomel. The sutures should not be taken out for at least a fortnight, as it is not a very uncommon accident for the wound to yield and the intestines to prolapse, unless time is allowed for very complete repair.

Cancer of the Large Intestine

apart from cancer of the rectum, runs its earlier course so insidiously that its existence is usually overlooked until an attack of acute obstruction of the bowels draws attention to the abdominal condition.

Symptoms. Cancer of the large intestine occurs with equal frequency in men and in women, generally after the age of fifty. The earlier symptoms are malaise with some loss of flesh, an uneasy feeling in the stomach with increasing constipation. There is no pain, but the uneasiness is always referred to the same spot, and is rather increased than diminished by pressure. Sooner or later a severe attack of stomach-ache with inability to pass wind and with complete constipation makes the patient summon a doctor. Examination of the abdomen during an acute attack of obstruction shows a movable mass in the abdomen which is painless, and is easily felt although it is not visible through the abdominal walls. The temperature is usually normal or subnormal, though it may be raised to 102–103° F. Vomiting, which is generally a troublesome symptom, may be entirely absent. In the later stages there is often peristalsis visible through the distended abdominal walls. Inquiry will generally show that the patient has had previous attacks of a less severe character, which have passed off with a copious diarrhoea.

Treatment. The radical treatment depends upon a clear appreciation of the intra-abdominal conditions. Cancer of the large intestine is so limited in extent that it may only involve half an inch or an inch of the bowel. It leads to obstruction by forming a ring-like constriction. *It is a strictly local lesion for a long time, so that there are no secondary deposits, and the neighbouring lymphatic glands are unaffected in the earlier stages.*

Usual Course of a Case. The narrowed intestine becomes blocked by some transient congestion, and the faecal contents of the bowel accumulate on the proximal side of the stricture, where they form the tumour felt through the abdominal walls. *Experience has taught that resection of the bowel is a very dangerous operation when it is performed in a case of acute obstruction.* The patient, therefore, must be put to bed, kept warm, be rigorously starved, and the lower bowel must be emptied by copious enemata of hot soap and water, or by large irrigations of warm olive oil. The stomach should be washed out with normal saline solution by means of a stomach-tube, if vomiting is troublesome. These measures will soon afford the patient relief, and a full dose of castor oil may be given with the greatest advantage when the bowels have begun to empty themselves and the attack is passing off. A fresh

attack of obstruction may be postponed by strict attention to diet—taking especial care to eliminate all substances which are likely to leave much undigested residue—and by keeping the bowels gently relaxed. But the patient should be warned that these means are only palliative, and that he ought to seek surgical advice with a view to an exploratory operation whilst he is still in a good state of health. It may be found possible to remove the whole segment of diseased intestine without undue danger to life, or it may only be desirable to perform a colotomy. But before a colotomy is done, the patient or his friends should have the operation and its after-effects clearly explained. In cases of acute obstruction where other measures have failed to give relief, it may be necessary to make an artificial anus to save the life of the patient.

Diverticulitis

Diverticula of the small and large intestines have been known for many years, the best recognized being Meckel's diverticulum. It is only recently, however, that the attention of surgeons has been called to them as more than occasional causes of obstruction and peritonitis. A greater experience of abdominal surgery has proved that diverticula of the intestine are of no infrequent occurrence, especially in persons who are advanced in years, who are excessively fat or who have become rapidly emaciated. They are much more frequent in men than in women, according to present statistics. The descending colon and the sigmoid are the most common places for diverticula to be formed, but they have also been discovered in the caecum, in the ascending colon, and in various parts of the small intestine. They are often multiple, and in some cases, at any rate, they seem to be associated with the distribution of the blood supply to the intestinal wall. They may remain as pathological curiosities only recognized after death. They may cause chronic ill-health, like that resulting from a chronic inflammation of the appendix. They may inflame and suppurate, leading to perforation of the bowel, and to the formation of an abscess which is probably diagnosed as "pericolic"; or, they may cause acute obstruction and a general suppurative peritonitis. The treatment must depend upon the condition found at the time of the operation, but it will often be necessary to perform a lateral anastomosis if perforation has occurred. D'A. P.

DISEASES OF THE LIVER, GALL BLADDER AND BILE DUCTS

Injuries. Injuries of the Liver.—When met with, injuries of the liver may be caused by either

direct or indirect violence. The former are usually due to perforating wounds dependent upon stabs or to the projectiles of firearms, and the latter to crushes such as when a patient is pinned between the central pole of a cart and a wall or is jammed between two heavy bodies such as the buffers of railway wagons. Injuries or lacerations of the liver caused by crushing forces are usually so severe or are accompanied by other serious damage to adjacent viscera that they terminate fatally within a short period of the reception of the damage.

Perforating wounds of the liver whether due to stabs or the projectiles of firearms should be treated by immediate operation, since it is impossible from the external appearances to form a correct opinion of the extent of the damage, or even of the anatomical structures which have sustained an injury. The abdominal cavity should be opened in the region of the perforation, all blood or debris carefully sponged away, and the exact extent of the damage ascertained. If the bleeding from the injured portion of liver is not severe it should be treated by gauze packing, and if the reverse, mattress sutures of No. 2 catgut should be inserted with a blunt-pointed curved needle, so that when tied they approximate the injured surfaces. In some cases success in arresting hæmorrhage is materially assisted by packing a small roll of gauze in the wound in the liver and then suturing as above described. After treatment in this manner the greater portion of the wound in the parities should be sewn up and one angle left open for the gauze drain. When dealing with perforating wounds caused by firearms it often will be advantageous to excise the margins of the perforation in the abdominal wall. The results of injuries of this kind have very considerably improved since early operation has become the recognized practice.

Injuries of the Gall Bladder or Biliary Ducts.—These are much less frequently met with than those of the liver. The majority of cases are perforating in character and due to stabs or gunshot wounds, but very occasionally rupture of the gall bladder or bile ducts has been due to crushing injuries. On one occasion I found the gall bladder lying free in the peritoneal cavity after a severe crush. When there is an external wound the abdominal cavity in the region of the external wound should be at once opened and the extent of the injury made out. If the gall bladder is the seat of the injury and is either perforated or lacerated it should at once be removed, and if the common bile duct is damaged the wound in it should at once be sewn up with fine chromicized catgut. When the common bile duct is completely divided, it may be expedient to close both ends, and then perform an anastomosis between the fundus of

the gall bladder and the anterior aspect of the second portion of the duodenum.

Hydatid Cysts.—Hydatid cysts in the liver are either single or multiple, usually the former, and most frequently met with in the right lobe. Occasionally they occupy the space between the upper aspect of the liver and the lower aspect of the diaphragm, when they are called subphrenic hydatids. They are not common in England and when met with are either in patients who have been in Australia or other countries where the disease is common, or are in men who have lived in close association with dogs, such as shepherds, or employed in slaughterhouses where diseased animals are killed. Occasionally the affection is contracted by the consumption of watercress or other uncooked vegetable which has been contaminated by the excreta of a dog in whose intestines the *Tænia Echinococcus* lives as a parasite. Men consequently are much more frequently affected than women. Hydatid cysts in the liver or subphrenic space generally give rise to slowly growing swellings which only become manifest either by the formation of a painless tumour in the hepatic region, by the development of pressure symptoms consequent upon involvement of one or other adjacent viscera, by rupture of the cyst into the peritoneum, the pleura, pericardium, lung or some portion of the alimentary canal or urinary system, or by infection with the organisms of suppurative and the formation of an hepatic abscess. Unless one or other of the complications just mentioned occur hydatid cysts may exist for a long time without their presence being known. When an abdominal swelling in the hepatic region is suspected of being a hydatid cyst it is justifiable to puncture it with an aspirating needle in order to confirm the diagnosis, but whenever this is done and the diagnosis is definitely established then the surgeon ought to be prepared to proceed with an operation for effectively dealing with the parasite. If this is not done material may escape from the interior along the line of puncture and infect the peritoneal cavity. The operations which are to be recommended for the treatment of hydatid cyst of the liver depend upon the situation of the cyst and its relation to neighbouring viscera, and also to the size of the cyst. The first part of every operation is exposure of the portion of liver containing the parasitic cyst. This is effected by making an incision over the affected area—either through the abdominal or the thoracic walls, in the former case a lumbar incision occasionally being necessary. In a few cases a combination of the abdominal and thoracic methods may be advisable. When the portion of the liver containing the cyst has been exposed, the surrounding structures are protected, the over-

lying hepatic tissue and the cyst wall cut through and the cyst cavity opened. The contents are evacuated, which may either be simply fluid or fluid and a quantity of daughter and grand-daughter cysts. Next, the internal lining of the cyst is separated and removed. The further treatment depends upon the size of the cyst. If small or of moderate dimensions deep sutures of chromicized catgut should be passed through the cyst wall and adjacent portion of the hepatic tissue in such a manner that when tied the walls of the cavity are held in apposition, and afterwards the external wound is closed. When the cyst is large, deeply placed or in a somewhat inaccessible position, after the contents have been evacuated, and the inner lining removed, the margins of the opening in the cyst are fixed by a number of sutures to the margins of the parietal incision, and any portion of the latter not required for this purpose closed, and drainage established by the insertion of a rubber drainage tube. After a period this tube is shortened, replaced by one of smaller calibre and then removed.

When suppuration has occurred drainage should always be established as in the manner mentioned in the paragraphs dealing with abscess of the liver. Occasionally calcification will be found in the walls of the cyst, in which case the plaques of lime-thickened cyst wall can be detached with a large Volkmann's spoon, or if not readily detachable allowed to separate and come away in the discharge.

Hydatid cysts of the liver or subphrenic space when treated on the lines detailed above usually offer a good prognosis, but care must always be taken to prevent, if possible, infection of the cyst cavity by the micro-organisms of suppuration, otherwise the course of treatment will be prolonged, and in some cases there will be a danger of amyloid disease occurring owing to the prolonged suppuration and continued purulent discharge.

Abscess.—Abscess of the liver may be either single or multiple. The single or localised abscesses are more common in the right lobe, and may be caused either by infection of the hepatic tissue by the micro-organisms of suppuration, in association with injury, or the presence of a parasitic cyst or extension from an infected gall bladder, or by the *amœba coli* in connection with dysentery of the large intestine. Multiple abscesses of the liver commonly follow pyæmic infection occurring in the course of appendicitis, hæmorrhoids or other septic affection of the portal area. The *amœbic* or tropical abscess is only met with in patients who have been in a country where *amœbic* dysentery occurs. Often an abscess of this nature only develops some time after the period of infection with dysentery, and in some

patients the symptoms of dysentery may have been so slight as not to have been noticed. I have seen patients with an *amœbic* or so-called tropical abscess of the liver who have been in England for two years after being in a dysentery-affected country, and in whom the dysenteric affection of the intestine has been quiescent before hepatic symptoms have manifested themselves. The main symptoms of hepatic abscess when single and localised, whether dependent upon pyogenic infection or due to the *amœba coli*, are raised and irregular temperature, enlargement of the affected portion of the liver, pain in the hepatic region and evidence of septic or toxic poisoning. As already stated, the right lobe is most frequently involved, and when the abscess is located in the lower or anterior portion it can be felt as a swelling extending below the costal margin, and when the anterior aspect of the gland is chiefly affected the overlying intercostal space or spaces may be obliterated and œdematous. When the upper aspect or diaphragmatic surface is the seat of the purulent collection there is often associated perihepatitis and a cough worse at night and convulsive in character. Pain only becomes apparent or a marked symptom after the affection has extended to near the surface of the organ and caused a localised peritonitis. Often the upper portion of the right rectus abdominis muscle will be found rigid, especially when the inflammation is approaching the surface. When making a diagnosis one must bear in mind some forms of basal pneumonia, subphrenic abscess from appendicitis, or rupture of a duodenal or gastric ulcer, and empyema of the gall bladder extending to the adjacent portion of the liver. Careful consideration of the previous history, however, will usually enable one to eliminate these affections when making a differential diagnosis. When left untreated abscesses of the liver may go on for a considerable period, especially those of *amœbic* origin, but ultimately they extend either to the skin or some adjacent structure such as the lung, pleura or bronchus, the stomach or duodenum, or colon, or the pelvis of the kidney, and burst, the contents being then passed along whatever canal has opened. Thus the contents may be coughed up, passed per rectum, vomited, or discharged through an external opening. A few cases are on record where a hepatic abscess has burst into the pericardium and caused sudden death. The pus of an hepatic abscess when of *amœbic* origin usually has the appearance of chocolate or anchovy sauce, owing to the presence of hepatic tissue, debris and blood. When, however, pyogenic affection has occurred this is rendered less apparent. The *amœba coli* are not readily found in the contents of the abscess cavity, but if a scraping be taken from

the internal aspect of the abscess wall they can readily be demonstrated. Whenever an abscess of the liver has been definitely diagnosed it should be treated by surgical measures, the contents evacuated and the cavity drained. Aspiration should only be done when everything is prepared, so that the surgeon can proceed to evacuation and drainage. Some cases of tropical or amoebic abscess have been successfully treated by aspiration and removal of the contents, but this is not recommended owing to the difficulties which may ensue owing to escape of pus along the track of the aspirating needle. The surgical treatment comprises incision of the structures overlying the affected portion of the liver, opening and evacuation of the contents of the abscess cavity, and the establishment of drainage, care being taken to avoid infection or contamination of any exposed cavity or organ. The methods of surgical approach are similar to those mentioned in connection with the treatment of hydatid cysts, viz. abdominal incision, anterior or lateral according to the position of the abscess, (b) thoracic incision through the overlying portion of the chest wall, (c) combined abdominal and thoracic incision when the abscess is extensive and underlies portions of the abdominal and thoracic walls, and (d) lumbar incision when the lower and posterior parts of the right lobe of the liver are the seat of the abscess.

Multiple abscesses, consequent upon infection from the portal area, are usually associated with septic pylephlebitis, and do not offer many prospects of success from surgical measures. The primary affection should be determined and surgically treated if possible, the affected portion of the liver incised and drained, and if a definite micro-organism can be isolated which is the pathological cause of the affection, treatment by appropriate vaccines may be tried.

Localised abscesses of the liver if not very large and not associated with other affections offer a good prognosis when surgically treated, but multiple pyæmic abscesses usually terminate fatally.

Actinomycosis not unfrequently causes multiple pyæmic abscesses of the liver, most commonly in association with a similar affection of the cæcum vermiform appendix or other portion of the alimentary canal. They are recognized by the presence of the typical granules of the ray fungus in the pus. These most commonly are yellow in colour, but occasionally they are black, in which the pus has the appearance of being mixed with grains of black gunpowder. In addition the pus from an actinomycotic abscess of the liver is most commonly very thick, tenacious and mucoid. In these cases the prognosis is very

grave; I have never yet seen a patient recover, but the course of the affection may be quite prolonged.

Tuberculous abscess has been met with in cases of tuberculous disease of the lungs and intestines, but the affection is so rare that little is known concerning it.

The liver possesses considerable regenerative power, and when a large quantity of hepatic tissue has been destroyed by the abscess, in part it is reproduced.

Cirrhosis.—Atrophic cirrhosis of the liver of alcoholic origin gives rise to ascites, and although in the main a medical affection, certain well-selected cases have been considerably benefited by surgery. Several measures have been practised, but all have the common object of establishing an anastomosis or communication between the veins of the portal system and those of the general systemic circulation. The form of operation I have found followed by the best results is fixation of a considerable area of the great omentum between the strata of the anterior abdominal wall and immediately behind the recti muscles and within their sheaths. This operation seems to be of greatest value in comparatively early cases of alcoholic cirrhosis of the liver, when the patients are moderately young, or at least not old, and are not affected by any other disease.

Tumours.—Tumours primary in the liver may be either simple or malignant. The former are usually adenomata, or angiomatica, but gummata very frequently give rise to appearances which suggest primary tumours in the liver, and in cases of doubt it is always advisable to try the effect of antisyphilitic treatment. On one occasion I successfully removed a tumour primary in the liver which on detailed investigation was shown to be a fibrous angioma in which calcification had occurred in much of the fibrous tissue.

Growths, however, of this kind are so rare that they may be dismissed without further consideration. Malignant tumours of the liver may be either carcinoma or sarcoma. They are not common, but if they can be diagnosed in an early stage an attempt should be made to remove them by resection of the affected portion of the gland. Secondary malignant growths in the liver are much more common, and may be due to metastasis or to direct extension of a carcinomatous growth from the gall bladder or the bile ducts, usually the gall bladder. The tumours of metastatic origin are not amenable to removal by surgical operation, but when the portion of liver adjacent to the gall bladder is affected by a direct extension of a carcinomatous growth of the gall bladder, a small proportion of these cases can be success-

fully treated by excision of the gall bladder and the affected portion of the liver, together with removal of those lymphatic glands in the hilum of the liver which receive the lymphatic vessels from the gall bladder and the cystic duct. During recent years I have successfully treated three patients by this operation. The cure, however, is not generally permanent.

Cholelithiasis or Gallstones.—The majority of affections of the gall bladder and the bile ducts which come under the observation of the surgeon are due directly or indirectly to the presence of gallstones either in the gall bladder or in one of the bile ducts leading thence to the duodenum. There are, however, a small number of cases which will be considered later which are caused by other conditions. Usually gallstones arise primarily in the cavity of the gall bladder and are due to bacterial infection. Naunym has conclusively demonstrated that the centre of many gallstones contains a core of desiccated mucus and micro-organisms, and I on many occasions have seen such a core in calculi which I have removed. The micro-organisms which are most frequently seen in this connection are either of the coli group or are the typhoid bacillus, usually the former. There, however, is no doubt that in many instances the commencement of the formation of gallstones in the gall bladder is consequent upon infection of this viscus by the typhoid bacillus in the later stages of an attack of typhoid fever, owing to direct extension of the intestinal infection along the common and cystic bile ducts to the gall bladder. In the nucleus or core of many gallstones clumps of bacilli can be demonstrated which have the characteristics of the typhoid organisms. Cholesterin is the most important constituent of biliary calculi and may even form the entire mass, but usually it is associated with small quantities of bile pigments and lime salts. Both the cholesterin and the lime salts appear to be formed as the direct result of the bacterial inflammation of the gall bladder. Although the gall bladder in the majority of instances is the seat of the primary origin of biliary calculi, there is a minute percentage of cases where the formation of the calculi commences in the intra-hepatic bile ducts. As far as my observations upon this point have extended I have formed the opinion that in these latter cases there is often a preponderance of bile pigments in the composition of the calculi. Two other factors which appear to be of great importance are the catarrhal condition of the mucous membrane both of the bile ducts and the gall bladder and the obstruction of the free passage of bile from the gall bladder into the bile ducts and the duodenum. This latter appears to be consequent upon swelling of the

mucous membrane caused by the bacterial infection.

It appears to be necessary that the vitality of the bacteria should be considerably attenuated in order to excite the formation of biliary calculi, and on this account it is thought that the mode of approach of the infecting bacteria to the gall bladder and bile ducts is via the liver from the blood stream in most cases, and only in a much smaller number by direct extension from the alimentary canal of infection from the duodenum along the bile ducts. The evidence upon this point, however, is conflicting and at the present it does appear to be possible to be dogmatic. Further investigation will probably enable one to decide. Gallstones and their complications are much more common in women than men, the percentage being approximately seventy-five per cent. to twenty-five per cent. They generally occur between thirty-five and sixty, but occasionally they are met with in young women and children, and also not unfrequently in old people. In the latter category, however, if careful inquiries are made into the past history, evidence can usually be obtained of gallstones having been present for many years. Experimentally many attempts have been made to induce the formation of gallstones by infecting the gall bladder with cultures of micro-organisms; usually, however, the infection produced has proved to be of too virulent a character, and support has thus been given to the theory that the attenuated infection has reached the gall bladder via the liver, and not via the intestine and bile ducts.

The signs and symptoms of the presence of gallstones vary according to the exact locality of the calculi, the amount of obstruction in the course of the biliary channels, and the virulence of the infection of the mucous membrane, and also to any accompanying complication which may have been induced. When they are located in the gall bladder and the associated infection is a mild one, the most frequent symptom is sudden pain or colic in the hypochondriac or epigastric regions, the pain radiating upwards, through to the back or towards the right scapular region. The pain begins suddenly without any apparent reason, often at night when in bed, soon reaches its greatest intensity and may last from a few minutes to several hours. It is accompanied usually by nausea, by vomiting, and often ceases as suddenly as it began. In the moderate and slight cases there is little disturbance of either temperature or pulse-rate, but often rigidity of the upper portion of the right rectus abdominis is noticed. Often the pain is referred to the middle line in the lower part of the epigastrium, and is diagnosed as being due to "dyspepsia" or

gastralgia. It is probably caused by a gallstone engaging in the portion of the gall bladder which becomes continuous with the commencement of the cystic duct. The gall bladder then becomes distended with serum and mucus, and sooner or later the calculus falls back into the cavity of the gall bladder and the pain at once ceases.

Jaundice is not met with in attacks of this kind. The tendency for an attack of this kind to subside naturally has given rise to the erroneous idea that gallstones in the gall bladder can effectively be cured by medical measures. If the cases, however, are watched for a sufficiently long period it will generally be found that further attacks occur, and that the so-called cure has been imaginative. When a gallstone instead of falling backwards into the gall bladder passes into the cystic duct, it may either pass onwards into the common bile and thence into the duodenum and be evacuated per anum, or it may be arrested either in the cystic duct or in the common bile duct. When impacted in the former, the pain persists for a longer period and is somewhat intermittent, whilst there is often a rise in temperature or even a rigor. In addition the gall bladder becomes enlarged and there is produced either an empyema of the gall bladder or the viscus becomes distended with mucus secreted by the mucous glands in its mucous lining and a mucocele results. Which of these results happens depends on the nature of the bacterial infection. In both cases the gall bladder becomes enlarged and forms a tumour which can be felt in the hypochondrium. In the former the swelling is tender and often becomes attached to the deep portion of the overlying part of the anterior abdominal wall, whilst deep-seated oedema may be detected on careful palpation. In the latter the swelling forms more slowly, is not markedly tender, and there is no oedema.

When the obstruction to the lumen of the cystic duct by the calculus is incomplete and the bacteria are somewhat virulent the gall bladder becomes filled and distended with a mixture of bile and pus, whilst the mucous membrane of both bile duct and gall bladder become inflamed, swollen, oedematous, or even ulcerated, then in addition to pain there are rigors, chills, raised temperature and pulse-rate, and periodical sweating, and the general condition of the patient indicates the existence of a serious septic condition. In these cases the infective condition may spread down the bile ducts and affect the pancreas, causing acute or subacute pancreatitis. If the stone completely obliterates the lumen and there is bacterial infection, similar symptoms are manifested, but usually the affection is of a more chronic

character and the rigors, etc., occur at irregular intervals. The presence or absence of a tumour in the hypogastrium is variable and depends upon the condition of the walls of the gall bladder before the onset of the acute attack. When they are much thickened from previous inflammation a marked tumour is usually absent, and often the attacks subside and leave a condition of a contracted gall bladder, which, owing to adhesions and involvement of the adjacent portions of the stomach and duodenum, cause the appearance of symptoms which suggest a gastric or duodenal ulcer. A careful consideration of the history, however, will usually enable the surgeon to eliminate these possibilities when making a differential diagnosis. When biliary calculi are arrested in the course of the common bile duct, often they give rise to attacks of jaundice, owing to temporary obliteration of the lumen of the bile canal. The jaundice is intermittent, since the degree of obstruction varies from day to day, but in severe cases complete obstruction may be established, and then the jaundice will be permanent. Generally it is not associated with enlargement of the gall bladder sufficient to be felt on palpation of the right hypochondrium. This is due to the fact that the walls of the gall bladder are diseased or thickened and not readily distensible. The pain is not so marked as when the calculus is in the cystic duct, and the area of tenderness on palpation is at a point along a line drawn from the ninth costal cartilage to the umbilicus, and overlying the rectus abdominis muscle. If the jaundice is of a transient character and is in connection with pain which is suddenly relieved, the indications are that a small stone has passed into the duodenum and can be found on examination of the stools. Often a small calculus is arrested in the ampulla of Vater, and if there is a virulent bacterial infection pancreatitis is induced. This gallstone may move up and down and act as a kind of ball valve. The attacks of fever, etc., are similar to those mentioned above, but differ in being usually associated with jaundice. Gallstones are not common in the hepatic bile ducts, but are met with when common duct obstruction has existed for a long time and further stones have either come down from the gall bladder or have been formed within the ducts owing to the infected condition of the lining membrane and contents of the bile ducts. On many occasions I have removed a series of gallstones extending from the orifice of the common bile duct where it opens into the duodenum to the hepatic ducts where they emerge from the liver, and on rare occasions I have even removed them from the intra-hepatic portions of the ducts.

The complications which are met with in the course of gallstones are usually those due to an

infective process or to the passage of a gallstone from the gall bladder or one of the ducts, usually the former, into one of the adjacent viscera, especially the duodenum or the colon. Acute perforation of a distended gall bladder may take place into the peritoneal cavity, in which case the onset will be similar to perforation of any other abdominal viscus, but the site of the most intense pain will be in the right hypochondrium or the adjacent part of the epigastrium, whilst the upper portion of the right rectus abdominis will be very rigid. The previous history of signs or symptoms of gallstone disease, combined with the clinical aspect just mentioned, will often enable the surgeon to make an exact diagnosis. Bile appears at an early stage in the urine. The treatment consists in immediately opening the abdomen by a vertical incision commencing at the costal margin opposite the eighth costal cartilage and extending downwards for three or four inches. The perforated gall bladder should at once be removed, and the contaminated peritoneum carefully cleansed either by sponging when the area is limited or if extensive by irrigation of the entire peritoneal cavity. Drainage should be established either through the original incision or through a second one over the right iliac fossa.

It is more common to find that the gall bladder, containing one or more large calculi and the seat of an infective inflammation, becomes adherent either to the first portion of the duodenum or to the transverse colon, and a fistulous communication is established between the lumen of the gall bladder and that of the adherent portion of the intestine. Through this a calculus may pass and then cause symptoms of acute intestinal obstruction owing to impaction and obstruction of the lumen of some portion of the intestine. The treatment indicated is opening of the abdominal cavity, removal of the impacted calculus and closure of the fistulous opening, together with cholecystectomy. Occasionally an inflamed gall bladder containing gallstones becomes adherent to the deep aspect of the anterior abdominal wall and causes an abscess which bursts through the overlying skin or points at the umbilicus. The purulent contents are discharged along with possibly some of the smaller calculi, and a sinus is left through which exudes bile-stained pus, mucus and fragments of gallstones. These cases ought to be treated by opening up the sinus, removal of any gallstones which may be present, and usually removal of the gall bladder.

Whenever the surgeon has diagnosed the presence of gallstones either in the gall bladder or in one of the bile ducts, and a gallstone is not at once passed after an attack of colic, then surgical measures for the removal of the gall-

stones and the treatment of any associated inflammatory or infective condition should be at once recommended. A gall bladder which contains a gallstone, or a gallstone in one of the biliary ducts, is a constant source of danger to the health and life of the patient, firstly on account of the liability to the occurrence of serious infective affections, secondly to the liability of an attack of biliary colic, and thirdly to the possibility of the development of carcinoma of the gall bladder or of one of the bile ducts.

When an operation has been decided upon in connection with gallstones, it is often a matter of doubt as to the extent of the affection and also as to the position of the calculus or calculi. On this account it is strongly advised that the position of the incision in the abdominal parieties should be so placed that the entire biliary duct system—gall bladder, cystic duct, common bile duct, and hepatic ducts—can if occasion demands be explored and dealt with through the same opening. A vertical incision, commencing at the costal margin in the region of the eighth costal cartilage and extending downwards over the junction of the middle and outer thirds of the rectus abdominis muscle will be found to be the best. Through this the surgeon can deal with affections of the gall bladder and the cystic duct, also with conditions in the common bile duct and the hepatic ducts. It may, of course, be necessary to enlarge the incision either upwards or downwards according to the needs of the case which is being operated upon—when in the former direction it is effected by prolonging the upper extremity in an inward and upward direction towards the ensiform cartilage and along the outer boundary of the subcostal triangle. Considerable assistance can be obtained in effecting a thorough exposure of the bile ducts by placing a sand-bag or a hard pillow underneath the loins. The object of this proceeding is to raise the lumbar and lower dorsal portions of the spinal column, to separate the lower margin of the thorax and the pelvis, to rotate the liver on a transverse axis, and thus bring the bile ducts and the gall bladder nearer the deep aspect of the anterior abdominal wall. This manoeuvre will be found of greater assistance in operations upon the common bile ducts and the hepatic ducts, than when the gall bladder alone is being manipulated. Whenever the abdominal cavity has been opened the gall bladder, the cystic duct, and the common bile ducts should be carefully palpated, in order to determine the locality of any calculi and also the position of adhesions. When the gall bladder is very distended it may be necessary to defer the investigation of the common bile duct until the former has been emptied.

The operations which are found of greatest value are—

Cholecystostomy. In this operation the fundus of the gall bladder is incised, the contents—gallstones, mucus, bile, débris, etc.—evacuated, and then the margins of the opening are sutured to those of the upper part of the parietal incision. It is only necessary to pass these sutures through the serous and muscular layers of the abdominal wall. A rubber drainage tube is inserted and free drainage established. A biliary fistula is thus created, but if there is no obstruction in the bile ducts this usually closes in from three to five weeks. This operation is recommended when the gall bladder is only slightly diseased and there is no evidence of stricture or obstruction in the cystic duct. Cholecystectomy comprises removal of the entire gall bladder and the greater portion of its cystic duct. The gall bladder may be detached by working from the fundus to the cystic duct, or in the reverse direction commencing just beyond where that duct joins the hepatic duct. In the latter case the cystic duct is seized with pressure forceps and cut through close to the common bile duct after a ligature has been applied. The separation is then continued towards the fundus. If the liver can be lifted up by an assistant so as to give a good exposure the latter method of operation will be found to be easier, since the cystic blood-vessels are ligatured at the commencement, and consequently little hæmorrhage is met with—merely a little oozing from the surface of the liver from which the gall-bladder has been separated. Cholecystectomy is indicated in all cases where the cystic duct is either obliterated or strictured, in cases where the gall bladder is thick walled or the mucous membrane much ulcerated from long-existing infection, when a fistulous communication exists between the gall bladder and the alimentary canal, and also whenever it is suspected that malignant disease of the gall bladder is commencing. A number of variations may require to be considered in connection with the performance of this operation, but they scarcely come within the scope of this article.

Choledochotomy. This operation—incision of the common bile duct—requires good exposure of the gastro-hepatic omentum and adjacent structures in order to enable the operator to carry out his manipulations. The duct may be incised either as it lies between the two layers of the gastro-hepatic omentum or after lifting up and separating the first portion of the duodenum as it lies behind this structure. The former operation is applicable in most cases, but when a calculus is lodged in the lower part of the common duct and cannot be moved, then the latter is necessary. The common bile duct should always be incised in its long

axis, and the aperture made sufficiently large to allow the contained calculus to be taken out without causing bruising and laceration of the walls. When all the calculi have been extracted, the opening in the common duct should be first closed by a tier of catgut sutures and then over this a second tier which fixes the peritoneum and the tissues of the gastro-hepatic omentum. Usually it will be advisable to drain the region of the opening in the common duct by a rubber tube passed through a part of the parietal wound owing to the liability of oozing of bile along the line of sutures. When the common bile duct is much ulcerated or the seat of a septic infection it should be drained by a rubber tube, and no attempt made at suturing. This form of operation is sometimes known as choledochostomy.

Duodenocholedocholithotomy. If a calculus is impacted in the lowest portion of the common bile duct just above where it opens into the second part of the duodenum, it may be removed by first incising the anterior wall of the second portion of the duodenum and then enlarging the opening of the common bile duct and through this removing the stone. Usually, however, I have found it more convenient to remove it after incising that portion of the common bile duct which lies behind the first part of the duodenum as mentioned above.

The results which have been obtained by operation in connection with gallstones and their complications have been very satisfactory. Recent statistics give a mortality of about three per cent., but when those cases are considered in which the operations have been carried out in the early stages, and before the calculi have passed into the common duct the mortality is considerably less.

The gall bladder may become the seat of an infective condition owing to extension to it of micro-organisms from the adjacent portions of the alimentary tract. Usually these are colon bacilli, streptococci or typhoid bacilli, and in the very acute cases often a mixed infection can be demonstrated. The most serious of these conditions is often called acute gangrenous or acute phlegmonous cholecystitis. It usually comes on quite suddenly and occasionally after an attack of typhoid fever. The entire thickness of the walls of the gall bladder may be gangrenous or only the mucous membrane. The symptoms are those of an acute septic abdominal condition chiefly located in the right hypochondrium. The treatment is immediate abdominal incision and excision of the diseased gall bladder. The prognosis in these cases is often very grave.

Cancer of the gall bladder is occasionally met with and nearly always appears to be the result of the long-continued presence of gall-

stones in the gall bladder. Some authorities have stated that from fourteen to fifteen per cent. of patients who are the subject of gallstones ultimately become cancerous. I think, however, that this percentage is too high. It undoubtedly happens that not unfrequently when removing a gall bladder for gallstones of long standing that the viscus is found to be cancerous. If the disease is limited to the gall bladder or has only involved the portion of liver immediately adjacent, the gall bladder and the neighbouring portion of liver should be excised together with the lymphatic glands in the hilum close to where the cystic duct joins the common duct.

Cancer of the bile ducts is extremely rare and when seen has usually been in connection with gallstones. If localised it should be treated by excision if possible. Often, however, this is not possible, owing to involvement of adjacent structures before the diagnosis has been made or the patient come under observation.

H. J. W.

THE RECTUM

The first essential of the treatment of any disease of the rectum is a proper diagnosis. This may seem a platitude, but at the same time it is a necessary statement, as in no other part of the body are so many blind diagnoses made as in this region. The first essential for diagnosis is an examination, and without this the practitioner is not justified in making any diagnosis or prescribing any treatment. This cannot be too much insisted on because it is far too much the habit to depend upon some statement of symptoms given by the patient and without any further information to diagnose and treat the case. This is so curious and also at the same time so absolutely wrong that one naturally wonders why it is that sensible, well-read men of practical experience, as qualified practitioners of the present day must needs be, can and do, make this most appalling initial error. Should a patient come complaining of a pain in any other region of the body it is perfectly certain that he will not be allowed to go without a thorough investigation having been made of the region or orifice affected.

There are I think two reasons for this: one is the wish to spare the patient any possible distress there may be of having a rectal examination made—this is too often pandering to a form of mock modesty which is both ridiculous and wrong. But the other and more common reason is, I fear, ignorance. This seems rather a harsh statement, but if it is thought out it will be seen that as things are at present this must be so. A student or a recently qualified man will when he has finished the ordinary course

probably do three months or more working at special departments such as ear, throat, eye, and diseases of women, and in all these he will learn what to look out for and how to do it. What happens in the case of all rectal work? Let any one think how many cases they individually examined or even saw at all as students or residents, and the number will be found to be very small. The reasons for this I need not repeat here, I have already discussed them elsewhere, but the practical point I wish to bring home is that in private practice as well as in general surgery it will be admitted that a large part of general surgery has to do with this part of the body, and in the present-day surgery of this region, the surgery of the rectum, may be said to be collateral to abdominal surgery. It is thus seen that that region of the body in which surgery is more common than almost any other is the one which those going into practice are least prepared for, and it would be a great step forward in the education of the students in this most important part of their work if special wards were set aside for the treatment of these cases which at present flock to and overflow one or two special hospitals where the Englishman is rarely seen but from which every advantage is taken by medical men from the colonies and America.

Symptoms of Rectal Disease. The three most common symptoms in all ordinary rectal ailments are in order of frequency *hæmorrhage, pain and discharge*, but the one for which relief is most frequently sought is pain.

Hæmorrhage is a symptom of various rectal ailments. It is the most common symptom of piles and often occurs in prolapse; it is an occasional symptom of carcinoma, and is usually present in acute and chronic proctitis associated with colitis; it occurs occasionally in cases of polypus and adenoma and is frequently profuse in cases of villous tumour. It will thus be seen how wrong it must be to make any diagnosis without a proper and fair examination. Valuable time is lost, and this in the case of a growth often means the difference between removal or the reverse, and in cases of colitis or infective ulcerated proctitis, every day makes a difference.

When the hæmorrhage consists of a small quantity lost each day at the time that the bowels act and this has been going on for some time, the cause of it is nearly certain to be hæmorrhoids, and it is astonishing how long some continue with this symptom without seeking advice. Various instances have come under my own observation where people have consulted their own medical men for marked anæmia and have entirely omitted to mention this daily loss of blood, which eventually has by accident been discovered and has turned out

to be the only cause of the anæmia, the proof being that when the hæmorrhoids, *i.e.* the cause, are removed, the anæmia rapidly disappears.

Sudden profuse hæmorrhage from the rectum occurring in mid-adult life must always be viewed with great suspicion, as it is probably due to one of two causes:—(1) villous growth; (2) ulceration of a vessel in a malignant growth. Hæmorrhage associated with frequent actions of the bowels is usually a symptom of ulcerative colitis, but it may also be occasioned by multiple polypi, rectal adenoma or carcinoma; in the latter case it is rare. When due to colitis the blood-stained discharge is pink in colour and does not readily clot. It is of that peculiar salmon pink colour which is characteristic of all subacute inflammatory states of the mucous membrane of the large bowel.

Another important form of hæmorrhage is secondary or post-operative hæmorrhage.

The treatment of hæmorrhage must be palliative or radical.

Treatment. This will depend upon the cause of the hæmorrhage, and will be considered under the various headings, *viz.* hæmorrhoids, prolapse, etc. As a temporary relief some astringent form of suppository may be used, *i.e.* enules of hemesine, or if the hæmorrhage is caused by prolapsing hæmorrhoids or mucous membrane the prolapsed parts may be washed with a solution of Hazeline and water before being returned, and in cases where the hæmorrhage comes from the rectum constipation should be avoided. The palliative measures mentioned above must not be considered as a permanent treatment; the proper treatment will depend entirely upon the origin of the hæmorrhage.

Pain. This is the most usual symptom for which patients seek relief; it may vary from a dull intermittent ache and go on in all gradations to an intense agonizing pain. The dull ache is usually due to hæmorrhage or prolapse. Acute pain is generally caused by fissure, and in this case the pain follows an action of the bowels. Pain which is not traceable to any particular cause, and which may come on at any time, either starts as a dull ache and gradually gets to a paroxysmal height, or it commences acutely at once. These pains usually occur in young people, and are due to some lesion at the anoproctodeal junction which it may not be possible to diagnose without an anæsthetic. If when the patient comes under observation there is a history of pain having occurred at various times it may be taken for granted that an anæsthetic is necessary for a proper examination, to discover the cause, and as this lesion always requires some operation to cure it, it is better to arrange for the one anæsthetic to serve the double purpose. Pain associated with discharge is due

to either a submucous abscess, ulcerative proctitis, or some growth innocent or malignant.

Discharge. This will consist of either pus or pus mixed with blood, and in certain instances there is a profuse mucous discharge from the rectum. In this last case the excessive mucous discharge may be caused by a simple growth, *i.e.* papilloma adenoma or prolapse. It also exists in individuals of a nervous temperament, when it is frequently associated with pruritus. A blood-stained discharge is usually an indication of ulcerative proctitis of a greater or lesser degree, or some infective condition of a submucous track; it is also an indication of a new growth, but when this is the cause the discharge is dark in colour and most offensive. Multiple polypi are also the cause of a blood-stained discharge. When the discharge is ordinary pus it is nearly always due to an abscess which has an opening at the ano-rectal junction.

Pruritus.—When this troublesome complaint is seen early enough and when it is not due to some lesion of the anoproctodeal junction it usually can be readily cured by proper precautions in diet and the application of some local remedy. Beer, champagne, and claret may all be factors in producing transient pruritus ani, especially beer. When there is no obvious cause the urine should be tested for sugar, as pruritus ani is a common symptom of glycosuria, and a proper diet will cure both the symptom and the disease.

The lesion which produces pruritus ani and which should always be looked for is usually situated in the mid-posterior line and can be brought into view by the aid of a bivalve speculum. The application of pure lactic acid to this lesion arrests the irritation at once and in early cases will permanently cure the patient. Resinol ointment, boro-chloretone powder, and the following prescriptions are both palliative and comforting.

Chloretone $\bar{\text{5}}$ i
Extract of Conium $\bar{\text{5}}$ ii
Cremor Euthymol $\bar{\text{5}}$ ii.

Calamini (Corbyns No. 3) $\bar{\text{5}}$ i
Zinci Oxidi $\bar{\text{5}}$ i
Liq. Carbonis $\bar{\text{5}}$ i
Glycerini $\bar{\text{5}}$ i
Aq. Calcis $\bar{\text{5}}$ iv
Orange Flower Water $\bar{\text{5}}$ iv.

Relief is also obtained by bathing the part with one in twenty solution of carbolic acid; a two per cent. solution of tincture of iodine in rectified spirit will also produce the same result; ionic medication has produced some good results and so has the application of X-rays.

When once the disease is thoroughly established the only *cure* is to remove the affected

area, and even then great care must be taken in the after-treatment of the thickened rugose anal skin.

Fissure.—There is only one effective way of treating a fissure, and that is by dividing the posterior portion of the external sphincter. Any attempt to cure fissure by means of the application of some caustic is not only useless but extremely painful and sometimes dangerous. If the patient is unable to lie up the following operation can be quite easily carried out under local anæsthesia. Some four per cent. eucaine solution is injected under the skin half an inch behind the fissure in the mid-posterior line and the needle is gradually worked forward, injecting the eucaine as it goes, until the whole area concerned is anæsthetized. An incision is then made through the skin and continued until the posterior fibres of the external sphincter are divided, and this incision usually divides a small vessel which bleeds freely and *must* be stopped before the patient leaves. A small plug of sterilized gauze is placed between the edges of the incision and kept in place by a wool pad and a T-bandage. It is usually desirable to give these patients a morphia suppository, which will begin to act as the effect of the eucaine is wearing off. The plug is removed after forty-eight hours, and the wound washed with saline and peroxide of hydrogen and a small strip of gauze introduced. The bowels should act on the third day, and after this has taken place daily boracic hip-baths are most beneficial and comforting to the patient, who is usually well in ten days. Should the healing of the wound be somewhat slow the sterilized gauze may be replaced by red lotion which may be alternated with some two per cent. tincture of iodine applied to the granulating surfaces. Constipation must be avoided.

Abscesses.—As soon as a rectal abscess is discovered it must be opened, and when the incision to open it is made through the skin the incision should be a free one, which in the case of a big abscess will permit of the insertion of the finger so that the whole cavity may be investigated and any pockets or diverticula made out, broken down and formed into one big cavity, which must be thoroughly washed out with saline solution and irrigated with peroxide of hydrogen, after which the cavity is packed tightly with ribbon gauze. This is removed after forty-eight hours, at which time the bowels should be made to act. The wound is then treated as any other abscess cavity.

It must be remembered that the patient should be made aware of the fact that a fistula nearly always remains after an abscess, which will need further operation.

When the abscess is a submucous one the treatment of it is more difficult and should not

be undertaken unless the medical man has had some experience in rectal work; the operation being a somewhat complicated one.

Fistulæ.—A fistula is the unhealed track of an abscess which has occurred in connection with the bowel. The treatment may be quite simple or extremely difficult. When the fistula is a straightforward one with an external opening, a straight track and an internal opening, which latter will *always* be situated at the ano-proctodeal line, a probe-pointed fistula director is passed through the external opening along the track and brought out at the internal opening. The director is then pushed on until there is a sufficient length passed through to enable the probe-pointed end to be brought out on to the buttock. A curved bistoury is now used to incise all the tissues overlying the director, and when this incision has been made it will be found that except in subcuticular tracks more or less of the external sphincter has been divided. In a subcuticular fistula only a few of the outer fibres of the muscle will have been divided. If the fistula is the result of an ischio-rectal abscess it may be necessary to divide the whole of the sphincter. Any overlapping edges of skin or mucous membrane must be cut off. Although hæmorrhage may be free it is rarely necessary to ligature any vessels, and if the wound is bathed with hot hazeline solution and then packed with plain sterilized gauze which has been soaked in this solution the hæmorrhage will be checked. The dressing is removed after forty-eight hours and the removal will be facilitated by irrigating with saline. The wound is lightly repacked with dry sterilized gauze. An aperient is given on the third day, and after this the wound is treated with daily boracic baths and the surface cleaned with peroxide of hydrogen and painted over with a two per cent. solution of iodine every other day.

Care must be taken, especially in deep fistulæ, to pack the wound so that no sinus or pocket is overlooked. If this should happen a fresh abscess is nearly certain to occur.

After ten days what is known as "pocketing" may take place, and careful search for this must be made, and should such be found it must be broken down, cleaned out with peroxide of hydrogen, and *firmly* packed with gauze.

When a long narrow track remains which has become chronic and refuses to heal, the track should be curetted and zinc ionic treatment given by means of a special electrode which is made of zinc wire whipped with coarse thread. Iodine may be injected also into these sinuses, but nitrate of silver should never be used.

Horseshoe fistulæ, multiple, complex or complicated fistulæ, require special operative skill to ensure a good result. In these cases as much knowledge as possible should be gained

by palpation of the buttocks, when the pipe-stem-like feeling of the track can be felt in most of its ramifications. A straight incision is then made between the external opening and the *original* internal opening and a careful search is made on the cut surfaces to see where any side tracks exist. The usual indication is a transverse section of granulation tissue and a probe passed into this can be gradually worked to the end of the sinus which must be laid open or freely dilated so that it may be curetted and packed. In these complex fistulæ the mistake too often made is not to cut sufficiently freely, and it is difficult unless there has been some personal experience to understand how freely this must be done.

For the treatment of recto-vesical and recto-vaginal fistulæ the reader is referred to the special books written on this subject.

Hæmorrhoids.—External hæmorrhoids are treated by incising the swelling, turning out the clot, and treating the wound with ordinary surgical methods. When, after the removal of the clot, the incised skin falls inwards, it should be removed. This treatment can be carried out with local anæsthesia.

Internal hæmorrhoids may be treated by palliative or operative measures. As a rule palliative measures are ineffective, but in certain instances, where there is an obvious history of overfeeding, etc., the effect of diet and suitable treatment should always be tried, as it may possibly cure, and if it does not do so it is an essential preliminary for operation. Injections of carbolic acid are sometimes useful. Five to eight minims of a ten per cent. solution of carbolic in glycerine is injected into the middle of the pile, which must be brought thoroughly into view and should be returned into the bowel after the injection. As a palliative measure this may be found useful. Ointments, drugs, suppositories, etc., are known to the profession by the score, and it is unnecessary to enumerate them.

Operation. The best operation for a general practitioner to undertake is the ligature operation, and Sir Charles Ball's method is probably the best and the safest. This operation consists of ligaturing the pile, threading the end of the ligature, which should be of *strong* catgut, on a curved needle with which the skin opposite the hæmorrhoids is transfixed, then the two ends of the ligature are tied, thus bringing down the hæmorrhoid to the skin edge, the main mass of the pile is then removed, leaving sufficient stump to prevent the ligature slipping. By this method the area of operation can always be seen and the unpleasant sequelæ which sometimes occur in the ordinary ligature operation are not so likely to happen.

The clamp and cautery provide another

simple method of operation, but the possibilities of hæmorrhage and infective ulceration occurring are much greater than when the modified ligature operation is performed. Excision of the pile-bearing area should not be undertaken by any one who is not actively engaged in surgery.

After-treatment. This is the same whatever be the operation performed, except in the case of excision when some of the details are different. A purge of calomel, two grains, is given on the third night, followed by a saline draught in the morning, and the bowels should be kept relaxed until the wound is healed. If the colon has not previously been sufficiently emptied, in other words if the patient has not been properly prepared for operation, it occasionally happens that on about the fifth day the bowels do not act, or only insufficiently, and there is no response even to an enema. When a rectal examination is made in these cases the bowel will be found "ballooned out," and a large mass of hard faecal matter felt which causes obstruction. This will have to be forcibly broken up and got rid of by various enemata. Such a process it need hardly be said is extremely bad for the wound and is a strong indication of the necessity for proper preparation previous to operation. A boracic bath is given on the fourth day and continued once or twice daily until the wound is healed. When the clamp and cautery have been used the wound must so to speak take its chance, and as a rule the result is successful. In the ligature operation the wound should be cleaned daily with peroxide of hydrogen and swabbed over with iodine every other day. If the hæmorrhoids have been simply ligatured with silk or thread the ligatures will come away on the seventh or eighth day, and the remaining wound will gradually heal. If catgut has been used the ligatures will become absorbed. The wound is usually healed in about three weeks.

When the hæmorrhoids have been excised it will be found that on the fourth or fifth day the sewn edges have separated from an eighth to one-third of an inch, sometimes even more; this is what usually occurs. The same treatment as for ligature should be adopted and the surfaces should be kept apart by a small piece of dry gauze. The wound is usually healed in from ten to twelve days.

Secondary Hæmorrhage.—This occurs in its worst form when hæmorrhoids have been ligatured. A ligature either slips, when the hæmorrhage occurs within the first twenty-four hours, or hæmorrhage occurs about the eighth day, when the ligature comes away and a large amount of blood may be lost in a short time. The indications will be pallor, sweating, and continuous yawning. When an examination is

made the anus will be found to be almost patulous and the rectum will be full of blood. When possible an anæsthetic should be given, the rectum washed out, and the bleeding point sought for. If on account of the anæmic state of the patient this cannot be found, four inches of large rubber tubing ($\frac{3}{4}$ in. wide) should be passed into the bowel and gauze packed round between the tube and the rectum.

After Ball's operation, or the radical cure, any secondary hæmorrhage can be at once seen and dealt with without any necessity to resort to the measures mentioned above.

Sepsis.—The indication of this is a rise of temperature either at once or after the third or fourth day, increasing pain, a hot throbbing feeling in the bowel, and commencing œdema of the skin edge with sanious discharge soon becoming purulent.

The treatment consists of boracic baths and hot fomentations between whites, frequent irrigation with warm saline, and the wound is cleaned with peroxide of hydrogen.

In all cases of operation a rectal examination should be made at the end of the third week, and if there is any suggestion of contraction the patient should be ordered a vulcanite rectal plug which should be passed twice a week and held in position for one minute.

Ulcerative Proctitis.—The sooner this disease is recognized and the quicker treatment is begun the better will be the result. It is far more common in women than in men, in fact, except in post-operative cases, it rarely occurs in men.

The indications are pain, a blood-stained discharge of a peculiar salmon-pink colour, and often œdema of the anal tissues.

When due to post-operative sepsis the special symptoms are pain, increasing when it should diminish, a high temperature, and œdema of the anal tissues.

When seen in the initial acute stage the treatment should consist of frequent warm boracic baths with fomentations between whites and irrigation of the operation area with saline and a mild solution of peroxide of hydrogen, such irrigation to be done every six hours. The response to this treatment will show itself by the lessening of the pain and the œdema, the dropping of the temperature and an alteration in the character of the discharge, which will gradually lose its salmon-pink tint. If the tissues are now examined the operation area will be found to be rough and granular, rather painful and bleeding readily. Ionic treatment by means of zinc cataphoresis will gradually result in a cure, but these patients must continue to remain under observation until healing has definitely taken place.

When the ulcerative proctitis is not post-operative it has usually been in existence for

some time before the patient comes under observation, and the treatment will entirely depend upon the extent to which the ulceration has gone.

The immediate requirements are to keep the ulcerated mucous membrane as clean as possible and then to make out the extent of the disease, and when possible to limit the extension of it by means of ionic treatment. The result of this will be that the ulceration will cease, fibrous tissue will form, and eventually a stricture will be the result, which must be treated by excision when possible. But if the ulceration extends too far, colotomy is the only thing left.

A moderate stricture can always be relieved by the periodic passing of bougies, but this is a distressing process for the patient and never really satisfactory.

Polypi and adenomata, when single, may exist for a long time without causing any special symptom. But when once attention has been called to them they should be removed by ligaturing the pedicle when there is one, or by removing the tumour with an elliptical piece of mucous membrane of the bowel when the tumour is sessile, which is more often the case in adenomata.

These single tumours usually occur within the first three inches of the bowel. When they can only be reached with difficulty the question of removal becomes a much more serious one, and each case must be dealt with on its own merits. It must be carefully borne in mind that there is a strong tendency in these simple tumours to become malignant after a certain age; and it is especially for this reason, apart from any discomfort which their presence may cause, that it is most necessary to remove them.

Villous tumours, although in themselves not malignant, are extremely apt to become so if imperfectly removed, and it is necessary to remove them with almost the same freedom as is done in malignant disease.

Differential diagnosis consists in the profuse hæmorrhage in villous tumour, which is unusual in malignant disease, the soft velvety feeling of the tumour itself, and the presence of normal mucous membrane right up to the edge of the growth.

In malignant disease the mucous membrane is altered in character at the edge of the growth, which is raised and hard and beyond this is ulcerated.

Early diagnosis is of the greatest necessity for the efficient treatment of malignant disease, and when symptoms such as hæmorrhage, pain, tenesmus, discharge, or even only discomfort occur a proper and thorough examination should always be carried out, and the medical man must not rest content until he is *definitely satisfied as to the cause of the symptoms.*

The urgent necessity of great care in this respect increases with the age of the patient, for although malignant disease does occur in young people it is not common. After the age of forty-five any such symptoms as those mentioned above must be carefully investigated.

Excision of the Rectum.—When the rectum has been excised, either by the perineal or the trans-sacral operation, the gauze packing should be removed on the third day, and sometimes it is desirable that the patient should have an anæsthetic; for this purpose gas and oxygen is usually sufficient. The wound is then thoroughly irrigated with saline solution, followed by some diluted peroxide of hydrogen, and this is again washed away with more saline and the wound is now lightly packed with dry sterilized gauze. No medicated gauze should be used in these cases. The wound should be dressed twice daily, and as there is always a certain amount of sloughing it is quite ten days before the wound is clean, after which healing takes place rapidly. Should the healing of the wound flag it may be stimulated with red lotion or iodine.

Colotomy.—The treatment of a colotomy wound will depend upon what operation has been performed. If it has been the one recommended in the author's book on diseases of the rectum the after-treatment is quite simple. A purge is given on the third night and after this has acted the Paul's tube will probably come away. The wound is cleaned in the usual way and a piece of dry gauze is placed between the bowel and the subjacent skin. The two ends of the incision are protected and kept carefully clean and the daily lavage of the colon is conducted in the following manner:—A long rectal tube is passed along the upper opening of the colon towards the cæcum and the outer end of the tube is attached to a Higginson's syringe; between one and two pints of warm water are then slowly injected into the bowel, the edges of the colotomy being held together to prevent any backward flow from the bowel. The enema is kept in the bowel as long as the patient can comfortably bear it (generally about twenty minutes). The patient is then turned over (face downwards) on to a "slipper" and the water is returned with all the contents of the colon and firm pressure over the cæcum ensures the complete emptying of the whole colon. This should be done with the morning dressing and the patient is then quite comfortable and clean for the rest of the day.

F. C. W.

ABNORMALITIES, INJURIES AND DISEASES OF THE KIDNEY AND URETER

Abnormalities.—The kidneys may vary in number, size, form, position and mobility.

Variations in Number. According to Sir

Henry Morris, imperfect development (hypoplasia) or complete absence of one kidney has been noted once in 2400 necropsies. In the majority of cases the ureter is absent also, but occasionally a rudimentary one, pervious in its lower half and opening naturally into the bladder, may exist, while, still more rarely, two perfect ureters may pass from the pelvis of the functional kidney and enter the bladder in normal situations. Such anomalies can only be diagnosed by an X-ray examination after the passage of bismuth-coated ureteric catheters. Abnormalities of the sexual organs and absence of the suprarenal gland may be associated with defects of the kidney. The surgical importance of absence of one kidney is far greater than statistics seem to indicate, for in about fifty per cent. of the recorded cases the solitary kidney was so diseased as to be the cause of death. Atrophy of one kidney from disease, causing complete loss of function, is of more frequent occurrence. In rare instances accessory kidneys may be present on one or both sides. Their presence is due to a developmental error and is of no clinical importance.

Variations in Size. The kidney may be greatly enlarged, sometimes to twice or three times its normal size. Hypertrophy to such a degree is usually compensatory and takes place when the other kidney is atrophied or congenitally absent. An abnormally enlarged kidney should always excite the suspicions of the surgeon and should never be operated upon until the presence and functional activity of the opposite one has been ascertained.

Variations in Form. Fœtal lobulation may persist to a greater or less degree, and is of little importance beyond the fact that a malformed organ is more liable to disease than a normal one. Another anomaly which occurs with comparative frequency (once in 1100 necropsies) is fusion of the lower poles of the kidneys in front of the vertebral column, resulting in the "horseshoe" kidney. The union may be either by a band of fibrous tissue or by a mass of renal parenchyma: in the latter case the two kidneys will be continuous with one another. In rare instances the upper poles alone are united, or both kidneys may be completely joined to form a solid mass of renal tissue which lies in front of the vertebral column and gives rise to a tumour of considerable size, the nature of which can only be surmised by the passage of ureteric bougies which are opaque to the X-rays.

Fusion may result in both kidneys lying on the same side of the vertebral column and simulating a hypertrophied solitary kidney. In nearly all cases of fusion each kidney possesses a ureter, which usually passes ventrally to it and opens normally into the bladder.

Variations in Position. The kidneys may lie anywhere along the normal line of the ureter, *i. e.* from the second lumbar transverse process to the second sacral vertebra; and their long axes may point in every conceivable direction. Malposition, particularly downwards, may be associated with fusion and with abnormalities of the vessels and ureters. The firm fixation of a congenitally misplaced kidney differentiates it from the "floating" and movable varieties.

Variations in Mobility. Abnormal mobility of the kidney is of sufficient importance to require special consideration.

Floating Kidney is a rare congenital anomaly which may occur alone or in conjunction with other defects. The organ is completely surrounded by a fold of peritoneum and possesses a long mesonephron in which the renal vessels and ureter are situated. The condition is so rare that it may easily be mistaken for a "wandering" spleen, an omental or mesenteric tumour, an ovarian cyst, or a pedunculated uterine fibroid.

Movable Kidney is an acquired condition that may be defined as one in which the organ descends to such an extent on inspiration that the fingers of the examining hand can be placed above its upper pole. It occurs most commonly in women between the ages of seventeen and thirty, and most often on the right side. The left kidney alone is rarely affected. Undue mobility of both kidneys is generally associated with general visceroptosis. The perinephric fat is usually diminished in amount. The kidney may be enlarged from passive congestion, or may show signs of degeneration, with dilatation of its pelvis from recurring attacks of hydronephrosis owing to kinking of the ureter.

Causes. The actual cause of movable kidney is the atrophy, elongation or rupture of the numerous fibrous bands that connect the renal capsule to the perirenal fascia in front and the abdominal wall behind. This may be brought about by severe injuries, tight-lacing, chronic cough, alterations of intra-abdominal pressure following pregnancy and the removal of large tumours or cysts, loss of the perinephric fat, and the action of gravity assisted by pathological enlargement of the kidney itself or of the liver and hollow viscera. In the majority of cases the subjects of movable kidney are thin and possess long, slender bodies.

Symptoms. Sometimes a kidney that possesses a large range of movement gives rise to no symptoms at all, and is only discovered accidentally, but in the majority of cases the cardinal symptom is pain in the loin of a dull aching character, occasionally associated with a sicken-

ing sensation and the feeling that "something" is moving. The pain is increased by exertion and nearly always relieved by rest in bed. The dragging pain sometimes alternates with paroxysms resembling attacks of renal colic, but seldom quite so severe. These paroxysms, known as Dietl's crises, usually follow unusual exertion, jolting or muscular strain, and are accompanied by vomiting, sweating and faintness. The crises are due to increased tension of the kidney from torsion of the renal pedicle or kinking of its ureter. If the tension is not soon relieved, the kidney increases in size and becomes so tender that palpation may be unbearable. During the attack the urine is scanty and may contain blood, albumin and casts. Usually, a few hours after the onset of the attack, the pain passes off, micturition becomes frequent and a large quantity of pale urine of low specific gravity is passed.

A movable kidney, by continually dragging upon the adjacent viscera, may set up chronic inflammation of the duodenum, bile ducts, stomach or colon, and so give rise to dilatation of the stomach, hepatic colic or temporary jaundice, vomiting, flatulence and other indications of gastro-intestinal disturbance.

Neurasthenia is so commonly associated with nephroptosis that careful consideration is required when the question of treatment arises. In some cases, and unfortunately they are in the minority, the nervous phenomena are induced by the constant dragging pain of a mobile kidney, while in others they constitute the primary affection, in which the mobile kidney either plays a secondary part or is entirely disregarded. As might be expected, operative treatment confers no relief in the latter class of case.

The physical signs are those of a movable tumour of renal contour which can be grasped between the hands, and when compressed gives rise to a sickening sensation. The percussion note is resonant anteriorly owing to the intervening colon, and dull posteriorly.

The *diagnosis* depends upon the shape and consistence of the tumour, its mobility, and the ease with which it recedes into the loin or escapes beneath the ribs when pressure is exerted from below. Apart from abdominal tumours of pelvic origin, wandering spleen, and tumours of the omentum and large intestine, which are seldom difficult to exclude, owing to the difference in their history, course and symptoms, a distended gall bladder may be confused with a movable kidney. The mistake will be avoided if it be remembered that the gall bladder is directly beneath the anterior abdominal wall, so that during inspiration it appears to strike the examining hand, even though very little pressure is exerted, that it

can be moved laterally, that its upper extremity is continuous with the liver or disappears beneath the anterior costal margin, that it cannot be pressed back into the loin, that the percussion note over it is dull and that the lower pole of the kidney may be felt behind and to the outer side of it.

Treatment. In slight cases treatment should be directed towards the improvement of the general health and the strengthening of the abdominal muscles by massage and breathing exercises. At the same time, if the patient be thin, a fattening diet should be prescribed. Riding, dancing, violent exertion of any kind and prolonged standing should be avoided; whenever possible, the patient should loosen her clothes and lie down for at least an hour during the day. The ordinary corset should be discarded in favour of one that is straight-faced, extends as far downward in front as possible and exerts its greatest pressure on the lower abdominal segment. The measurements should be taken and the corset applied when the patient is in the dorsal decubitus with the hips well raised. The so-called kidney belts, with pads of different shapes and sizes, are of little if any value in maintaining the kidney in position. During a crisis absolute rest, hot fomentations and anodynes are required.

Operative treatment (*nephropexy*) is indicated when the symptoms are severe and complicated by Dietl's crises, when neurasthenic symptoms are secondary to the nephrop-tosis, and when both conditions are unrelieved by palliative treatment. *Nephrectomy* is only necessary when there is an extreme degree of hydronephrosis, provided the opposite kidney is healthy.

Nephropexy is contra-indicated in all cases where neurasthenia is the primary disorder, or when partial or general visceroptosis co-exists.

Injuries of the Kidneys are caused by contusions, sudden blows when the parietes are relaxed, crushing forces such as "buffer-accidents" or the pressure of a cart-wheel on the loin, sudden flexions of the trunk, falls from a height and penetrating wounds. The results of these injuries range from subcortical hæmorrhages and lacerations of the renal parenchyma or pelvis to complete division or destruction of the kidney. Though an injury to the kidney alone is the commonest visceral lesion following an abdominal contusion, in severe cases it may be complicated by rupture of the peritoneum, liver, spleen or lung. Hæmorrhage is generally profuse, the extravasated blood forming a large hæmatoma in the perirenal tissues or escaping into the abdomen if the peritoneum be torn. Occasionally the pelvis and ureter become plugged with clots, causing an ob-

structive anuria on the injured side and not infrequently a reflex one on the opposite side. Injuries of the pelvis and ureter lead to extravasation of urine and subsequent abscess formation.

Symptoms. The classical symptoms and signs are shock, pain, local tenderness, hæmaturia, the formation of a tumour in the lumbar region and diminished secretion of urine (oliguria). These may follow each other in rapid succession or at considerable intervals.

Shock may be absent altogether, even when the kidney is seriously damaged, but in the majority of cases it is severe and lasts for several hours.

Pain sets in early and may be very severe; it radiates downwards from the lumbar region to the groin, is usually continuous and may alternate with acute attacks of renal colic, due to the passage of clots along the ureter. If the bladder be filled with clot, pain will be felt in the hypogastric region and urethra as well.

Tenderness in the loin is often pronounced, and is accompanied by a degree of muscular rigidity that varies with the extent of the injury.

Hæmaturia is one of the most constant symptoms; it commences early and is often profuse. The blood is bright red, intimately mixed with the urine and clots rapidly. The flow is usually continuous and persists for several days, but it may cease suddenly and be resumed again after an attack of "colic," during which the clot that obstructed the ureter is passed. Absence of hæmaturia when other symptoms of renal injury exist is suggestive of complete rupture of the ureter. Hæmorrhage into the abdominal cavity through rupture of the peritoneum is characterized by early collapse and signs of free fluid with shifting dullness in the flanks.

The formation of a tumour by blood extravasated into the perirenal tissues can only be surmised in the early stages, from the existence of fullness in the loin and increased dullness on percussion unaffected by the position of the patient, for muscular rigidity is too great to allow of accurate palpation. Later it may be possible to feel a large elongated swelling that does not move with respiration and has the colon resonance in front of it.

The development of a swelling in the lumbar region some days or weeks after an injury to the kidney is usually due to perinephric abscess, hydronephrosis or pyonephrosis.

The secretory function of an injured kidney is always inhibited for a few days and may be suspended altogether. Owing to this inhibition, and in spite of the false impression conveyed by the frequent micturition that is associated with hæmaturia, the actual amount of urine

passed in the first forty-eight or more hours is greatly diminished in amount (oliguria). When the function of one kidney is totally suspended oliguria may persist for several weeks, or may rapidly merge into anuria (total suppression), for if the remaining kidney be healthy, it is slow in taking on the extra work that is thrust on it, and if it be diseased it may be incapable of continuing it. A temporary oliguria is always followed by a compensatory polyuria.

Treatment. Having ascertained that the blood is coming from the kidney and not from the bladder, by passing a catheter, running in about ten ounces of sterile water, and measuring the amount that is recovered, the patient should be kept in bed, given subcutaneous injections of ergotin, and kept on a low diet. Clots in the bladder should be removed by means of a large catheter attached to an aspirator bottle, or with a lithotrite and an evacuator. When hæmorrhage is profuse or continuous and threatens life, an exploratory incision and probably nephrectomy will be necessary.

Perinephric Abscess—

Cause. Though a perinephric abscess may follow the acute specific fevers or be secondary to disease of the appendix, colon, spleen, liver, lungs, etc., it is most often due to a primary affection of the kidney, such as pyelitis, pyonephrosis, calculus, tubercle, etc.

Symptoms. The general symptoms are those of septic absorption, characterized by a dry tongue, constipation, rigors and a continuous or intermittent temperature.

Local Symptoms. Continuous or paroxysmal pain in the loin, occasionally radiating along the course of the lumbar nerves; rigidity of the spine and sometimes flexion of the thigh from irritation of the psoas muscle; obliteration of the normal hollow in the loin; rigidity of the lumbar muscles; increased heat and occasionally redness and œdema of the skin. On palpation, a tender indefinite swelling can be felt; fluctuation can rarely be obtained owing to the density and thickness of the parietes. The urine is normal unless the abscess be secondary to a pyogenic infection of the kidney, when it will contain pus and bacteria.

Diagnosis. In the absence of a definite renal lesion, a perinephric abscess is most likely to be mistaken for hip disease or spinal caries. The absence of projection, rigidity and local tenderness over the vertebræ, in the one case, and the painless mobility in all directions of the partially flexed thigh in the other, readily serve to eliminate these affections.

Treatment. In the early stages the usual treatment of inflammation by rest, hot fomentations and so on must be instituted, but imme-

diately the presence of pus is suspected an exploratory incision should be made in the loin and a drainage tube inserted. The subsequent treatment depends upon the primary cause of the abscess.

Renal Calculus.—Renal calculi are formed more often in males than in females and during the first, third and fifth decades.

Etiology. Though the actual process by which a calculus is formed is not thoroughly understood, it is well known that two factors are necessary, firstly, the presence of a suitable nucleus upon which the urinary salts can be deposited, and, secondly, some altered condition of the urine which leads to the precipitation of these salts. The nucleus may be formed of mucus, pus, epithelial cells, blood clot, any kind of foreign body (*e.g.* a ligature), or the ova of a parasite such as the bilharzia. The predisposing causes that lead to the deposit of urinary salts are the uric acid, phosphatic or oxalate diatheses; unfavourable hygienic surroundings; a diet containing an excess of either animal or vegetable foods, and, in children, a deficiency of milk; also climatic conditions in which moisture and sudden changes of temperature predominate.

Varieties. In order of frequency, the uric acid stone comes first, then the oxalate of lime and the alternating calculus composed of uric acid, oxalate of lime and phosphates in layers, and, lastly, calculi composed of pure lime salts, mixed phosphates, cystin and xanthin. The uric acid stone is smooth, rounded or oval in shape, and almost transparent to the X-rays, while the oxalate stone is rough, mammillated, rounded and quite opaque to the rays.

Symptoms. The cardinal symptoms of renal calculus are pain, hæmaturia, pyuria and frequency of micturition.

Lumbar pain is often the most prominent symptom; it is aching and dull in character, radiates down to the thigh or testis, and alternates with agonizing attacks of renal colic that may be started by riding, jumping, jolting, or merely by turning over in bed. The pain of renal colic is due to a successful or unsuccessful attempt on the part of the stone to pass from the kidney to the ureter, and only subsides when the stone either reaches the bladder or falls back into the renal pelvis; it is often accompanied by such profound collapse as to lead to a sense of impending death.

Hæmaturia, sometimes profuse, and sometimes so slight as only to be recognizable by microscopical examination of the urine, almost invariably accompanies or follows the attack of colic. Hæmorrhage may be of short duration or may last for several days; it is most profuse when due to the irritation of a rough oxalate calculus.

Pyuria is due to traumatic inflammation of the renal pelvis and is a constant symptom in long-standing cases of lithiasis. *Frequency of micturition* is an important symptom, as it points to vesical or renal irritation. It is most marked during the day, when the patient is moving about, and seldom occurs during the night, when he is at rest, unless the urine contains crystals or pus.

Diagnosis. When a positive skiagram is unobtainable and when the clinical history and features of the case are obscure, a diagnosis of renal calculus can only be made by eliminating all other possible causes of lumbar pain and hæmaturia. Careful physical examination will enable such causes of lumbar pain as spinal caries, aortic aneurysm, locomotor ataxy and tumours of the spinal cord to be excluded. Cystoscopic examination of the bladder will eliminate diseases and tumours of the prostate and bladder, and microscopical examination of the urine will prove the absence of tubercle bacilli, hyaline and granular casts, pieces of new growth and the ova of bilharzia.

Treatment. The treatment is essentially surgical, provided the renal function is sufficiently active to withstand the shock of nephrolithotomy or possibly nephrectomy.

Palliative treatment consists of the free use of distilled water or alkaline mineral waters, and the judicious administration of anodynes and urinary antiseptics.

Prophylaxis is necessary when the urine is loaded with "gravel" without there being definite evidence of a calculus. The formation of *uric acid* is diminished by avoidance of an excess of nitrogenous food and of alcohol, particularly port and sherry. Potassium citrate or ammonium benzoate should be given internally.

Oxaluria. Milk, eggs, fruit, vegetables, tea, cocoa and chalky water must be avoided, and their place in the diet taken by citrated milk, bread, fish, meat and potatoes and lime-free water such as Contrexéville and Vichy.

Phosphaturia is relieved by increasing the animal and by diminishing the vegetable food, and by keeping the urine strongly acid with large doses of acid sodium phosphate.

Calculus anuria, i.e. suppression of urine without uremic symptoms should be relieved by immediate drainage of the affected kidney.

Ureteric Calculus.—A rough calculus composed of calcium oxalate or calcium phosphate may become impacted in the ureter either just below the pelvis of the kidney or just above the wall of the bladder. The irritation set up by the stone causes ulceration and subsequent stricture of the ureter, while the obstruction it offers to the passage of the urine leads to dilatation of the ureter, hydronephrosis and pyonephrosis.

Symptoms. These are exactly the same as those due to a renal calculus, with the possible addition of a tender spot along the course of the ureter at the point where the stone is arrested. A stone in the pelvic ureter can sometimes be felt by vaginal or rectal examination.

Diagnosis. Unless the stone is actually protruding into the bladder, when it can be seen on cystoscopic examination, an accurate diagnosis can only be made by the assistance of an unmistakable radiogram. Shadows cast by calcareous glands near the brim of the pelvis or by phleboliths in the vesico-prostatic plexus can be distinguished as such by having a second radiogram taken with an opaque bougie in the ureter. An impacted ureteric calculus should not be mistaken for appendicitis if these aids to diagnosis have been employed.

Treatment. Expectant treatment is permissible when the stone is small and there is reasonable hope of its being passed naturally. Its escape can be aided by the administration of diuretics and by endeavouring to alter its position by pushing a ureteric catheter against it. If a second radiogram taken three weeks after these manipulations shows that the stone is descending, expectant treatment should be persevered with, but if its position remains unaltered and if pain and colic are severe, an immediate operation should be performed. An operation is also imperative in all cases complicated by anuria or pyonephrosis.

Hydronephrosis is the term employed to denote the distension and destruction of the kidney by partial obstruction to the urinary outflow.

Causes. Any form of mechanical obstruction in the urogenital tract, whether congenital or acquired.

Congenital Causes. Phimosis, strictures and malformations of the urethra, bladder and ureters, and abnormalities of the renal arteries, whereby the ureter is compressed.

Acquired Causes. Urethral stricture, enlarged prostate, vesical calculus, malignant disease of the bladder or prostate, ureteric calculus, acquired stenosis of the ureter due to inflammatory changes, renal calculus, movable kidney and the pressure of pelvic and abdominal tumours.

Changes in the Kidney. The continued effect of back-pressure leads to dilatation of the pelvis and calyces and pressure atrophy of the renal substance, until the organ becomes converted into a loculated, thin-walled sac which may be no larger than an ordinary kidney, or may reach an enormous size. The fluid in the cyst is pale in colour, of low specific gravity and contains traces of sodium chloride, albumin and urea. The sac soon becomes adherent to

adjacent structures and, if large, displaces the colon inwards. Acquired hydronephrosis, though generally unilateral owing to the frequency with which it is due to stone or kinks of the ureter, may also be bilateral; congenital hydronephrosis is nearly always bilateral.

Symptoms. In the early stages symptoms are slight or absent, but as the cyst increases in size the patient complains of thirst and dull aching pains in the loin, with occasional acute exacerbations. During one of these acute attacks a tender, gradually-increasing swelling can usually be felt in the loin. At the same time the amount of urine passed diminishes in quantity, and sometimes contains blood, owing to the presence of a stone or to congestion of the kidney from torsion of its pedicle. Suddenly, as the result of recumbency or of some posture adopted by the patient, the pain disappears, the tumour diminishes in size and a large quantity of pale urine is passed. When the hydronephrosis is secondary to some fixed form of obstruction, such as a pelvic tumour, enlarged prostate or urethral stricture, the cyst undergoes a steady and progressive enlargement and often remains undetected until it has attained a considerable size, the symptoms being masked by the condition to which it is due. A hydronephrotic kidney presents all the *signs* of a renal tumour, and in addition may give a fluid thrill on percussion.

Treatment is essentially surgical and depends upon the cause. When the obstruction is situated in the lower urinary passages it should be dealt with before any operation on the kidney is contemplated. If it fails, or if the seat of obstruction is above the bladder, the kidney must be exposed and examined. If the kidney substance is almost completely destroyed and the function of the opposite kidney is known to be sufficient by previous catheterization of its ureter, an immediate nephrectomy should be performed, but if a considerable amount of renal substance is still present, and if the cause of the distension can be removed or relieved by operative measures, the kidney should be saved. Simple nephrotomy and drainage is only permissible when the obstruction is caused by a calculus (which is of course removed at the same time), otherwise a permanent urinary fistula develops and can only be cured by nephrectomy.

Pyonephrosis—

Causes. In some cases pyonephrosis is secondary to a primary pyelitis, during the course of which the ureter has become partially obstructed by blood clot, inspissated pus or tuberculous debris, but in the majority it is due either to a hæmatogenous or an ascending septic infection of a hydronephrotic kidney.

Clinically, pyonephrosis is most often secondary to long-standing cases of urethral stricture, enlarged prostate or vesical calculus.

Symptoms. The early symptoms are those of the obstructing agent, together with febrile symptoms, dull aching pain in the loin and pyuria. The quantity of pus that is passed varies considerably, and in an intermitting case it may be absent altogether at times. As the disease progresses, constitutional symptoms of septic infection—high fever, rigors, sweats, dry brown tongue, etc.—become pronounced, and a tender swelling develops in the loin. This swelling possesses all the distinctive features of a renal “tumour,” with the exception that its mobility is limited by inflammatory adhesions. Chronic cases may be complicated by perinephritis and perinephric abscess.

Diagnosis. A diagnosis of pyonephrosis is founded upon the presence of a tender swelling in the renal region, accompanied by intermittent or continuous pyuria and constitutional symptoms of septic absorption. Pyonephrosis is most likely to be confused with perinephric abscess and hydronephrosis with concomitant cystitis. Apart from an exploratory incision, the only method of arriving at a definite conclusion is by examination of the separated urines. Needless to say, the cause of the obstruction should be ascertained whenever possible.

Treatment. Palliative treatment is only permissible in slight cases or when the obstruction is caused by an inoperable malignant growth. In all others nephrotomy or nephrectomy is necessary. Nephrotomy and drainage, followed by the treatment of the cause of distension, will often suffice, but should the kidney be completely destroyed or a urinary fistula persist after nephrotomy, nephrectomy must be performed, provided always that the presence and functional activity of the opposite kidney has been predetermined.

Pyelitis, Pyelo - Nephritis, and Suppurative Nephritis.—The term surgical kidney is sometimes inaptly applied to these suppurative diseases of the kidney, owing to the frequency with which they follow obstruction in, or disease of, the lower urinary passages. But it must not be forgotten that there is another great group of cases (e.g. the pyelitis of pregnancy) in which the pathogenic micro-organisms reach the kidney either by the blood or lymph streams, or by direct extension from neighbouring organs.

Causes. *Ascending infection* may be due to cystitis, urethritis, stricture, enlarged prostate, vesical calculus, ureteric calculus, etc.

Hæmatogenous infection occurs during the course of pyæmia, ulcerative endocarditis and

the specific fevers. In the absence of these diseases, and provided there is some septic focus in the body from which pyogenic micro-organisms can enter the blood stream, a contusion or slight injury to the kidney or the irritation set up by a calculus will lead to suppuration. Infection by contiguity and lymphatic infection may be secondary to appendicitis, colitis, pelvic peritonitis, osteomyelitis of the ilium or vertebrae and splenic, hepatic or sub-phrenic abscesses. The bacteria that usually cause suppurative diseases of the kidney are streptococci, staphylococci and the bacillus coli communis.

Symptoms. Continuous or intermittent high temperature, occasional rigors, headache, nausea or vomiting, loss of appetite, drowsiness and a dry, brown fissured tongue, in varying degrees of severity. The urine is usually acid when the infection is hæmatogenous, and alkaline when secondary to disease of the lower urinary passages; it contains pus, degenerated epithelium, renal casts, and sometimes blood. The quantity varies; in acute cases it is usually diminished in amount and there may even be a reflex anuria; in chronic cases polyuria is the rule.

Local signs in slight or chronic cases may be absent altogether, but usually, and especially in acute cases, there are localised or radiating renal pain, tenderness on pressure, muscular rigidity and enlargement of the kidney. The disease is generally unilateral when due to hæmic infection and bilateral when secondary to an ascending infection.

Diagnosis. Suppurative diseases of the kidney must be distinguished from acute Bright's disease, cystitis and pyæmia.

Acute nephritis is distinguished by convulsions, œdema, dry skin, scanty dark urine containing granular casts and a large amount of albumin, and absence of, or insignificant renal pain. *Cystitis* is characterized by frequency of micturition, vesical tenesmus and slight fever. Though the urine in cystitis may be acid, it is usually neutral or alkaline. *Pyæmia* is easily recognized by its characteristic temperature, constitutional symptoms, tender swellings of the joints and formation of metastatic abscesses. In some cases an accurate diagnosis of pyelitis or pyelonephritis can only be made after cystoscopy and catheterization of the ureters.

Treatment. 1. *General.* The patient must be kept in bed and given a light diet, consisting mainly of milk, until all febrile symptoms subside. The bowels must be kept well opened by aperients which promote watery evacuations. Sweating should be encouraged by hot-air baths, hot packs and in severe cases by hypodermic injections of

pilocarpine. Urinary antiseptics should be given, and diuresis promoted by large draughts of water. The benefits derived from the employment of vaccines and sera are doubtful, but in the pyelitis of pregnancy, where the pathogenic micro-organism is the *B. coli*, great benefit may be obtained by subcutaneous injections of anti-colon-bacillus serum in three doses of 15 c.c. on consecutive days. As the serum is only antitoxic, it is useless to continue its administration if an immediate effect is not produced by the initial doses.

2. *Local* should aim at the relief of pain by dry cupping and the removal of any cause of mechanical obstruction by surgical measures.

Tuberculous Kidney.—Tuberculous disease of the kidney occurs in two forms—acute and chronic.

Acute Tuberculosis occurs in the kidneys (particularly in young children) as part of a generalized miliary tuberculosis. The disease rarely produces definite symptoms referable to the kidney, and is not amenable to treatment.

Chronic Tuberculosis (tuberculous pyelitis and pyelonephritis) is of comparatively frequent occurrence between the ages of twenty-five and forty. Men are more often affected than women and, as a rule, only one kidney is attacked, the other remaining free from infection for months or years. Infection takes place either through the blood stream or by direct extension from the urogenital tract. Hæmatogenous infection occurs in the majority of cases, the tubercles being first formed in and around the glomeruli. It is not until these tubercles break down and burst into the calyces that symptoms arise from which a definite diagnosis can be made. Invasion of the pelvis is in due time followed by spread of the disease along the ureter to the bladder, and thence as an ascending infection to the opposite ureter and kidney. The formation of granulation tissue in the pelvis and ureter leads to dilatation of the calyces from back-pressure. Sooner or later infection with pyogenic micro-organisms takes place, giving rise to tuberculous pyonephrosis and frequently to perinephritis and perinephric abscess. Ascending infection is rare and occurs as the result of a primary tuberculous focus in the bladder or as a complication of extensive disease of the epididymis, vas deferens and prostate.

Symptoms. In the early stages the general health is usually unaffected and local symptoms may be absent. As the disease progresses there may be anæmia, wasting, digestive disturbances and irregular fever, together with a train of characteristic signs and symptoms, of which the most important are—

1. Dull, aching pain in the loin, unrelieved

by rest and worse at night, with occasional attacks of renal colic when caseous masses pass along the ureter. Renal pain is accompanied and often succeeded for some weeks or months by pain in the perineum and along the urethra as a result of irritation of the neck of the bladder by the tuberculous urine. The kidney may be enlarged and tender and the ureter thickened.

2. Frequency of micturition and polyuria. These are early signs and often the only ones at the commencement of the disease; when combined with

3. Intermittent pyuria and the passage of acid, hazy urine in which a sediment slowly deposits, the presence of tuberculous disease is highly probable. The diagnosis can only be verified by finding tubercle bacilli, or by microscopical examination of films made from the centrifugalized urine passed during the twenty-four hours. In doubtful cases where very little pus and very few bacilli are present, the diagnosis can only be established by inoculation of a guinea-pig. Later in the disease, when cystitis develops, the urine usually becomes alkaline from secondary infection and contains an excess of pus.

4. Hæmaturia may be absent, slight or profuse. Unlike the hæmaturia associated with renal calculus, it is an early sign and seldom persists.

Diagnosis. It is highly important that the nature of the disease and its location should be ascertained early, in order that successful treatment by nephrectomy can be carried out before the opposite kidney becomes infected. An accurate diagnosis can only be made in the early stages, either by the characteristic changes in the appearance of the ureteric orifice as revealed by the cystoscope, together with microscopical examination of the urine collected by catheterization of the ureters, or by the result of animal inoculation.

Treatment. When both kidneys are affected, or when there are tuberculous foci elsewhere and the patient is obviously wasting rapidly, *palliative* treatment in the shape of anodynes and urinary antiseptics will meet the needs of the case. But where the disease is unilateral and the opposite kidney is able to carry on the functions of both, an early nephrectomy gives the only prospect of a permanent cure. Localised ulceration of the bladder, secondary to disease of one kidney, is not a contra-indication to nephrectomy, as it tends to heal after the kidney has been removed. The healing process can also be accelerated by subcutaneous injections of tuberculin in small doses, and by lavage of the bladder with weak solutions of perchloride of mercury (1 in 3000) or protargol (1 in 4000).

Tumours of the Kidney.—Renal tumours occur at all ages, but perhaps most often before five and after forty. Malignant tumours are more common than simple. The only simple tumours that give rise to any special symptom are—papilloma of the renal pelvis and angioma of the papillæ. In both of these the only symptom is painless, intermittent hæmaturia. A diagnosis is only arrived at by exploratory nephrotomy.

Malignant Tumours (carcinoma and sarcoma) arise either in the suprarenal gland or in the kidney. The varieties are as follows—

1. Adreno-carcinoma, developing from the intratubular epithelium—highly malignant and of very rapid growth.

2. Hypernephroma or adrenal carcinoma. This arises in the suprarenal gland and invades the kidney; it is of slow growth and generally occurs in adults.

3. Sarcoma occurs either (a) as a congenital tumour or within the first few months of life, or (b) in adults. In the first type both kidneys are usually affected, in the latter, one only. The tumours grow rapidly and attain a great size.

4. Teratomata occur in children and are generally situated near the hilum of the kidney. They are composed of embryonic elements, striped muscle fibres, sarcomatous tissue and sometimes contain fat, cartilage and bone. They grow to an enormous size and rarely give rise to metastasis.

Distinctive Features of a Renal Tumour—

1. The tumour lies behind the large intestine.

2. As the tumour enlarges it comes in contact with the abdominal wall at or about the level of the umbilicus.

3. There is usually an area of resonance anteriorly between the tumour and the liver.

4. There is no resonance posteriorly between a renal tumour and the spine, as there is between a splenic tumour and the spine.

5. The contour of a renal tumour is rounded and generally longest in its vertical axis.

Diagnosis. A tumour of the kidney must be distinguished from—

1. *Splenic Tumours.* These move on respiration and are movable. The spleen has an anterior notched border and sharp margins. The long axis of the tumour extends obliquely downwards, forwards and inwards. The percussion note is resonant posteriorly and dull anteriorly.

2. *Hepatic Tumours.* These are immediately beneath the anterior abdominal wall and have no bowel in front of them. The lower margin usually has a sharp edge.

3. *Enlargement of the Gall Bladder* (see p. 792).

4. *Tumours of the Colon and Ovary.* There

is usually little difficulty in recognizing these tumours by their characteristic features, and by the fact that the kidney can generally be distinguished and separated from them.

Treatment. The affected kidney and as much as possible of the perirenal fat should be removed as soon as the presence and the function of its fellow has been determined.

Cysts of the Kidney.—There are only four important varieties which require attention.

1. **Congenital Cystic Disease.**—This condition is bilateral and is usually associated with cyst formation in other organs, particularly the liver. The kidneys retain their normal outline, are often greatly enlarged and are converted into cystic masses, in the walls of which very little secreting substance can be found. In a fair proportion of cases the condition is only discovered at a necropsy, but in the majority renal pain and intermittent hæmaturia are pronounced symptoms. Death from uræmia usually takes place at middle age.

2. **Polycystic Kidney** occurs in adults and is not infrequently unilateral. The changes in the kidney are of congenital origin and similar to those of congenital cystic disease. The signs and symptoms are practically identical, with the exception that as only one kidney is affected the patient may attain old age.

Treatment. If a polycystic kidney causes inconvenience on account of its size, it may be removed, provided the opposite kidney is healthy.

3. **Simple Cysts** arise in the renal cortex. They are rare, affect one kidney only, grow slowly and only cause symptoms when they reach a large size.

Treatment. If the cyst causes inconvenience it should be incised, drained and packed with gauze until healing by granulation has taken place.

4. **Hydatid Cysts.**—These may be situated beneath the capsule or in the substance of the kidney and may ultimately destroy the whole organ. The cyst may rupture into the renal pelvis or into the adjacent viscera, and, like hydatid cysts elsewhere, it may become inflamed and suppurate.

Symptoms are usually absent unless the cyst becomes very large, or suppurates, or bursts into the renal pelvis. In the latter case there may be renal colic from the passage of daughter cysts along the ureter and hydatid hooklets may be found in the urine.

Treatment. It is sometimes possible successfully to enucleate a single cyst, but generally, and especially if the kidney is greatly disorganized, nephrectomy is necessary.

C. A. R. N.

SURGERY OF THE BLADDER

The symptoms that are associated with diseases of the bladder are few in number. The problem which is presented to the practitioner who has to treat a case of bladder disease is first the detection of the nature of the disease in question, and secondly its appropriate treatment.

The symptoms of which the patient complains may be summed up generally in the expression, *some abnormality associated with urination*, coupled perhaps with pain somewhere in the urinary tract, and possibly involving the lumbar and sacral regions as well.

An accurate diagnosis can only be arrived at by the employment of instruments of precision, and for this purpose, the catheter, the sound, the separator, the cystoscope and X-rays must be called into requisition. In order to explain the exact weight that must be laid upon the various symptoms, and the exact mode of employing the aids to diagnosis which are at our disposal, the various bladder lesions will be enumerated *seriatim*, together with their diagnosis and treatment.

Congenital Affections of the bladder are few in number. Absence of the bladder and congenital sacculi in connection with it are rarely seen, and if operative measures are demanded they can only be undertaken by one who has special experience of bladder surgery.

The same remarks apply to ectopia vesicæ. The attempts which have been made by many surgeons in the past to roof in the bladder have invariably been only partially successful, because it is impossible to construct an artificial sphincter. In recent times Maydl and other surgeons have succeeded in implanting the base of the ectopic bladder together with its ureteric openings into the sigmoid flexure. The danger of this method largely depends on the subsequent liability of the kidneys to infection from the bowel. Recent statistics, however, have shown that the mortality, both immediate and remote, has been reduced to seven per cent.; and this method, therefore, may be considered to be applicable if not to all at least to many cases of ectopia vesicæ.

Non-operative treatment resolves itself into keeping the parts clean and providing some efficient absorbent to soak up the urine as fast as it is secreted. In some instances an india-rubber shield or bottle may be fixed so as to catch some portion of the urine. The patient's condition is, however, usually so deplorable that he is only too willing to submit to any operation which is likely to relieve him of his intense discomfort.

Injury of the bladder through an external

wound is rarely met with, and must be treated in accordance with ordinary surgical principles. A gunshot wound, if inflicted with one of the small modern high-velocity projectiles, should not be lightly interfered with. The experience of the South African War showed that a bullet might perforate both the bladder and intestine without fatal consequences. The outlook in such cases is grave, but in a patient who is suffering from severe shock the results of abstaining from operative interference are usually better than those which will be yielded by exploration of the parts in question.

In civil practice by far the commonest form of injury is rupture without external wound. In many cases the patient, who is drunk, blunders up against some obstacle, falls with his abdominal muscles lax, and the bladder is ruptured by the impact. In this condition he is possibly found by some neighbour and taken home to sleep off his debauch, and it is not till he awakes and finds himself unable to pass any water at all or perhaps only a small amount of bloody urine that any suspicion of his injury is entertained. It may be that he has been crushed and his bladder ruptured, and possibly his pelvis is fractured in addition. In either case the two important questions to be determined are whether the bladder is ruptured or not, and, if rupture has occurred, whether it is intra- or extra-peritoneal. In either case prompt treatment is necessary, and must be undertaken by the practitioner in charge if skilled surgical assistance cannot speedily be obtained, for nothing is more certain than that early treatment is the only passport to success. Every hour that the patient remains untreated adds materially to his danger. The diagnosis is usually sufficiently determined by the history of the case coupled with the inability to pass water, or possibly the voiding of a small amount of blood-stained urine. It is rarely if ever necessary or advisable to pass an instrument with a view to locating the rupture, or passing in more fluid as has been recommended by some writers. A small incision above the pubes will be sufficient at first to permit of the exploration of the peritoneal surface of the bladder or, if necessary, of its interior. After such an incision no doubt can remain. The rupture must be sewn up with a Lembert suture, and if the urine has found its way under the peritoneum means must be taken to drain the subperitoneal tissues. This can usually be effected by draining through the suprapubic incision. In rare instances it may be advisable to drain either through the loin or even by the perineum.

Increase in the size or capacity of the bladder
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can hardly be styled a disease. It is a symptom of some obstruction at the neck of the bladder, or in the urethra. The cause must be sought and appropriate treatment carried out. (See later under *The Prostate and The Urethra*.)

Diminution of the capacity of the bladder not infrequently calls for treatment. It depends usually on an old cystitis, which may have been associated with ulceration and subsequent cicatrization in all probability of tubercular origin. It is possible that the bladder may have been injured at a previous operation. Instances are recorded of pieces of the bladder being removed during the operation for radical cure of hernia. In most of these cases there is but little to be done in the way of treatment. The cause of this condition will probably not be ascertained without having recourse to a cystoscopic examination, and the bladder may be so small as to render an examination of this kind impossible.

If a previous attack of severe cystitis appears to be an adequate explanation of the symptoms it is possible that dilatation of the bladder by gradual hydrostatic pressure by means of a funnel and catheter or a syringe may considerably increase the bladder capacity; but it must be very gradually and carefully carried out or the mucous membrane of the bladder may be split. If the diminution in size is due to the cicatrization of a tubercular ulcer, but little good can be expected from such treatment.

Foreign Bodies in the bladder often give rise to very anomalous symptoms, especially if they have been introduced from erotic motives. In this case the patient is almost sure to conceal the cause of trouble, even if he suspects its true cause. Should the practitioner meet with such a case, diagnosis will present considerable difficulty. In the early stages symptoms will probably be entirely absent. If the patient applies for treatment, it will be because he knows he has a foreign body in his bladder, which he desires to be removed, and for this purpose, the aid of the surgeon should be sought. If an early removal is not effected, bladder irritability is bound to ensue later on. Sepsis and phosphatic deposits in the bladder will occur, and skilled treatment will be needed to remove this condition.

Retention of Urine is by far the commonest abnormality of the urinary organ that the practitioner is called upon to treat. In no part of his work is an accurate diagnosis more imperatively demanded.

The following tabular statement summarizes the causes of retention—

- | | | |
|----------------------|---|---|
| | { | Stricture of the urethra. |
| | | Enlarged prostate. |
| 1. <i>Mechanical</i> | { | Calculus impacted, possibly in the urethra or neck of the bladder. |
| | | Tumour in the bladder. |
| | { | Abscess in or near urethra or bladder. |
| | | Hysteria and habit spasm. |
| 2. <i>Nervous</i> | { | Reflex, <i>i. e.</i> after operations. |
| | | True nervous affections such as injuries and diseases of the spinal cord. |
| 3. <i>Infective</i> | { | Bacteriuria and cystitis generally. |

The above causes will now be considered more in detail.

True Urethral Stricture depends, as is well known, on the cicatricial contraction which has resulted from old inflammation and is usually a sequel of gonorrhœa; and when it gives rise to an attack of retention must be relieved by the passage of an instrument. All but the worst types of stricture are capable of complete and permanent cure if they are incised (external or internal urethrotomy); and after the immediate trouble caused by the retention has been temporarily relieved, the question of complete cure should be carefully considered. For this purpose a graduated steel sound should be passed daily for some months, in fact until the tendency to recontraction has completely disappeared.

Many of the slighter varieties of stricture, complicated as they often are by much congestion and swelling of the part, readily yield to the passage of instruments, though it is difficult to lay down any absolute rule as to how often the instrument should be passed. In some instances half a dozen or a dozen passages at intervals of three or four days or a week will suffice. If, however, the stricture does not yield to this method of treatment, coupled with the administration of ordinary diluents, alkalies and antiseptics such as urotropin, hetralin, etc., steps should at once be taken to consider whether operative interference is or is not desirable. If the patient is old and feeble, the stricture of long standing, and the condition of the kidneys is doubtful, it may be better to remain content with the passage of an instrument at intervals. The operation of urethrotomy is, however, attended in skilled hands by such good results, both immediate and remote, that there are few patients in whom it may be regarded as inadmissible. Each case must be decided on its merits.

It may be well at this point to discuss the special steps that must be taken to purify the patient as well as the instruments with which

he is treated. The healthy urethra contains but few organisms, and these are situated as a general rule close to the urethral orifice. If the retention is a chronic affair the bladder may be septic before any instrument has been passed. In any case all that can be done to the patient is to carefully wash the orifice of the penis with soap and water with the addition of a weak antiseptic. Powerful antiseptics are too irritating and therefore inadmissible. There are various methods in vogue for cleansing urethral instruments. Boiling is by far the simplest. Its only disadvantage being that soft catheters are injured by repeated boiling. Sterilized glycerine is perhaps the best lubricant. It mixes readily with the water and is readily washed out of the urethra by the next act of micturition. If a stricture is treated by graduated steel bougies many difficulties are avoided. There is no unseen interior of the catheter to contain unknown septic products, and the metal instrument is not injured by boiling. If the walls of the bladder are atonic a catheter must be employed and correspondingly increased care is demanded. Unless the bladder is very foul it is rarely advisable to wash it out for the purpose of cleaning it. It soon resumes its natural purity when the obstruction to the urinary outflow is removed.

The diagnosis of enlarged prostate is not as a rule difficult. The bladder capacity is generally enlarged, and the patient usually has partial or complete retention. The age of the patient, coupled with some prostatic swelling per rectum, and a difficulty on entering the bladder with a catheter, completes the diagnosis. A decision should be promptly come to as to whether an operation for its complete removal should be attempted, or regular catheterization recommended. If the patient's health is good, there is no question of the advisability of recommending removal. It is the only method of treatment by which natural urination can be restored, and the result when undertaken early is both perfect and permanent. Whether the perineal or suprapubic route should be employed must depend on the surgeon who operates. The author unhesitatingly recommends the suprapubic. It has the great advantage of enabling the surgeon to see exactly what he is doing, and to treat if necessary any diseased condition of the bladder which might otherwise be overlooked.

It is well to bear in mind that in a certain number of cases of enlarged prostate the increase in size is due to malignant disease. The distinction, however, between an innocent and malignant prostate may present considerable difficulty. The malignant prostate is usually harder, firmer, more irregular in outline and more resistant when examined per

rectum. It rapidly increases in size and no permanent benefit can possibly result from removing it.

If catheterization is to be employed in place of operative treatment, the patient or his attendant must be well drilled in the technique of cleanliness, and the instrument should not be employed more often to start with than is necessary to keep the bladder empty. The patient should always be advised to *try and try again* to void his urine as far as he can in order to keep his muscles in order. Once he yields to the dictates of laziness and has frequent recourse to the catheter, he is unlikely to regain his natural power and his chances of infection are increased. If the bladder becomes infected it must be treated by local irrigation coupled with a few drops of nitrate of silver five grains to the pint. In some instances a few drops of the solution may be left in the bladder with advantage.

The patient's resistance to sepsis may be increased by the administration of a suitable vaccine made from his own secretions. If, however, his temperature rises and his desire for urination become frequent, there is but one form of treatment likely to prove useful. The bladder must be opened and drained. Excellent results may be obtained by the method if it is not too long delayed.

Calculus in the bladder rarely attains to the enormous size of some of the specimens in our museums. It is now detected and removed early; if small by lithotripsy, but if it be too large for this method and if it is associated with any other diseased condition of the bladder such as enlarged prostate, it can be easily extracted by the suprapubic route.

An X-ray photograph is a more certain method of diagnosis than the sound, and has the further merit of not alarming the patient nor affording any chance of infecting his bladder.

It is rare that a **Tumour** of the bladder is a cause of retention, and still rarer that retention is the first sign of its existence.

Bleeding at the end of micturition, preceded by the passage of some clear urine, is an almost infallible sign of tumour. If the tumour gives rise to retention, its radical treatment must at once be considered. Such cases demand surgical treatment, and can hardly be dealt with in the ordinary course of practice.

An **Abscess** or other inflammatory swelling at the neck of the bladder or anywhere in the course of the urethra is not likely to be difficult of diagnosis. It must be dealt with promptly by incision after the introduction of an instrument to make clear the exact situation of the urethra, which is often diverted by the swelling, and to ensure that no serious damage is inflicted on the urethra in the course of the

incision. Should it be impossible to locate the exact situation of the abscess, an incision should be made in the centre of the perineum as far as the neck of the bladder, which should be lightly divided. Such swellings are usually prostatic in origin and speedily clear up after incision. Delay should never be countenanced or the abscess may burst into the rectum as well as into the urethra and leave a sinus which is very difficult to heal.

Hysteria and **Habit Spasm** must be treated by persuasion, and catheterism never practised except as a last resource. A half-grain suppository of the extract of belladonna in some cases acts like a charm.

The retention after spinal injuries, which is really a condition of overflow owing to a lack of expulsive power, must be treated by regular catheterization. It will need all the skill of the practitioner to avoid sepsis, which is sooner or later almost inevitable. On the slightest indication of sepsis, the bladder should be carefully washed out with sterilized saline; one drachm of ordinary salt to a pint of water is sufficient for all practical purposes. The urethra should be well irrigated at the same time, after which fifteen minims of a five per cent. solution of silver nitrate should be introduced into the bladder and allowed to remain there. This may be repeated if necessary.

The same method of treatment should be employed in the chronic spinal lesions of tabes, sclerosis, etc. These conditions are, however, more amenable to satisfactory treatment, as in their earlier stages at any rate the expulsive power is not wholly absent. The application of the constant current is often of considerable assistance. A current strength of five milliamperes is usually well borne. The negative pole should be placed on the pubes and the positive on the sacrum.

Bacteriuria and **Cystitis** are rarely in their slighter forms a cause of retention. It is only when large quantities of ropy mucus and blood are passed, and great pain is present, that retention ever occurs. Catheterization should never be employed unless the condition urgently demands it, and the bladder requires regular washing out in order to alleviate pain, or to reduce the chances of septic absorption. It cannot be *too forcibly insisted* that the first duty of the practitioner is to discover the organism that has given rise to the cystitis. He must not be content with the diagnosis of cystitis. A vaccine prepared from the originating or master organism will often effect a cure when all other means have failed. It is well to bear in mind that bacillus coli is almost invariably present in these cases, but it often is not the prime cause of the cystitis, and it may tax all the skill of an experienced bacteriologist

to find the master organism. The author has on several occasions referred to an instance of this sort in which he removed an enlarged prostate from a patient whose urine swarmed with bacillus coli and streptococcus, but the cystitis remained. It was not until a few pyocyaneus organisms were discovered in the urine and a vaccine made from them that the patient, who had been a martyr to cystitis for some months, was cured. When the pyocyaneus vaccine was injected a permanent cure was effected in a fortnight.

Incontinence, as has already been stated, is a result of the overflow of urine from an overfull bladder. It is usually a result of enlarged prostate, and when this is the case must be treated by the methods that have already been described in connection with that disease.

In old people of both sexes, however, incontinence often results from mere muscular weakness. In such cases it is rarely constant in amount day by day. It varies with the health, the appetite and the food, and is rather of the nature of a slight leak than a regular and complete condition of incontinence. It is very distressing to the patient, who is often in the enjoyment of fair health and in possession of all his other faculties. Such patients should be encouraged to be careful to empty completely the bladder at each act of micturition. They think they do so, but such is not the case. Their acuteness of bladder sensibility has disappeared, and they are no more responsive to the stimulating effect of urine in the bladder than they are to being tickled on the skin. The application of a constant current at intervals is oftentimes a help to them. If not, a urinal should be worn, but they should be instructed not to rely on it, but only to use it in dire emergency. In women a pessary constructed of a piece of a rubber sponge and inserted in the vagina is often of considerable help in enabling them to retain their urine. Old women with atrophied vaginæ may find it difficult to retain. In younger women who have borne children and often complain of this condition it usually affords complete relief.

The **Enuresis** of childhood usually vanishes when appropriate treatment in the shape of waking the child up at proper intervals is practised; if not, the application of the constant current as before described is generally a satisfactory mode of treatment. Any reflex cause such as constipation, worms, etc., should be carefully searched for and removed.

Hæmaturia always demands a careful investigation in order to locate its exact site and determine its cause. It is never a disease *per se*. It is an indication of some diseased condition that must be found and treated.

Its relation to bladder injury has already

been discussed and appropriate treatment described. If it is due to infection, the symptoms of infection already referred to will dominate the situation and the hæmaturia is merely an incident in the case.

As an indication of tumour, either innocent or malignant, hæmaturia has already been alluded to. The exact diagnosis can only be made with the aid of the cystoscope, and the methods of complete removal of the tumour are beyond the scope of this article. There are instances, however, in which, though the tumour has been diagnosed, its removal for one cause or another has been negatived, yet the patient is suffering severely from pain and loss of blood. Careful treatment can do much to alleviate the patient's suffering. The bleeding may often be controlled by large doses of ergot, or in some instances by the injection of ferropyrin in ten per cent. solution. One drachm may be left in the bladder after washing out with hot water at 120° F.

Where extreme strangury supervenes there is nothing to be done but to open the bladder, preferably by the suprapubic route. These growths are liable to undergo partial sloughing, and the removal of parts of the growth coupled with the local application of styptics is the only means, if morphia is to be avoided, of affording temporary relief.

Other causes of hæmaturia from the bladder are enlarged prostate, varicose veins, cirrhosis, tubercle and filaria. If enlarged prostate is the cause, it is prostate to which the treatment must be directed. Varicose veins are rare but not unknown, and should they give rise to severe bleeding, the bladder must be opened and the clot cleared out. Indeed, it may be safely stated that bladder hæmorrhage of uncertain origin should always be thus treated if the blood cannot be removed by washing out the bladder, for the accumulation of blood in the bladder is always a dangerous, often a fatal, condition. The hæmorrhage of cirrhosis tubercle or bilharzia rarely give rise to much trouble. It is merely an incident in these diseases.

The subject of **Urinary Tuberculosis**, so far as treatment is concerned, must now be regarded as far more hopeful than was formerly the case. It is impossible to speak of the diagnosis from the bladder standpoint alone. It is essentially a disease of the urinary tract and rarely has for its starting-point the bladder. In the male in many cases it starts in the epididymis, invades the prostate and then attacks the bladder. In the female it is more often the kidney that is the first part of the urinary tract to be attacked and the bladder follows later. This same sequence of events may occur in the male as well. Bearing these points in mind,

the next question to be determined is, what are the signs that the bladder is invaded? The first symptom is usually frequency of micturition, coupled, perhaps from the first, or followed soon after by the presence of pus and occasionally of blood as well in small amount in the urine.

The diagnosis is made provisionally by finding some evidence of old tubercle elsewhere in the body in addition to the urinary trouble. It is absolutely established by the presence of tubercle bacilli in the urine. In cases of doubt, some of Koch's old tuberculin should be administered. The patient's temperature should be practically normal when the dose is given—.001 c.c. If no reaction occurs a second dose should be given two days later—.002 c.c., and if no reaction still occurs, a third dose after two days interval .005 c.c. If no reaction occurs after this amount has been administered it may be assumed that the patient is not suffering from urinary tuberculosis.

Treatment must be both local and general. The general treatment is carried out by injections of Koch's new tuberculin; $\frac{1}{50000}$ mg. is administered, and a second dose a week later. The dose is then gradually increased each week until $\frac{1}{500}$ mg. is reached. These injections should be administered once a week for some months, with occasional intervals of a fortnight or three weeks about every three months. At the same time the patient's general health should be attended to. Plenty of fresh air and food must be prescribed, and urinary antiseptics administered as well, especially if the infection is a mixed one. It is possible that a vaccine may be demanded at the same time for some other organisms that may be present in the urine.

It is perhaps going too far to say that a cure can often be effected. It is, however, quite certain that most of the symptoms may disappear, and the patient be restored to health so far as clinical signs and symptoms are concerned for some years at any rate.

W. B. C.

DISEASES OF THE URETHRA

Methods of Examination. These include inspection, palpation, instrumentation and detailed investigation of the source and nature of urethral discharge and threads.

Instrumentation. In this connection a complete revolution of method has taken place in the last ten years. The normal urethra swarms with bacteria in its first inch or so but higher up it is sterile. It has been proved that it is quite easy to sterilize the urethra for a short time by means of antiseptic washes. If this is not done before instrumentation bacteria will

be pushed up by the instrument and planted in the deep urethra and bladder. *It may therefore be laid down as an absolute rule of practice that no instrument should be passed up the urethra until the anterior urethra has been well flushed with an antiseptic lotion.* The best antiseptic wash is oxycyanide of mercury, 1 part in 4000 of water, but if that cannot be obtained boracic lotion may be used. The wash is made up in a douche tin or bag and suspended three to four feet above the level of the patient's urethra. To the tubing of the douche tin is attached a urethral nozzle and shield of which there are many forms on the market.

A pint or more of the wash is allowed to flow into the urethra through the nozzle up against the compressor urethræ, whence it rushes back again and out around the mouth of the nozzle, which is not allowed to block the urethra completely. The hands of the operator must be sterilized and the meatus and the glans penis cleansed with soap and water. An antiseptic lubricant must be at hand. The ideal lubricant is glycerine 20 parts, tragacanth 2 parts, sterilized distilled water 100 parts and oxycyanide of mercury $\frac{1}{4}$ part. This is put up in large tin squeeze tubes. Another good lubricant is vaseline, which can be sterilized by heat and put up in similar tins.

All urethral instruments will withstand sterilization by heat except those made of gum-elastic. Modern gum-elastic instruments will, however, withstand boiling water for a time, so that in emergency the practitioner is advised always to boil his instruments.

For repeated use gum-elastic catheters after they have been rinsed clear of lubricant can be rendered sterile by a twenty-four hours' soaking in 1 in 1000 corrosive sublimate aqueous solution.

Examination to detect the Source of Threads and Pus. The patient must have held water for some hours. The anterior urethra (as far as the compressor) is washed out into a clean glass and inspection made to detect pus and threads. When the washings come away clear the patient is asked to pass water into two glasses. If both are clear the deep urethra is free. If the first contains haze and threads and the second is clear the deep urethra is inflamed. If both are cloudy the bladder is also inflamed. If the cloud disappears on the addition of acetic acid it consists of phosphates and not of pus.

How to Anæsthetize the Urethra. The best drug is novocaine nitrate in strengths of two to four per cent. in distilled water. Suck up a drachm of this solution into a boiled stylo-filler, inject it into the urethra, and get the patient to hold it in for some minutes by

grasping the penis with the thumb and forefinger. The deep urethra can be desensitized by gently stroking some of the solution through the compressor with a finger placed in the perineum on each side of the bulb. Novocaine is ten times less toxic than cocaine.

Never use cocaine for the urethra. The deep urethra is the most sensitive absorbing mucous membrane in the body. Many deaths have been reported from the use of cocaine in the urethra, half a grain being a fatal dose.

Congenital Malformations. The last inch of the urethra may lack a floor, a condition termed hypospadias. In such cases the meatus is often a mere pin-hole which, if neglected, will lead to double hydronephrosis. It should therefore always be cut and an opening of sufficient size formed.

Blind pits lined by epithelium, termed "para-urethral follicles," are common defects. Their mouths open on the glans penis just within or just outside the meatus. Rarely they open at the junction of the glans with the prepuce. They may be several inches deep and are of practical importance as they tend to harbour the gonococcus with great tenacity. In fact such infected follicles can only be destroyed with caustic or the actual cautery. If the tissues round them become indurated, these infected follicles are usually mistaken for a chancre. Their real nature becomes evident when a hole is found in their centre which will admit a probe, and from which pus and gonococci exude.

Rupture of the Urethra.—Rupture of the urethra in the region of the triangular ligament occurs in boys who have fallen astride a beam; less commonly rupture behind the triangular ligament occurs in adults suffering from fractured pelvis.

Inspection reveals blood issuing from the urethra, and extravasation of blood into the forepart of the perineum and scrotum. If the rupture is incomplete the patient may be able to pass blood-stained urine, but if complete he is usually unable to pass any water at all.

Never proceed to examine such a patient with an instrument until all preparations have been made for an operation. Anæsthetize the patient and then make an attempt to pass a catheter into the bladder. If it goes in easily the rupture is incomplete. Tie the catheter in and leave it a week if possible.

If it fails to enter the bladder cut down in the middle line of the perineum between the anus and root of the scrotum on to the end of the catheter. If the upper end of the urethra can be found pass the catheter on into the bladder and reunite the cut end of the urethra around the catheter with catgut stitches. If the upper end cannot be found a second opera-

tion must be performed when further help has been obtained.

In either case leave the perineal wound open so as to permit the drainage of blood and urine. Some authorities advise that the bladder be drained suprapubically, asserting that in this way a stricture is avoided. A troublesome stricture tends to form at the site of suture unless the after-treatment is carefully attended to.

After-Treatment. The catheter is left in for seven days and is then removed. A urethral wash is administered and a steel bougie gently passed into the bladder. This is repeated every week for a month, every fortnight for a month, and then once a month for a year or more. A urotropin mixture should be taken for twenty-four hours before and after the passage of the bougie.

Urethral Calculus.—Urethral calculi are usually of renal origin, but they may come from the prostate. In the adult, the ureter being narrower than the urethra a urethral calculus will usually pass. As it does so it may set up temporary retention of urine and even a urethral discharge. In children, the urethra being narrower than the ureter, a calculus will usually become impacted either at the neck of the bladder or a short distance from the tip of the penis. In the first case the stone should be gently pushed back into the bladder with a lithotrite, crushed and evacuated. In the second case a longitudinal incision should be made in the floor of the urethra directly over the stone, the stone extracted and the wound closed with a few catgut stitches. Such wounds heal rapidly in a few days.

Chronic Inflammation.—Properly to understand the diseases of the urethra the student must conceive the urethra as an epithelial tube surrounded by a vascular fibrous and muscular coat. The epithelium tends to send offshoots into the surrounding tissues. These may be simple tubes in which case they are called lacunæ of Morgagni, or the tubes may branch and rebranch so as to form racemose glands of varying sizes. These glands are the glands of Littré and the glands of Cowper.

Chronic inflammation is generally due to infection with the gonococcus. After the acute stage of the urethritis is over the gonococcus tends to linger in certain places. It may linger in a patch of the subepithelial layer of fibrous tissue, setting up a chronic hyperæmia with increased proliferation of tissue cells. The part thus affected when viewed by the urethroscope is seen as a hyperæmic patch which fails to dilate properly when air is forced into the tube. It is called a *soft stricture* and is seen during the early months of a chronic urethritis. Such a soft stricture should be slowly dilated up to

45 F. with a Kollmann's dilator, and it will then disappear completely. If it is neglected in the early stages it will lead inevitably after months or years to a *hard fibrous stricture*. The hyperæmia disappears, the epithelium becomes smooth and flattened, and the fibrous tissue progressively contracts till only a pin-point can be seen surrounded by a glistening ring of fibrous tissue. If the patch involves only a small portion of the wall a crescent-like stricture is formed on one side of the canal and the canal is not narrowed to nearly so great an extent. In a few cases a long tunnel stricture is formed which can be felt from the outside.

The gonococcus may also linger in a lacuna of Morgagni, or in the lumen of a gland of Littre. In the early stages such infected lacunæ are seen with their mouths surrounded by a hyperæmic ring, with pus issuing from them, and with the deeper parts of the gland forming a bulge in the wall of the canal. If large these infected glands extend into the corpus spongiosum, and can easily be felt against a steel bougie as it lies in the urethra. They may sometimes be cured by regular massage of the anterior urethra on to a steel bougie, but they are most quickly got rid of by destruction with silver stick, or the actual cautery applied under the guidance of the eye through a urethrosopic tube. No cures of chronic urethritis are more startling than these. One treatment may be sufficient to cure a relapsing gleet of many years' standing.

If the mouth of such an infected gland becomes blocked an abscess will form. This may burst into the urethra and resolve, or it may also burst externally and lead to a fistula. Such fistulæ may persist as tracks lined with granulation tissue or may become lined with epithelium. Urine escapes through them during the act of micturition. Infection of glands deep in the perineum may lead to periurethral abscess, urinary abscess, and extravasation of urine.

Rare manifestations of chronic urethritis are warts and polypi, both of which can only be removed by means of the operating urethroscope.

Stricture of the Urethra.—Most cases of stricture are due to a neglected urethritis. Towards the eighth week of an acute urethritis the site of a commencing stricture can be detected through the urethroscope as a hyperæmic patch which fails to dilate under air distension. If dilatation with a Kollmann's dilator be carried out while the stricture is young and soft there is no tendency to a relapse.

Stricture also occurs at the site of a rupture of the urethra (*vide supra*) and congenital narrowings of the meatus are not uncommon.

A stricture acts adversely by setting up back pressure on the bladder and kidneys so that

it leads to such complications as uræmia pyelo-nephritis, calculus and extravasation of urine.

The patient is usually aged thirty to fifty and complains of difficulty in passing water. He has to strain and yet the stream is thin and micturition takes longer to perform and the desire becomes too frequent. There is usually a gleet discharge and the urine contains urethral threads. Pain is not present unless the condition is complicated by cystitis or stone. In neglected cases complete painful retention of urine ensues and in very bad cases there is painless retention with leakage or overflow.

The final attack of retention is often brought on by things which congest the pelvic veins, such as alcohol or cold.

Diagnosis. Below the age of fifty the diagnosis has to be made from tabes and acute gonorrhœal retention; after that age from enlarged prostate.

An accurate diagnosis can only be made by means of the urethroscope. A stricture once seen can never be forgotten, and to make the diagnosis with this instrument is very simple. If a sound be used it is the easiest thing in the world to mistake spasm for stricture, and if a stricture is present false passages will probably be made and the bladder may become infected.

Treatment of Stricture. The best treatment is prevention in the early months of a urethritis, but when a fibrous stricture is present the simplest and safest method of treatment is by slow dilatation as it presents less risks than urethrotomy.

The secret of success is to go slowly, the object being to make the fibres of the stricture tire, as elastic tires. Tearing only leads to the formation of a more obstinate stricture than before.

The largest gum-elastic bougie that will pass is determined. At the next sitting a start is made with that, and it is followed by two, or at most three, larger sizes on the French scale. The sittings are repeated once, or at most twice, a week. When 18 F. is reached steel bougies are substituted for the gum-elastics, a start being made with a 7-9 E. and the stricture is worked up slowly until at least 15-17 is reached, but better results are obtained if a 17-19 can be passed. The meatus will usually have to be cut to permit this, as the meatus is the narrowest part of the canal, and in most men will only take a 12-14 to a 14-16.

When a stricture has been dilated to its fullest extent it may be permanently cured, but in the majority of cases it will recur again unless a bougie be passed periodically. The patient should return every six months and have a bougie passed if he wishes to avoid a

recurrence, and keep his kidneys free from back-pressure. If after some years there is clearly no tendency to recurrence he can cease to attend.

Other methods of treatment such as internal and external urethrotomy, excision, electrolysis, ionization and so forth do not fall within the scope of this article.

Retention of Urine.—*Common Causes.* In males: acute urethritis, stricture, tabes and enlarged prostate. In females: retroverted gravid uterus, pelvic tumour, disseminated sclerosis and hysteria. In children: phimosis and impacted urethral calculus.

Rarer Causes. Reflex retention after operations—bladder tumours, foreign bodies—muscular atony, which may be due to over-distension or to various poisons such as acute specific fevers, belladonna or lead. The cause is usually discoverable if a careful systematic examination be made with these facts in mind.

Treatment. A patient with acute retention of urine should never be treated until he has been put to bed in blankets in a well-warmed room. While preparations are being made for catheterization a suppository of morphia (half-grain) should be given and the patient may then be sat up in a hot hip bath with a blanket round his shoulders. A dose of ten grains of urotropin in a little hot water should also be given as a draught. Meantime preparations are being made for catheterization (see p. 813) in case the hot bath fails to relieve the retention.

In the case of an enlarged prostate the procedure has been described in detail (vide *Surgery of the Prostate*).

In a case of suspected stricture start with a 10 E. olive-headed gum-elastic catheter and work down to 4 E. If none of these will pass try fine bougies. If one of these passes leave it in and the urine will dribble away alongside of it. If not suprapubic puncture must be performed (see p. 823) and repeated till further help can be obtained and urethrotomy be performed.

In the case of an acute urethritis if the hot bath fails it is found by experience that the best procedure is to pass a catheter. The bladder wall is very resistant to infection with the gonococcus and the deep urethra and prostate are already infected. The only risk is that epididymitis may follow. Such patients are always feverish and they ought to be kept in bed till the fever subsides.

In a case of retroverted gravid uterus a catheter must be passed and repassed every four hours for some days, until the uterus rights itself naturally. If it fails to do so it must be replaced under anæsthesia.

In the case of reflex retention after an operation pass a catheter and when the bladder is empty

inject half an ounce of a two per cent. solution of boro-glyceride into the bladder and leave it there. In a few hours the bladder will empty itself spontaneously and will give rise to no further trouble.

Extravasation of Urine.—This may occur after traumatic rupture of the urethra, but it is usually seen after spontaneous rupture of the urethra behind a stricture. It may also arise from the rupture of a perineal abscess into the surrounding tissues, in which case a stricture need not necessarily be present.

A gangrenous cellulitis ensues and the urine and inflammatory exudate spread forward in front of the triangular ligament into the subcutaneous tissues of the perineum, scrotum, penis and abdominal wall. The patient exhibits the signs of profound toxæmia. Prompt operation will save nearly every case, especially if spinal anæsthesia be employed, as it minimizes the risks of uræmia and of lung and heart complications.

An incision is made in the middle line of the perineum between the root of the scrotum and the anus, which is deepened until a stinking gaseous abscess cavity is struck. If a large tube is inserted into the cavity, which communicates with the bladder, there is no need whatever either to explore the urethra with an instrument or to try to force a way into the bladder.

Attempts to explore the urethra and bladder add to the length of the operation, lead to unnecessary laceration of parts and achieve nothing that is not already achieved by the simple central perineal incision. Multiple small linear punctures should now be made with a sharp-pointed curved bistoury through the skin and down to the infiltrated cellular tissues all over the scrotum, penis and abdominal wall, as far as the cellulitis extends. There is no need to place tubes in these incisions as the fluid draws away much better without.

Effusion is encouraged by means of large boracic fomentations and hot lysol hip baths, and the patient's vital forces must be conserved and encouraged in every way.

A week or ten days later, when the acute crisis is over and the patient's general condition improved, internal urethrotomy can be performed in the usual manner, and a catheter tied into the bladder. The wounds then heal up rapidly and nought remains to be done save the regular passage of steel bougies.

Urethral Fistulæ.—Fistulæ may be the result of operations such as external urethrotomy and perineal prostatectomy. Spontaneous fistulæ nearly always result from a previous urethritis, which has left behind a chronic infection of one or more urethral glands, such as the glands of Cowper or Littre. After years the dormant bacteria may break forth afresh and give rise

to an abscess which, if it bursts simultaneously into the urethra and to the outside, will give rise to a fistulous track lined by granulation tissue. If such a track be neglected it may in time become lined with epithelium. Strictures usually coexist. The treatment for fistulæ is urethrotomy combined with thorough scraping of the fistulous tracks. A catheter is tied into the urethra for a week or ten days, by which time the fistulæ should have healed. Steel bougies must be passed at regular intervals as described above in the treatment of strictures.

F. K.

SURGERY OF THE PROSTATE

The diseases of the prostate gland are inflammatory conditions, tumours, cysts and calculi; but in everyday diagnosis the practitioner has only to think of the two common classes of disease, namely inflammatory conditions and tumours. Inflammation of the prostate is commonly seen in young men, whereas tumours will seldom be met with before the age of fifty.

Inflammation of the Prostate (Prostatitis).—Inflammation of the prostate is the result of invasion of the gland by bacteria. Bacteria reach the gland most commonly by ascent of the urethra, the gonococcus being the best-known example, though cases of primary staphylococcal or streptococcal urethritis are met with in which the bacteria likewise ascend to the prostate. Bacteria may also be carried up to the prostate on an instrument; or they may reach the gland by way of the blood-stream. Important predisposing causes are sexual or alcoholic excess, prolonged or habitual horse-riding, bicycling, or motoring.

Pathological Considerations. When the gonococcus reaches the prostatic ducts and acini the blood-vessels pour forth an inflammatory exudate into the acini and interstitial tissues. The prostate, therefore, swells and grows hot to the touch, and if the inflammation is very acute the walls of the acini will be broken and a large abscess be formed. If an abscess forms it will burst sooner or later into the deep urethra. If it has not burst it can usually be made to empty into the urethra by the steady pressure of a finger inserted into the rectum. It is seldom that a prostatic abscess requires an incision for drainage. Occasionally neglected abscesses burst into the rectum, or into the perivesical cellular tissues.

In most cases, however, no definite abscess can be felt, and after a time resolution may occur, the exudate be absorbed, and the gland return to its original state; but this can only be expected in about ten per cent. of the cases, and does not occur in any case till at

least eight weeks from the onset of the acute urethritis. Most commonly resolution does not occur, but a balance of power is established between the opposing forces; the gland produces a little muco-pus, but not enough completely to destroy the invading cocci; the coccus almost ceases to irritate with its poisons, and lives quietly on in the hope of being conveyed to fresh soil. Many victims at this stage consider that they are cured, paying little attention to the slight stickiness or minute bead of muco-pus seen in the mornings, on rising, at the end of the penis. They become "gonococcus carriers," and may spread the disease.

In such cases the practitioner should picture the prostate as a fibrous sponge full of muco-pus, which can most quickly be made to return to the state of health by being regularly squeezed out, a process which permits a fresh exudate from the blood-vessels, charged with bactericidal bodies, to enter the meshes of the sponge and destroy the intruder.

Clinical States. Prostatitis may be acute or chronic. The chronic is usually preceded by an acute attack, but may come on insidiously.

Acute Prostatitis.—A patient with acute prostatitis gives a history of having had connection some ten days to three weeks previously. This was followed by urethral discharge, which was neglected for a week or ten days, or was treated purely with internal remedies. If injections have been used it will usually be found that they were begun too late or were too strong or too weak, or were not used often enough. Unfortunately it has been the fashion to teach that if a patient with urethritis is seen early, he ought not to be given injections for ten days or a fortnight. Under such treatment the precious time is lost during which the disease is confined to the urethra in front of the compressor urethræ, during which time injections can get at the whole extent of the disease and cure it. Injections given in the early stage cannot "drive the discharge back" unless they are too strong or too weak.

When the disease has spread to the deep urethra it affects the prostate in practically every case. No fresh symptoms may arise to mark the time of this spread, but usually the following symptoms are noted. The frequency of micturition is increased, night and day; there is burning pain, worse at the end of micturition; chordée is intensified and there may be a few drops of blood at the end of micturition. Very often there is fever at night, and the temperature may go up to 104° or 105° F. *Fever is not a noticeable feature in gonorrhœa unless the prostate is affected.* Coincident with these symptoms the yellow urethral discharge often ceases for some days, so that a mistaken diagnosis may

be made of cystitis, stone in the bladder, or even tuberculosis. Joint complications are common at this stage and *never occur in the absence of prostatitis*. When joint troubles arise the urethral discharge often disappears for weeks at a time, as the condition is one of septicæmia. This fact deserves to be more widely appreciated.

The acute stage usually lasts some three to five weeks, and if much fever is present the patient will feel so ill that he will have to keep to his bed, but many cases run a much milder course and the patient may be able to keep about and at work. Any indiscretion in this acute stage is very likely to be followed immediately by epididymitis, as the blood resistance is in a very unstable state, and prolonged "negative phases" are easily produced. Such indiscretions are prolonged walking, violent exercise of any kind, dancing, alcohol, sexual excitement, and last but not least the injection of vaccines. *The practitioner who uses vaccines in the acute stage will sooner or later have cause to regret it.* The ideal state, then, for the patient would be complete rest in bed, but this can seldom be enforced unless there is marked fever.

After three to five weeks the acuteness of the disorder dies down, and either the disease clears up or passes into the chronic stage.

Chronic Prostatitis.—In the majority of cases the symptoms are very slight. The patient may complain of a gleet, a mere drop of sticky secretion, yellowish, white or almost clear, that can be squeezed out of the urethra in the morning on rising, or at each micturition. Others will state that they see nothing at the meatus for weeks, months, or even years at a time; then some indiscretion in diet, or too much alcohol, riding or copulation may bring out a yellow discharge which lasts for a day or two and then dies away again. The patient may also complain that he notices threads in his urine. Many complain of a tickling sensation in the urethra, or a feeling of dampness, and of a teasing desire to pass water once or twice at night, and too often in the daytime. Pain is not commonly a feature, but when present it may simulate that of other complaints. It may be felt in the urethra one inch from the end of the penis, deep in the perineum, and at other times it is referred to distant parts, to the vas and testicles, to the back of the loin and down the legs. It is usually a dull aching pain which lasts for hours and is made worse by prolonged sitting or riding, but colics have been described.

Pain in the joints, sciatica, lumbago, or pain in the muscles of the neck are common, and are the result of the absorption of gonococcal poison; and a certain number of cases of chronic osteo-arthritis will be found to have inflamed

prostates, and can be cured by treatment of these.

Sexual symptoms, such as nocturnal emissions, are frequent, and the discharge may appear to be purulent or even blood-stained. Natural cure often occurs after a bout of constant wet dreams. Other sexual symptoms are premature ejaculations, prostatorrhœa, imperfect erection, diminished vigour, sexual hypersensitiveness, painful ejaculation and sterility, and sexual neurasthenia.

Chronic prostatitis is one of the commonest diseases in large towns, and its existence is of great social importance. The man with prostatitis is a "gonococcus carrier," the result being chronic invalidism and often sterility of the wife; blindness for the children; stricture for the man; and chronic arthritis for both man and wife.

Diagnosis. The diagnosis is made as follows:—A douche can or bag, to hold two to three pints, is hung up some three to four feet above the patient's penis. Into this is placed a clear antiseptic solution, namely oxycyanide of

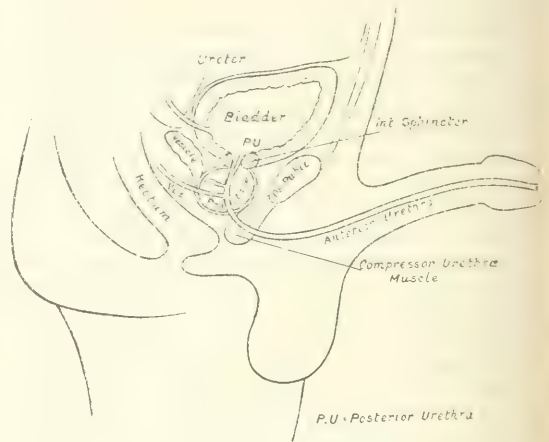


FIG. 1.—Diagram of the Relations of the Prostate.

mercury, one part in four thousand of warm water. A urethral nozzle is attached to the tubing of the douche can. The patient, having held water for some hours, reclines on a couch with a receptacle held under the penis. The doctor washes out the first six inches of the urethra with a pint of fluid. The fluid being unable to pass beyond the compressor urethræ, penetrates as far as the bulb, and then rushes back into the receptacle, carrying with it all the pus and threads from the anterior urethra. The receptacle is emptied into a tall conical glass and the washings inspected for haze and threads. The urethra is then washed again and the returned fluid inspected in a second glass, and so on until the washings returned are quite clear. It is now certain that the anterior

urethra is clear of pus and threads. The patient is then instructed to pass water into two glasses. If both are clear this is proof that the posterior urethra is not infected. If the first contains maze and threads and the second is clear it is certain that the deep urethra is infected but the bladder is clear. If both are hazy it is evidence that the bladder is also infected. If the deep urethra is infected there can seldom be any doubt that the prostate is also involved. To confirm it proceed as follows:—Insert a gloved finger into the rectum. The prostate may at once be felt to be swollen, hot and tender, and at one spot a large projecting abscess may be felt. *If it is too tender no further examination*

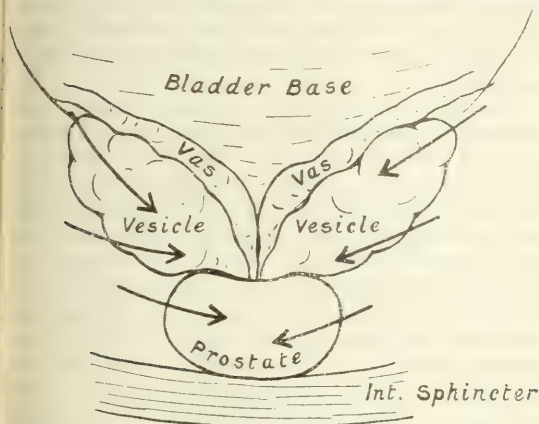


FIG. 2.—Directions in which to Massage the Prostate.

should be made, but if not, make gentle pressure with the finger from the outer limits of the swelling forwards and inwards towards the urethra. After a certain number of such squeezings it will be found that a drop or more of opalescent fluid has appeared at the meatus. This is prostatic fluid. It is caught on a microscope slide, spread out as a film, fixed by gentle heat, stained with methylene blue, washed, dried, covered with cedar oil and inspected with a $\frac{1}{12}$ oil-immersion lens.

Healthy prostatic fluid consists of little else but droplets of fat (lecithin) suspended in a clear fluid. These are seen in the film as blue amorphous particles of varying sizes. Here and there an epithelial cell may be seen, but *pus cells are remarkable by their absence*. In prostatitis the film of prostatic fluid contains a *large number of pus cells*. This is the diagnostic feature. It is uncommon to find either gonococci or other bacteria in a stained film unless the examination be made as the acute stage is coming to an end, and it is usually only possible to isolate the bacteria by repeated cultures on suitable media.

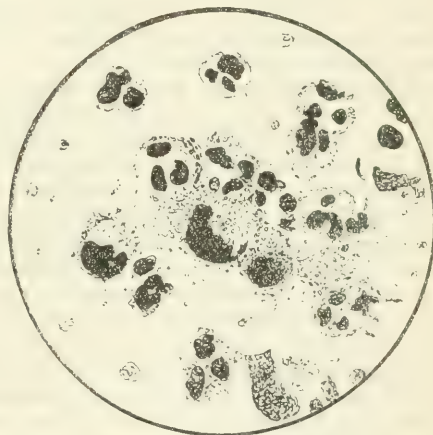
Prognosis. Spontaneous cure is not common until the disease has lasted for years.

After some years it tends to die out if no fresh infection occurs, but it often leaves behind a fibrous prostate and strictures. Adequate treatment such as that described below will cure the majority of cases within two to three months.

Treatment of Acute Prostatitis. The treatment of acute prostatitis may be summed up in the one word "rest." While the disease is



A



B

FIG. 3.—Prostatic Fluid: (A) Healthy; (B) Purulent.

in the acute stage (three to eight weeks from the onset of the urethritis) the defensive mechanism of the body is in a state of highly unstable equilibrium in its response to the gonococcal poisons. Active exercise, sexual excitement, or alcohol are enough to flood the circulation with an overdose of the poison from the inflamed areas. The result is a prolonged "negative" phase followed by a "positive" phase. During the "negative" phase the disease spreads with

great rapidity to the testicles and joints. If the patient lies quiet in bed the blood resistance remains at a more uniform level, so that complications are far less likely to occur.

Absolute rest in bed must be enforced if the urethritis is very acute, if there is fever, if the prostate is very much swollen and tender, or if the testicles and joints are acutely inflamed. This need not, however, be insisted upon in the less acute cases, but though the patient is allowed to be up and about he should be advised to model his existence as much as possible on the ideal of complete rest. The practitioner should write down the following directions on a piece of paper:—"No alcohol; no sexual excitement; no horse-riding, bicycling or prolonged motoring; no active exercise of any kind, no dancing, no overwork, no late bed-going. The diet should contain nothing that stings the mouth, *e.g.* curry, mustard, horse-radish. Drink should be plentiful for its flushing action on the kidneys and should consist of mineral waters, lemonade, barley-water, tea, coffee or cocoa. Ginger beer is barred under the diet heading." The patient should be warned of the dangers of complications if he breaks these rules. A well-fitting suspender should be worn.

Pain is best met by the application of local heat, or by means of hot baths. If excessive it requires the free use of anodyne drugs. Chordee is usually checked at once if the patient empties his bladder.

Sandalwood oil should only be used if the bladder irritation is excessive, as it is liable to upset the stomach and kidneys. Potassium citrate in twenty-grain doses is the best drug for routine use, and may be combined with hyoscyamus (twenty minims of the tincture), and be made up with the infusion of buchu or triticum repens. The bromides and belladonna prove useful in painful cases, but must be carefully watched for harmful effects.

The only local treatment permissible is a mild injection or irrigation for the anterior urethra only, such as potassium permanganate 1 in 3000 or albargin 1 in 1000. This serves to keep the discharge under control, and may often stop it altogether. Treatment applied to the deep urethra at this stage, except in the hands of experts, is more likely to make matters worse and is not likely to cut short the disease.

Vaccines should never be used in a case of acute prostatitis, as even in minimal doses they are likely to set up too profound a negative phase, which results in epididymitis, arthritis, and septicæmia. *The practitioner cannot be too carefully warned about this.* The directions sold with the bottles state that vaccines are to be used for chronic gonorrhœa, but not sufficient stress is laid on the word chronic.

At the end of six to eight weeks from the onset of the urethral discharge the disease tends either to clear up of itself or to pass into a chronic state. At this critical period in the case a week or ten days at the seaside may just turn the scale in the patient's favour by raising his general resistance, and enable him to throw off the disease.

Treatment of Chronic Prostatitis. In the treatment of chronic prostatitis all the above general rules of conduct must be adhered to, save that exercise may now be permitted, but alcohol in any form must be absolutely interdicted till the cure is complete. The patient must be encouraged to "get fit" and "keep fit," regular open-air exercise being of the utmost importance, and he must be prevented from brooding on his condition by means of cheerful suggestion.

To assist in maintaining the general blood resistance tonics should be prescribed, and now is the time for vaccines. Vaccines should be given at first in small doses every five days, starting with one million of a potent strain and working up to ten millions, the clinical effect being carefully noted. If no bad effects are produced the doses can be worked up to fifty millions, at intervals of ten days. Autogenous vaccines are best, but a good mixed stock vaccine is always worth trying. Weak strains are used by some surgeons in doses of 1000 millions or more, but it is better to use small doses of a strong strain. Good effects can only be expected from vaccines in about twenty-five per cent. of the cases. In most cases they will cause profuse discharge to disappear, but if the prostatic fluid be carefully tested it will be found still to contain pus and bacteria, and a relapse will occur sooner or later; but as this may not be for many months after all treatment has been suspended, the results to a casual observer will appear much better than they really are. A man cannot be scientifically passed as cured until the prostatic fluid is microscopically free from pus cells, the urethra is seen by the urethroscope to be free from strictures and inflamed glands of Littre, and the man has gone for at least three months without relapse, living his ordinary life and drinking alcohol. The practitioner should hesitate to accept any conclusions from published results, unless it is stated that such tests have been applied.

Local Treatment. This is absolutely essential if a cure is to be obtained. The prostate, being like a slack sponge full of purulent fluid, must be emptied by squeezing in the way already described, two or three times a week. The patient passes water immediately afterwards and clears the urethra. A topical application must then be made to the deep urethra, and is

most easily performed by means of the Ultzmann catheter and syringe, which can be boiled and kept ready for use in a dish of lysol and water. The catheter is lubricated and passed through the compressor urethræ, the syringe is then attached and its contents discharged into the prostatic urethra.

The best applications are increasing strengths of silver nitrate in water, rising from one grain up to twenty grains to the ounce.

Massage and deep applications should be continued twice a week for six weeks. The prostatic fluid should then be tested. If it still contains much pus it may be advisable

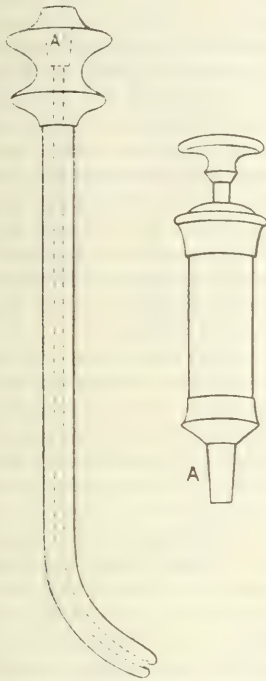


FIG. 4.—Ultzmann Syringe.

to continue treatment, but if not it is better to give the urethra and prostate a rest for a time, as the disease may often clear up after a month's rest.

If treatment is pursued on these lines there are few cases of chronic prostatitis that will not respond. Cases that resist a three months' course require further special treatment with Kollmann's dilators and the urethroscope, but a description of these does not come within the scope of this article.

Tumours of the Prostate.—The common tumours of the prostate are benign fibro-adenoma (ninety per cent.) and carcinoma (ten per cent.). It is very rare to meet with a tumour of the prostate in a man under fifty years of age. Symptoms only arise when the tumour causes obstruction to the flow of urine.

The results that follow from this are distension of the bladder, with hypertrophy and, later, atony of its muscle-wall; pouching; infection and stone formation in the stagnant pouches of residual urine; back-pressure on the kidneys; secondary infection of the kidneys either from the blood stream, or as the result of unclean instrumentation; raised intra-abdominal tension, leading to hernia and hæmorrhoids; raised blood pressure and hypertrophy of the heart.

In carcinoma the malignant cells invade the surrounding tissue spaces, the pelvic and lumbar lymphatic glands, the bones and viscera.

Clinically most cases of prostatic enlargement can be divided into three groups—"the irritated bladder," "the blocked bladder," "the leaky bladder."

"The Irritated Bladder."—The patient complains that for many months he has had repeated calls during the night to rise from bed and empty the bladder. His bladder has also been irritable in the daytime, but he has felt no pain. He has also noted that micturition takes longer to perform, and that the stream is poor.

In such a case the differential diagnosis has to be made by considering the common causes of increased frequency of micturition.

1. *The frequency of quantity: permanent*, from diabetes or chronic nephritis; *temporary*, from error in diet or drink, from worry, overwork or sexual excess.

2. *The frequency of irritability: mechanical*, from stones, tumours, foreign bodies, urethral obstruction; *bacterial*, from the presence of pus in the urine.

3. *The frequency of physical defect: over-stretched giant bladder*, caused by stricture, tabes, enlarged prostate; *dwarf bladder*, caused by inveterate cystitis.

"The Blocked Bladder."—The history is one of periodic attacks of complete retention of urine, accompanied by great pain above the pubes, set up by cramp of the still potent bladder muscle. Anything that produces congestion of the pelvic veins will bring on an attack, such as excess in eating or drinking, sexual excess and chill. Between the attacks the bladder may be unduly irritable and the stream be poor.

The differential diagnosis is made from other causes of complete retention of urine in men.

1. *Urethral: in the lumen*, stone, foreign body, pedunculated bladder growth; *in the wall*, stricture, urethritis.

2. *Vesical: diseases of the nervous system*, such as tabes.

"The Leaky Bladder."—The patient complains that he cannot hold his water, that every few minutes a little water dribbles away quite painlessly and without straining, wetting his

bed and his shirt and trousers. He is usually troubled with "lumbago" or "backache," has lost flesh, has no appetite, vomits occasionally, and is afflicted with great thirst, all of which are signs of renal back-pressure and renal inadequacy. Examination reveals a large dull hypogastric tumour rising out of the pelvis towards the umbilicus, a tumour which in a male can rarely be anything else than a distended bladder. There is, in fact, retention with overflow, but there is no pain because the bladder muscle is worn out and is unable to pass into cramp.

The differential diagnosis has to be made from consideration of the causes of incontinence of urine.

1. *False incontinence*: i. e. retention with overflow, practically stricture, tabes and enlarged prostate.

2. *True incontinence*: (a) active, i. e. causes of increased frequency of micturition (*vide supra*); (b) passive, diseases of the nervous system, overstretched sphincter.

Diagnosis. So far the practitioner can have only a strong suspicion of what is wrong: he must confirm the diagnosis by rectal examination, which should be made after the patient has tried to pass all the water he can. Three questions must now be asked. Is the prostate enlarged? If so, is it a simple or a malignant enlargement? Is there a large amount of residual urine in the bladder, which can be detected bimanually? The question of residual urine can thus be easily settled without resort being had to a catheter. A simple adenomatous tumour of the prostate is soft, smooth and elastic, whereas a carcinoma is hard, often fixed to the sides of the pelvis, and may present definite isolated hard nodules of growth running up along the back of the bladder above.

In a certain number of cases no enlargement can be felt. This does not necessarily mean that the prostate is not enlarged. The enlargement may be pushing its way up into the bladder, as a so-called "middle lobe." These "middle-lobe" cases can only be diagnosed by the cystoscope.

Do not pass a catheter at the first visit to estimate the residual urine. The mortality after a first catheter carelessly passed is as high as after operation. The only call for a catheter at the first or second visit is painful and complete retention of urine. In no other circumstances is it wise to pass a catheter till more has been learnt about the case by watching it. If the patient chooses catheter life rather than operation after the case has been fairly put to him, or if operation is contra-indicated, then comes the time to start catheter life, and this is the right time to estimate the amount of residual urine, so that the doctor may judge

how often the catheter should be passed in the twenty-four hours.

A common diagnostic trap should be mentioned. The patient, though over fifty, may be suffering from urethral stricture. The question can only be satisfactorily settled by the urethroscope, with which instrument strictures can be seen; whereas with the catheter it is easy to mistake spasm for stricture and make a false diagnosis.

The urine should be tested for the presence of albumin, blood and pus. More important still is it to measure the amount of water excreted daily for some days, and the amount of urea. Persistent polyuria is the first sign of renal inadequacy. It is only in the last stages of the disease that persistent oliguria is met with, which passes at length into complete anuria. If the kidneys fail to secrete daily at least sixteen grammes of urea the outlook is bad. Examination is made to exclude or detect other signs of commencing renal failure, such as wasting, subnormal temperature, thirst, intermittent attacks of vomiting, headache, and high blood pressure. In this way facts are obtained which are essential for giving a prognosis and determining what line of treatment should be adopted.

If there is pus in the urine this may be due to coexisting urethritis or to a cystitis, but if the pus is coming from the kidneys (pyelonephritis) evidence will be given by attacks of pyrexia with rigors, profuse sweatings, rapid wasting and by the increasing prominence of the signs of uræmia.

Treatment. Treatment falls naturally under two headings. First the procedure to be adopted at the first few visits, secondly the question of what is to be done afterwards.

At the first visit determine to which of the three clinical classes the patient belongs. Label him. Is he merely complaining of irritability of the bladder: if so, what is to be gained by passing a catheter? Prescribe bladder tonics—ergot, strychnine—so long as his general blood pressure is not too high. If it is too high, prescribe bladder sedatives, such as buchu, combined with helmitol or urotropin.

If, however, he is complaining of *painful complete retention of urine*, a catheter will almost certainly have to be passed. But there is always time to go home to fetch the catheter, and meanwhile give thirty minims of laudanum by the mouth and give orders that the patient be put to bed in a warm room. When the room is warm, he is to be placed sitting up in a hot hip bath with a blanket round his shoulders, which will relieve his pain and will often enable him to pass a little water. He should never be left alone while in a bath, as there is risk of sudden fainting fits. By this time the practitioner will

have arrived back with his complete outfit for passing a catheter in the proper manner.

The outfit must include the following articles : (1) A douche tin or india-rubber douche bag to hold two pints; (2) six feet of rubber tubing and a clip; (3) a tin jug in which to make up a wash; (4) material for making up an antiseptic wash; (5) a urethral nozzle of some kind; (6) a sterile lubricant; (7) a suitable catheter; (8) some arrangement for sterilizing the catheter.

The best lubricant is made up as follows:—glycerine 20 parts, tragacanth 2 parts, oxy-cyanide of mercury $\frac{1}{4}$ part, sterilized distilled water 100 parts. This is put up in ordinary tin squeeze tubes, and is easily carried about and always ready for use.

A No. 9 or 10 (English scale) gum-elastic coudé is a good form of catheter, but perhaps the best of all is the "Marshall," made by Bell and Croyden, with a hard olivary tip, a flexible shaft and a large eye. The latter can be boiled many times, and indeed most of the best instrument makers now turn out gum-elastic catheters that can be boiled. Porgés white gum-elastic is as good as any of them.

After a catheter has been cleaned and dried it is best put away in a "paraform" sterilizer. A catheter can be carried about anywhere in this, where it lies constantly in dry formalin vapour. In emergency work the practitioner is advised always to boil his catheter just before use.

The normal urethra swarms with bacteria in its first three inches, but higher up it is sterile. The urethra must, therefore, be washed out before a catheter is passed. The best antiseptic wash for this purpose is oxycyanide of mercury, one part in four thousand of warm water. This drug may be obtained in tabloid form. If it is not to hand a fifteen-grain tabloid of chinolol dissolved in a quart of warm water makes an efficient and non-irritating wash, as does a solution of lysol, half a drachm to a quart.

The douche bag or tin is filled with two pints of wash and suspended by a nail or held by an assistant some two or three feet above the level of the patient's penis as he lies in bed. Clipping the rubber tubing with the first finger and thumb just above the urethral nozzle which is attached to the end of the tubing, the practitioner places the nozzle just inside the urethra and allows a gentle stream to flow into the urethra and back again around the nozzle into a receptacle placed beneath the penis. The urethra, as far as the compressor urethræ, is in this way flushed with a pint or more of the wash, and is rendered sterile for the time being.

The catheter is now lubricated and passed into the bladder. Not more than twenty ounces of urine should be withdrawn, as if the

bladder is completely emptied the sudden relief of pressure may act adversely in two ways. First, the splanchnic veins may fill up with blood, and the heart, being deprived of sufficient blood, may fail. Secondly, the renal veins may become so engorged with blood from the relief of both intra-abdominal and intra-ureteric pressure that the kidneys may stop work, with consequent anuria. A single catheterization is often sufficient to enable the patient to pass water again naturally. If not, the procedure must be repeated every six hours until the bladder is empty, twenty ounces being drawn off each time.

If the catheter passes into the bladder and nothing comes away, blood clot or less often a stone may be blocking up the eye of the catheter. First try and wash a little antiseptic from the douche bag through the catheter. This may be sufficient to start the flow. If this fails nothing remains but to do either a suprapubic cystotomy or a suprapubic puncture. If a catheter cannot be passed, but false passages are made—as is at once evident by the appearance of blood at the meatus—it is far better to desist and to proceed to suprapubic puncture of the bladder.

Suprapubic Puncture of the Bladder. Take a sharp hydrocele trocar and cannula, or a straight pleural trocar and cannula, boil it, and lay it in an antiseptic solution. Place the patient on his back, shave the pubes and paint the skin with tincture of iodine. Having felt the bladder rising out of the pelvis, place the index finger of the left hand on the upper border of the pubic symphysis in the middle line and then plunge the trocar and cannula, with one bold stabbing movement, vertically downwards into the bladder. Remove the trocar, and urine will immediately pour out like a fountain from the cannula. As soon as it ceases to come forth under pressure, pull out the cannula with a quick movement and seal the puncture with collodion. No aspirator is needed.

This procedure can be repeated as often as required till further help can be obtained, and is freer from risk than catheterization by an unskilled hand.

The best results of all are obtained by suprapubic cystotomy, the blood clot or stones being removed and a large tube being left in the bladder for drainage.

Lastly, if the patient is a leaker, as described above, then it is very unwise to proceed straight away to pass a catheter, as its passage on such a subject is more than likely to be followed by an attack of fatal uræmia. It is far wiser to leave such a bladder alone until the support of a second opinion can be obtained to consult upon the best line of procedure and to put the risks of any kind of interference before the friends.

The patient having been tided over his most urgent symptoms, it remains to be decided how to deal with him afterwards.

General Rules of Conduct for a Prostatic Patient. The worst enemy is chill, and every detail of the patient's life should be gone over with him, any point being corrected where chill is likely to creep in. This means attention to the bedclothes, the clothing, ventilation at home and at work, the getting to and from business, and the question of climate.

Anything that might give rise to engorgement of the pelvic veins must be avoided. Such things are alcoholic and sexual excess, heavy meals and constipation.

The blood pressure should always be measured, and if, as is usually the case, it is excessive (*i. e.* over 150 mm. of mercury) the patient must be warned against the dangers of high blood pressure, and treatment be adopted to keep it within safe limits.

To prevent the onset of hæmatogenous infection of the kidneys and bladder with the colon bacillus, constipation should be avoided, plenty of plain water or Contréxeville water should be drunk daily, and small doses of a urinary antiseptic should be taken regularly, the best being urotropin in three-grain doses three times a day.

In the early stages the patient may go on fairly comfortably for a year or so if these rules of life be adopted, but sooner or later he will have to make his choice between catheter life and operation.

In favour of catheter life is that the patient and his friends think that it is less dangerous than operation, though it is very doubtful if this is a fact, and this may be allowed to weigh in the decision if the patient can afford the time and money needed to secure clean and regular catheterization.

Against catheter life are its constant dangers, constant worry, its waste of time and expenditure, its risk of sepsis, shock, hæmorrhage, uræmia, and the fact that the catheter never cures, but is only a palliative, and can do but little to put off the early death of the kidneys from back-pressure.

In favour of operation is the excellent chance of absolute cure that it holds out now-a-days. The obstruction is completely removed, so that all need for a catheter disappears once and for all. The urine, if previously infected, often becomes clear, the frequent calls to micturate cease, the stream is restored to its normal dimensions and power, and all back-pressure being removed from the kidneys the general health improves in the most remarkable manner.

Against an operation must be set its risks. The mortality in the hands of experts has been

brought down to five per cent., a mortality which is lower than that of catheter life. It has been calculated by Watson that eight per cent. of cases die within the month after their first catheterization. This needs to be driven home in the minds of the public and the profession. The risks of the operation are shock, hæmorrhage, sepsis, lung complications, and most important of all, uræmia. Uræmia is the one that remains most formidable, but this will grow less and less as cases come to be operated upon earlier and to be picked more carefully. The operation may indeed be said to be the most successful in modern surgery when one considers from what miseries it saves the patient.

Contra-indications to the operations are:—(1) Cases of carcinoma; (2) cases when it is proved that the kidneys are incompetent and could not carry on their work if submitted to the strain of the operation; (3) in rich patients who can afford the time and money needed to ensure clean and regular catheterization, and who are unwilling to face the operation.

Operation is especially to be urged (1) when there is a clot retention; (2) when stone is present; (3) if catheterization is difficult or impossible; (4) if the patient is poor and cannot afford catheter life.

As to carcinoma, in a very few early cases it may be possible to excise the growth by Young's method. In other cases the bladder can be left alone if it is able to empty itself. If not, either catheter life must be instituted, or if this is too painful a permanent suprapubic cystostomy must be carried out and an apparatus be worn. It should not be forgotten that many cases of carcinoma run a chronic course of from five to ten years.

F. K.

DISEASES OF THE MALE GENERATIVE ORGANS.

I.—Diseases and Defects of the Testis

Acute Orchitis (Epididymo-Orchitis).—The symptoms differ somewhat according to whether the epididymis or the testis is the more affected. It may be stated generally that the signs and symptoms are more severe with the latter than the former, but suppuration is more frequent in the epididymis. Premonitory symptoms are fever, headache and general malaise. This is followed by pain, which is referred often to one side or other of the lower part of the abdomen. Should the patients desire to conceal the condition of the genitalia, it is easy for the practitioner to be misled by these abdominal symptoms. Soon local swelling and tenderness are manifest, the pain is peculiar and sickening, the parts being exquisitely tender. These signs

may speedily become masked or perhaps hidden by the effusion of fluid into the tunica vaginalis—a symptomatic hydrocele. The scrotum may be red, swollen and oedematous. All the signs and symptoms become worse if the testicle is allowed to hang down, when the dragging, sickening pain in the abdomen is particularly bad. In most cases the temperature remains elevated for several days. Usually the acute symptoms last four or five days, occasionally seven or eight; and in about a fortnight the patient is convalescent. Should the attack occur in the course of urethritis, the discharge diminishes or ceases, returning during the convalescence, a trap for the unwary. If both sides are attacked, they are affected one after the other, not simultaneously. Hardness and thickening persist for some months afterwards. Atrophy occurs slowly and not infrequently, especially in young subjects; occasionally the gland remains permanently enlarged. In urethral infections it is not infrequent for a hard nodule to remain permanently in the cauda epididymidis, leading to sterility.

Treatment. The patient must be put to bed and have the scrotum raised and supported with a pillow and icebag. A sponge-bag makes an extemporary icebag. An evaporating lotion is sometimes employed. Hot lead-lotion dressings and hot fomentations are sometimes used in the early stages. But they are of greater use later, when the initial inflammation has been checked, by increasing the vascularity of the part and aiding the removal and absorption of the inflammatory products. The bowels are freely opened with a purgative, such as calomel and sulphate of soda; and a saline mixture is given three times daily. If there is much pain some tincture of opium can be given, and in plethoric subjects twenty minims of antimonial wine. The diet must be light and easily digested. After the acute symptoms have subsided the testicle can be strapped; and, in any case, a suspensory bandage should be worn for a short time. If obvious suppuration takes place the abscess must be incised. When orchitis occurs in the course of some specific disease, such as malaria or gout, appropriate remedies must be given. In every case attention should be paid to the original source of infection, such as the urethral discharge, after the acute symptoms have subsided.

Chronic Orchitis.—In chronic orchitis the testis is larger and harder than usual. In a few months' time it may be followed by some diminution in size and obvious wasting. Thrombosis of the vessels of the spermatic plexus is commonly associated with it. If such thrombosis is present with an acute orchitis, such as is seen after mumps, the testis may remain permanently enlarged. A chronic

orchitis, especially if of long standing, will abolish spermatogenesis completely.

Treatment. Drugs have little effect on this condition. Iodide of potassium, and perhaps mercury, is given internally; counter-irritation and the inunction of mercurial ointments externally. But the patient will derive greater benefit if attention is directed more to the general health than to the local condition. Fresh air, exercise, change of scene and life, or a voyage, will do much good, although the local disease runs its course. The use of a suspender is often imperative on account of the dragging, sickening abdominal pain which the weight of the testis causes. Sufferers from this complaint often get very depressed mentally, becoming even melancholic.

Syphilitic Disease of the Testis.—The testis is never affected in the *primary* stage of syphilis. In the *secondary* stage the epididymis is affected more obviously than the body of the testis, which is unusual in blood infections. Both epididymes are affected, appearing enlarged and tender with a localised nodular mass in the caput epididymidis. The disease is really an epididymo-orchitis, in which clinically the epididymal factor predominates. The average duration of the syphilis before the incidence of this epididymo-orchitis is about four months. The diagnosis is generally easy from the history, the presence of other secondary syphilitic lesions, the similar and bilateral affection, and its rapid resolution under treatment with mercury.

In the *tertiary* stage the testicle is subject to two pathological invasions: a diffuse gummatous infiltration and the formation of a localised gumma, or gummata. These processes cause a form of epididymo-orchitis, but it is the testis rather than the epididymis which bears the brunt of the trouble. A testis affected with tertiary syphilitic disease is often called a sarcocoele.

Symptoms. The testis enlarges slowly, insidiously and painlessly, until its size and weight cause the patient to seek advice. In shape it is usually globular and pyriform, with a smooth surface. It is heavy, painless, hard and resistant to the touch, and generally devoid of testicular sensation. The skin of the scrotum may be adherent to it, and may even present a gummatous ulcer and hernia testis. A small hydrocele is often present. As a rule one testis only is affected, rarely both simultaneously; and the testis of the other side may become affected whilst the patient is under treatment for the first.

Treatment. The treatment of syphilitic diseases of the testes is the same as the treatment of the same stage of the disease elsewhere. It is beneficial to give mercury, by local inunction, as well as iodide of potassium. It is a good

plan to paint the skin with iodine three or four days before the incision, as it becomes more vascular and absorbs the drug quicker. The iodide of potassium should be commenced in five-grain doses and gradually increased to thirty grains three times a day. Iodipin, iodine and oil of sesame may be given in five-grain tablets, three times a day.

Tuberculous Disease of the Testis.—Tuberculosis of the testis is a replica of the same disease which we know by the name of phthisis in the lungs. There are three chief channels through which the testis can be infected: the lymphatics, the blood-vessels, and the vas deferens, besides infection by direct extension. It may occur as a primary disease, as secondary to tuberculosis elsewhere, or as an incident in general miliary tuberculosis.

Symptoms. Gonorrhœa and general excesses undoubtedly dispose to tuberculosis of the testis. Clinically the disease can be divided into three stages, which may be distinct or may overlap. The *first* is the stage corresponding to the deposit and fibrosis of the tubercle; in all probability it will be unnoticed by the patient.

In the *second* stage the tubercle undergoes caseation. At first it increases in size and becomes harder; then it softens in places as the caseous material breaks down. In the epididymis the skin soon becomes adherent and red, later giving way and discharging the cold abscess.

The disease enters on the *third* stage when a sinus is present. In some cases there are many sinuses and ulcers, the intermediate and surrounding skin being ragged, undermined and discoloured. The discharge is thin and watery, containing caseous material. In this third stage of the disease gross changes will commonly be found in the vesiculæ, prostate and testis of the other side, or elsewhere in the body.

Treatment. In the first stage the treatment should consist in local rest, abstinence from sexuality, and a healthy open-air life with plenty of sunshine, fresh air and good food. The local application of mercurial ointments is often beneficial, as is also the internal administration of tonics and cod-liver oil. This treatment should be continued for some time after the apparent cessation of the disease. Iron, arsenic and cod-liver oil are most useful in these cases; the latter being given by itself, the other two together. Methylene blue given in one-grain pills twice daily is sometimes beneficial. Tuberculin injections are often disappointing in these cases. If the disease, instead of quieting down progresses and enters upon the second stage, medical treatment ceases to be sufficient. If caseation has taken place it should be treated as elsewhere, by means of incision and erosion.

If the disease does not settle quickly, the question of castration, of the removal of a largely valueless organ that is a menace to the rest of the body, must be considered.

Even in cases where a careful examination, *per rectum* and otherwise, has been made to exclude the existence of tuberculous disease somewhere else in the body, castration is not always a successful operation. General treatment should be continued after apparent cure. At the present time the operative treatment of tuberculosis of the testis is in an uncertain condition. Both erosion and castration are unsatisfactory. It would appear that if only one testis is affected, castration should be done, and be followed by prolonged medical and hygienic treatment for fear of the disease breaking out elsewhere. When the disease affects both testes, or when only one is present, the conservative operation of erosion is better.

In the third stage castration is done not only for the sake of cure, but in—humanly speaking—incurable cases to relieve the pain, discharges and sleeplessness which the disease may cause.

The treatment of these cases with tuberculin is of value, though often disappointing; it is of most use in the first stage.

Malignant Tumours of the testes are comparatively uncommon, and clinicians have become more and more impressed with the great malignancy of such tumours. Out of 1,080 cases of malignant disease admitted to St. Thomas's Hospital, in only six was the testicle involved.

The process begins generally in the body of the testis; if rapidly growing it is very painful on account of its compressing the testicular tissues within the tunica albuginea. If it grows slowly the tunica albuginea stretches, even to several times the organ's natural size; the clinical course being painless. So long as the tunica albuginea is intact the tumour retains the shape of the testicle, suggesting the diagnosis of sarcocele or gummatous testis which is so often made. The growth itself invades the tunica albuginea, so that some rapid growths are painless and insidious. In fact the practitioner may be called in on account of an abdominal tumour which is in reality a secondary growth.

Malignant disease will be most likely confounded with a gummatous testis or some form of chronic orchitis. Should tuberculosis begin in the body of the testis, it too can be confused with malignant disease. Of the three chief affections of the body of the testicle—malignant disease, gummata and chronic orchitis—the first two will give the greater trouble in the diagnosis. Steady increase in size with pain in spite of treatment indicates growth; painless swelling which diminishes

under full doses of iodide of potassium does not. As the patient's only hope of life lies in the early and complete removal of the disease, time must not be spent in a prolonged trial of medicinal treatment. A syphilitic testis, sufficiently diseased to approximate and be confounded with malignant disease, will have lost all, or nearly all, of its physiological value. Hence there need be no anxiety in risking its sacrifice.

For excision, the only diagnosis required is that of a disorganized testis. No time should be wasted in trying to get beyond this. The treatment consists in early and free removal of the disease. Modern research shows that malignant disease is primarily a local affection, curable by its early removal. Unfortunately, in a very large number of cases the patient and the doctor only decide upon operation when there is no hope of cure, as is shown by the recurrences so often seen clinically.

The testis is one of the most serious situations in which malignant disease is known to occur. It has always been the custom to regard malignant growths of the testis as arising in the body of the gland, but it is now becoming recognized that some growths originate in the epididymis.

Malignant Disease of the Imperfectly Descended Testicle.—It has long been recognized that malignant disease affects imperfectly descended testes. At St. Thomas's Hospital in later years one case of an imperfectly descended testis was found amongst twenty-five cases of malignant disease of the testis—four per cent. It is not the *position* of imperfect descent, but the *condition* of imperfect development associated with it, which leads to the incidence of malignant disease. The possibility of an obscure tumour of the abdomen originating in an imperfectly descended testis, though apt to escape the memory, should be borne in mind.

The Imperfectly Descended Testis.—When a testis fails to descend it is rarely due to the interposition of any mechanical obstruction, but is a congenital defect due to some inability or lack of power of the part to develop properly. Thus failure in the full descent of the testis is comparable to a cleft in the palate in the development of the maxillæ. It is frequently associated with some other congenital malformation, by far the most frequent of which is an inguinal hernia. The testes ought to be in the scrotum in the eighth month of foetal life; certainly they should be fully descended at the time of birth. But development is not arrested at birth; and if the testes are not present then they may appear afterwards. The presence of the testis in the scrotum is a sign that the organ may develop and mature at puberty; its absence, that it will probably not mature fully.

The testis has at least two functions: *one* as regards the race, that of producing an external secretion containing spermatozoa, the spermatogenic function; the *second*, as regards the individual, that of producing an internal secretion which ministers to the maturation and perfection of the secondary sexual characters which constitute the distinctive plumage of the male. One fully developed and descended testis is quite sufficient to ensure the proper production of an external secretion with spermatozoa. Two testes are required to furnish an internal secretion sufficient for the full acquisition of male characters. It is known from many observations that only rarely is the imperfectly descended testis ever spermatogenic. When this very rare spermatogenic function is developed, it appears late, about the age of twenty years, and only lasts one to three years; then it passes away. This is an important fact; because if it is urgent for a man with bilateral imperfectly descended testes to produce an heir, he must be afforded the opportunity at this period. As regards its external secretion, the imperfectly descended testis is of very small account. *The practical value of an imperfectly descended testis lies in its internal secretion.*

In its descent the testis is preceded by a pouch of peritoneum, which forms later the tunica vaginalis and becomes shut off from the peritoneal cavity when the gland has reached the bottom of the scrotum. Should the gland fail to attain this situation, the closure of the peritoneal neck, the processus vaginalis, will fail. Thus it is to be expected that nearly every imperfectly descended testis will be accompanied by a total congenital hernial sac. But this is not always so, because development proceeds after birth; and though the gland may not descend, yet the processus vaginalis may become shut off from the peritoneal cavity. A hernial sac, potentially so at least, is present in four-fifths of the cases.

The next point to be considered is whether it is not better to leave the testis to develop in the position in which it is. Theoretically this may be so, and it is justifiable to watch young children; but practically we find that the imperfectly descended testis is liable to a number of accidents.

The testis has every disadvantage in being left long in its imperfectly descended position. After it is once certain that natural development is not merely delayed, but has failed to conduct the gland to its proper place, operative treatment should be undertaken.

The Significance of Pain in the Imperfectly Descended Testis. Attention was called first to the importance of this subject in 1903. Further and much extended observations

have confirmed the suggestions then put forward.

The symptom of pain in cases of imperfectly descended testis is one upon which great reliance can be placed. The pain meant is not that which accompanies or follows an attack of orchitis, but such as follows upon an effort, apparently coming on spontaneously, lasting from a few minutes to a few hours, and often followed by some swelling of the gland. When severe, these attacks are accompanied by faintness and vomiting. Sclerosis is known to be a very frequent and progressive change in imperfectly descended testes. It is also known to be no congenital abnormality; it must, therefore, be acquired; but how? The explanation is found to a large extent in the pathological causation, torsion, which gives significance to the clinical attacks of pain in these cases. It is very characteristic, particularly in subjects over ten years of age, to have a previous history of attacks of pain of varying duration in the imperfectly descended gland. From observations made during operations, there is no doubt that some degree of torsion of the cord frequently complicates imperfect descent. It is not easy to give statistics on such a difficult point of observation, but it may be stated that a twist will be found in as many as seventy per cent. of these cases. If the twist is increased sufficiently it will cause a stab of pain, which may be momentary or of some hours' duration. In certain reported cases the pain has been relieved during the attack by untwisting the cord. These examples furnish direct proof of the torsion being responsible, pathologically, for the attacks of pain noticed clinically. Further, in cases which give such a history twists of the cord are noticed. This being so, pain becomes very important in the history of these cases, and its occurrence in attacks is sufficient to warrant putting an end to the period of watching.

Torsion of the Testis.—Torsion of the testis has always been regarded as a condition deriving its interest from its rarity. Study of recent cases shows the mistakes that can be made; and if the older literature is examined in this light, cases will be discovered recorded under such diagnoses as hæmorrhagic infarction of the testis, acute thrombosis of the vessels of the spermatic cord, spontaneous necrosis of the testis, gangrene of the testis after hæmatocele, orchitis in misplaced testes, acute hydrocele, etc. It is true that all such cases are not due to torsion of the cord. There is every reason to believe that some cases are due to an infective inflammation of the testicle accompanied by hæmorrhage, as with the pancreas. Both clinically and pathologically, proved cases of torsion present many and

various pictures; so much so, that now cases of acute torsion, subacute torsion, and chronic torsion of the testis are recognized.

The youngest case was found in a baby fourteen days old, and the oldest is rather a doubtful case between seventy-five and eighty years of age. The majority, forty-seven per cent., occur about or shortly after the changes in the testis and spermatic cord which take place at puberty.

The testis on the right side suffered more frequently than the left. In about sixty-six per cent. (two-thirds of the cases) the gland was definitely imperfectly descended. In the remainder, thirty-four per cent., it is either definitely stated or implied to have been fully descended. These figures are in fact of little value, because, from study of the descriptions of the thirty-four per cent. in which the testis is said or implied to have been fully descended, it is obvious that some developmental defects existed. So that an examination of the available examples makes it certain that some developmental defect is present in a much greater proportion than the figure sixty-six per cent. represents. In fact, torsion of the testis would seem to be unusual, apart from such deficiency.

II.—Diseases of the Spermatic Cord

Encysted Hydrocele of the Cord.—The fluid is contained in one or several cysts, resulting from the irregular obliteration of the processus vaginalis. Clinically they form movable translucent cysts, and have but a slight impulse on coughing.

Treatment by tapping and injection may be tried, and is sometimes successful. The cyst is pressed with the forefinger and thumb into the upper part of the scrotum, where the skin is made tense over it. A trocar and cannula are then thrust sharply into it and the fluid evacuated. Through the cannula a few minims of pure carbolic acid are injected through a syringe, and the cyst lightly massaged. The patient experiences a feeling of local warmth, but soon loses it, owing to the anæsthetic action of the carbolic. He should be kept a day in bed. If this fails, or operation is preferred, the cyst is excised through an inguinal incision, the inguinal canal being opened and sutured when desirable.

The Spermatic Veins (Phlebitis and Thrombosis).—Inflammation of the pampiniform plexus is probably more common than most books indicate. The phlebitis is always followed by thrombosis. The cord becomes tender and swollen, a small hydrocele forms in the tunica vaginalis, the scrotum and dartos become thickened and œdematous, the testis becomes enlarged, painful and even inflamed. Next

to gonorrhœal urethritis, injury is the most frequent cause of thrombosis of the pampiniform plexus. But it may follow influenza, gout, rheumatism, typhoid and other specific fevers, etc. It begins with pain, often of a dragging, sickening character, and swelling in the part, accompanied by a rise of temperature and other constitutional disturbances. The patient, besides complaining of pain locally, frequently refers it to his abdomen. He must be put to bed when possible, and ice or heat applied, as seems desirable. The bowels should be opened freely. After a few days the patient will be able to get about, using a suspender bandage. In young men and youths the testis commonly ascends to the upper part of the scrotum into a position of acquired imperfect descent. At the same time it becomes smaller and painful; but sometimes it first enlarges.

Varicocele.—A varicocele is a dilated and tortuous condition of the lengthened and enlarged veins of the pampiniform plexus, which in the inguinal canal join up to form two or three trunks, which in their turn join up later to form one vein. It is a condition which appears, or makes its presence felt, about the period of puberty and early manhood. About ninety per cent. of cases occur before twenty-five years of age. After middle life it disappears and is very rarely seen in old men. The presence of a varicocele is dependent on the sexual activity of the testis.

Treatment consists of two kinds. First of all, only treat those who need it; warning others that little or no harm will result, that they will get better as they grow older, and not to listen to ignorant advice on the subject. With those who definitely complain of symptoms, treatment must be directed in two ways: towards the relief of the local and of the general complaints. Bearing in mind the intimate relationship between the appearance of the varicocele and the onset of puberty, benefit may be derived from advice against incontinence. It is as well to prescribe a suspender bandage, early rising, cold baths, regular healthy habits, exercise and a tonic. If this treatment is unsuccessful, or the symptoms local to the varicocele far outweigh the general and neurasthenic ones, it becomes justifiable to advise operation. But it must be remembered that only the minority of patients require operation. There is now only one operation for this complaint: that by means of the open method and an inguinal incision.

III.—Diseases of the Tunica Vaginalis

The *diagnosis* of a hydrocele is usually easy, but it is necessary not only to recognize it but to exclude certain other things. It is therefore desirable to discuss the subject briefly.

The age at which a hydrocele declares itself is very important for two reasons. Firstly, in infancy the hydrocele is almost always connected with gastro-intestinal fermentation; in childhood and early adult life it is very often concerned with some abnormal condition of the testicle or spermatic cord; later in life it probably arises in connection with the vascular changes associated with the decline of the activity of the testis. Secondly, as a hydrocele gets larger it may stretch and separate the testis from the epididymis.

Treatment. Treatment should always be directed to the cause, such as improper feeding in infants, or diseases of the testis or spermatic cord. When the cause cannot be treated, as in the hydroceles of the elderly, the practitioner is reduced to treating the symptom. This may be done in several ways, which will be considered *seriatim*.

Stimulating ointments sometimes help to cure the hydroceles of children, but never seem to affect those of adults.

Tapping a hydrocele is a purely palliative measure. The position of the testis is ascertained, so as to avoid inflicting an injury to it. The skin is carefully cleansed and a trocar and cannula of suitable size boiled. The surgeon then makes the skin of the scrotum tense with the left hand and selects the site for the tapping. Guarding the trocar with the forefinger of his right hand, it is thrust sharply into the hydrocele in an upward and backward direction. The trocar is withdrawn and the fluid evacuated, after which the cannula is withdrawn and the wound sealed with wool and collodion. Amongst a number of cases the longest period between theappings was two years. The shortest, was six weeks, in a youth of seventeen. The average period between theappings, for the 234 instances, was about six months.

Although tapping is a purely palliative measure, its repetition often gives complete satisfaction to patients of the well-to-do class.

Tapping and Injecting. Injecting is easily combined with the former operation and very considerably improves the results, whilst it gives little more trouble to the patient. The best substance to inject is pure carbolic acid, that is to say, ten parts of carbolic acid to one of glycerine. The little operation is conducted as in the first stages described under tapping. But after the fluid is evacuated the cannula is not withdrawn; and a syringe, which fits it, is filled with half a drachm to a drachm of a solution of ten parts of carbolic acid to one of glycerine, which is injected into the cavity of the tunica vaginalis. The patient experiences no more than a sensation of warmth. The cannula is withdrawn, the wound sealed, and the scrotum manipulated to allow the carbolic

to come in contact with all parts of the serous membrane. The patient should remain in bed for at least a day.

Spermatoceles and Hydrocles of the Testis.—The name hydrocele is applied to certain cysts which arise in connection with the testis. That of spermatocele is reserved for those cysts which contain spermatozoa. The fluid within the latter is either milky or opalescent; sometimes the spermatozoa are active, at others quiescent, frequently they are broken up into heads and tails; and, finally, there is reason to believe that they can disappear altogether. In consequence there is no line of demarcation between spermatoceles and hydrocles of the testis. They are very rare before puberty, slowly becoming more frequent as life advances. Clinically, they exist in three varieties: small multiple cysts, large solitary cysts, and a combination of these two, with cysts of all sizes. As a cyst grows it may lose its attachment to the testicle and become dislocated into the groin by the movements of the legs; then it may show no sign of its origin unless the fluid within it has indications of spermatozoa. When very numerous they are occasionally diagnosed as hydrocles of the tunica vaginalis.

On superficial examination a single large spermatocele can be easily mistaken for a vaginal hydrocele. If the testis is in front of the swelling, suspect a spermatocele. In this way a spermatocele of enormous size, containing ten ounces of fluid, was discovered. Simple tapping fails to cure these cysts; tapping and injecting are not nearly so successful with these cases as with vaginal hydrocles. In fact it is best to advise the excision of the cysts. When these are of the combined large and small type, probably the operation will need to be repeated.

A Hydrocele in a Scrotal Hernial Sac.—They formed five per cent. of the cases of hydrocele admitted to St. Thomas's Hospital. In these cases the neck of the sac has either become shut off by adhesions or plugged with omentum, rarely bowel. Operation is the only treatment.

Hæmatocele.—A hæmatocele, as its name implies, means a hæmorrhage into a cavity which already exists, such as the tunica vaginalis, in connection with which the term is most often used. A hæmatocele is almost always traumatic in origin, as the result of a blow or of the unskilful tapping of a hydrocele. Its presence may also be due, in rare instances, to malignant growth of the testis, other diseases of the testis and its blood-vessels, or exertion.

Symptoms. A hæmatocele may form slowly or quickly, according to the rapidity with which hæmorrhage is taking place into the cavity: if slow, it is painless; if rapid, painful. The swelling increases in size and weight, decreasing

in translucency as the hæmorrhage progresses, if a hydrocele was present first. The effused blood is slow to clot, and, if it is present in quantity, still slower to organize. The surface of the swelling is warm and becomes less uniform and regular as the blood clots. Later, it becomes less tense and the old clots may be felt as masses in the scrotum. The skin over a hæmatocele is sometimes ecchymosed and, more often, the dark colour of the blood can be seen through it.

Diagnosis. A hæmatocele must be distinguished from three main conditions—

(1) A hydrocele; (2) a hernia; (3) a tumour of the testis.

The treatment may be palliative or curative. The former consists of rest in bed with the scrotum raised and supported, an icebag or cooling lotions, etc. If the hæmorrhage does not stop, the swelling must be incised and the vessel ligatured. If the absorption, after the bleeding has stopped, is slow, the swelling should be tapped to remove all the fluid. This tapping should never be repeated more than once or twice, but open operation undertaken unless the patient's general condition forbids it. The operation consists, first, of incising the swelling; secondly, of removing all blood, clot and "false" membranes; thirdly, of excising the parietal part of the tunica vaginalis, or, if by reason of external adhesions it cannot be removed, it must be painted with "pure" carbolic acid or a solution of nitrate of silver (three grains to the ounce). There is yet a final alternative: the subjects of hæmatocele are generally men well past middle life, so that if the testis is much wasted there need be no hesitation in curing the patient by removing it with the tunica vaginalis. It shortens the convalescence and prevents all chance of recurrence.

IV.—Diseases and Deformities of the Penis

The Relief of Preputial Adhesions.—Babies suffering from phimosis can frequently be relieved by a measure which is less severe than the operation of circumcision, and which consequently is often preferred by the parents. Preputial adhesions are of two kinds: the prepuce becomes adherent to the glans penis near the corona glandis; and the folds of the prepuce become adherent to one another near the preputial orifice. The former adhesions are well recognized, the latter are not; moreover, the latter must be broken down before the former. This is begun with a probe passed into the meatus preputii. The canal of the prepuce is then stretched thoroughly with forceps in several directions.

The prepuce is then retracted and the remaining adhesions between it and the glans penis, in the neighbourhood of the corona,

broken down. The prepuce should be freely movable upon the glans, which can be completely exposed beyond the corona.

As compared with circumcision, the operation of breaking down the adhesions has two apparent advantages—it is less severe, involving no cutting, and the prepuce is retained. Circumcision is more complete, more cleanly, and more sure.

Phimosis.—Phimosis can be acquired as the result of the contraction of a cicatrix in the prepuce, as in the healing of a sore. When it is a congenital condition it is always associated with a small glans penis and a small meatus urinarius. The disadvantages which it possesses are the difficulty or impossibility of maintaining cleanliness, the retention of secretions which will form a focus of irritation, the dangers of paraphimosis, the production of an eczematous state of the mucous membrane of the prepuce and of the glans (a chronic superficial balanoposthitis), the possibility of epithelioma, its influence on the occurrence of venereal diseases and their complications, etc., and, in the congenital form, also the imperfect growth of the penis and glans penis. Phimosis bears an unimportant causal relationship to inguinal hernia. For choice, it is an operation which should be done in early babyhood. Then the operation is borne well, giving the minimum of discomfort, no anæsthetic is required, and usually no stitches. Care must be taken to remove the prepuce close to the frenum, otherwise the soft parts which remain swell, forming an unsightly lump in this situation. This is a very common fault. The mistake is usually made on account of dread of wounding the frenal artery, and is avoided by making a point of dividing this artery. It is not the division of the artery, but the removal of the soft parts which obviates the formation of the swelling. It is best to use catgut for ligatures and stitches as, being absorbed, there is no need to take out the stitches, a difficult and painful task with swollen tissues. This is applied in rectangular stitches, which stop all oozing and coapt the large raw surface. Many stitches are inserted, so that there are no gaps in the coaptation of the edges, union by first intention resulting.

At times the operation may be done for diagnostic purposes; the two things most commonly looked for being a primary syphilitic sore or an epithelioma, less frequently a preputial calculus.

Any chronically moist condition of the glans indicates the advisability of recommending the operation. A small, poorly developed glans would be benefited by the same procedure. On several occasions circumcision has been done on account of a chronic balanoposthitis, the result of a urethritis. The condition makes

its presence known by a watery secretion from the inner surface of the prepuce, which renders the surface of the glans penis moist and mistaken for a gleet.

The Phimosis of the Elderly.—When the period of sexual activity has passed away the prepuce again covers the glans penis. The prepuce itself undergoes involution with the rest of the parts. As it does so, its retraction over the glans is apt to be a proceeding of some difficulty. The glands under the prepuce continue to secrete, their secretion remaining under the prepuce, decomposing and irritating both the glans penis and the prepuce, producing a chronic superficial balanoposthitis and a deeper chronic inflammation in the prepuce, and contraction of the glans penis. The meatus in it also becomes contracted, so that it can no longer be withdrawn over the glans penis; and the secretions under it collect and ferment, producing further irritation. The greater the irritation of the glands by decomposing secretion, the greater the amount of secretion they produce. In this way a vicious circle is established; the result of the involution of the organs before the disappearance of sexual desire and capability from the nervous system.

In addition, if the meatus urinarius in the glans penis is not apposed to the meatus in the prepuce the urine will not be projected directly through the latter and clear the body. The loss of power, consequent on the changes in the prostate going on contemporaneously, assists in this; as does the dribbling at the end of micturition. In consequence, urinary salts become deposited under the prepuce, and even preputial calculi may arise.

The irritation is very serious. We do know that cancer of the penis is associated with chronic irritation due to the accumulation of dirt and secretion under the prepuce, whereas it is practically unknown in Mohammedan races who practise circumcision.

In consequence, the phimosis of elderly men must be regarded as a condition which demands active and operative treatment.

Paraphimosis.—By paraphimosis is understood the strangulation of the end of the penis by a tight foreskin which has been retracted over it. As it is withdrawn over the glans it lies just behind the corona and is soon deeply sunk beneath the folds of the œdematous prepuce which have followed after it. The deep position of the strangulating folds of the band and the superficial position of the œdematous prepuce are explained.

Paraphimosis in its later stages is a very painful condition, which often the sufferer will not declare until compelled. An injection of five to ten minims of cocaine, with a few drops of 1 in 1000 solution of adrenalin, under the

skin of the dorsum of the penis, proximal to the strangulation, in such a way as to interrupt the physiological continuity of each of the dorsal nerves, gives relief. Grasp the penis behind the constriction between the two first fingers of each hand, and, by exerting steady pressure on the glans with the thumbs, squeeze the glans through the constricting ring. This should be tried slowly and patiently. If it is not successful, make numerous punctures with a sharp narrow-bladed knife in the œdematous tissues; as the œdema subsides it will be possible to see the constricting band at the bottom beneath the folds of the prepuce. The folds are held well apart with the fingers of the left hand and the band freely divided with a knife. The band may also be divided in a manner similar to that employed for the division of the constricting band for relief of a case of strangulated hernia. A hernia director is passed under the band, which is then divided by a sharp bistoury, not a blunt hernia knife. Care must be taken not to injure the subjacent corpora cavernosa. The prepuce is then drawn forward. The part is washed with warm water, dried, dusted with boracic powder, and covered with a pad of wool which is retained in position by a T-bandage. It is well to see that no constricting band has been left behind the corona.

Deformities of the Penis.—The very great majority of patients present malformations of the penis in the region of the glans. Four deformities only deserve particular notice. These were—

1. Hypospadias, 52 per cent.
2. Deformities allied to hypospadias, 8 per cent.
3. Malformations of the raphe, 19 per cent.
4. Torsion of the penis, 21 per cent.

By **hypospadias** is meant a cleft on the under surface of the penis and perineum, laying bare the interior of the urethra. It is usual to distinguish three degrees of hypospadias. The *first* affects the urethra in the glans penis. The condition is quite common, the urethra opening just below the glans.

The important characters of such a case of hypospadias are three—

1. In micturition the stream is ejected at right angles to the penis.
2. In ejaculation, the sperm is ejected similarly.
3. The patients are perfectly capable of sexual connection and parentage, and are very prone to become infected by gonorrhœa.

This form of hypospadias is more of a disadvantage than a disability to its possessor.

The *second* degree of hypospadias opens the under surface of the urethra, the meatus being just in front of the scrotum. It is more serious, micturition being clumsy, paternity most improbable, the penis small and poorly developed,

rendering the patient unlikely to acquire urethritis or to require "circumcision." With regard to treatment, a new urethra can certainly be made by a plastic operation or operations. But it is a caricature of the urethra, without musculature for micturition and ejaculation. It is better for the patient to remain as he is and be content with his "down setting."

In the *third* degree of hypospadias the cleft is continued backwards, splitting the scrotum; the meatus urinarius being in the perineum. The disabilities of the patient are poor development of scrotum and penis; he has to squat for micturition; paternity and copulation are impossible. Treatment is a matter of cleanliness and common-sense.

Epispadias is the opposite condition to hypospadias; the urethra is cleft on the upper surface, the corpora cavernosa being everted to leave the split urethra uppermost. There are three degrees in epispadias, corresponding to those in hypospadias: affecting the glans penis, extending back to the root of the penis, associated with cleft pubis and ectopia vesicæ.

V.—Functional Affections

Impotence and Sterility.—Regarded from the point of view of the race, the successful performance of the sexual act requires two things on the part of the male, potency and seed-production. If either factor fails, the race cannot be propagated. The more important of the two factors is the second—the presence of the seed, which constitutes masculine fertility. The degree of potency required may be very small in order to impregnate the female.

By **impotence** is understood inability to perform the sexual act. Its causation is anatomical, pathological, physiological and psychological. In other words, the deficiency may be—in the parts, due to disease, in the functions, or in the mind. To the anatomical belong defects and deformities of the penis; among the pathological may be mentioned prolonged diabetes and albuminuria, wasting diseases, disease of the brain and spinal cord; while some of the physiological are imperfect erections and premature ejaculation. The lumbar sexual centre is subject to functional diseases, such as are known at other times and on other occasions as stammering bladder and enuresis. Of the psychological causes may be mentioned the obtrusion of disorderly ideas, of lack of confidence, fear, repugnance, etc.

The treatment must be directed to the cause, which if anatomical or pathological is frequently irremediable. For the psychological and physiological causes, sexual rest is the first desideratum. When it has been obtained, further treatment can be begun. The symptoms, such as emissions or spermatorrhœa, must be treated by

regulation of the order of life and diet. Tonics such as strychnine, iron, quinine and valerian in pills can be used. Drug habits must be sought for and broken. Finally, when nervous tone has been restored, the matter can be quietly discussed with the patient, encouraging him to allow sexual matters to take their course, quietly and without notice on his part. No patient is cured until his mind has become interested in some hobby or occupation.

Impotence is an acquired character in the great majority of cases, and is the incapacity to perform the act of coitus. By *infertility* or *sterility* is meant inability to procreate, a character which may or may not be associated with impotence. Many acquired infertile or sterile males are perfectly potent. The fact that a married couple do not beget children does not necessarily imply that one of them, at least, is sterile. It is well known that some unions are unproductive *per se*. The fault may be on either side, and it is a great mistake to assume that the fault is with the female, as is generally done. With that side of the question we have no concern in this article. The examination of the husband is the easiest and least embarrassing, and should always be conducted before that of the wife. The first question is to ascertain if the male is potent, which can be settled by a question. The second question is, Is the semen fertile? Cover-slip preparations of the semen are made, and if spermatozoa are found no further examination is required. A potent male whose semen contains spermatozoa can impregnate a female. On the other hand, if no spermatozoa are found after more than one examination the genitalia should be examined.

Masculine sterility can arise in two ways: congenitally and by acquisition.

Congenital Sterility.—The testes may be imperfectly developed or even absent. Or there may be some congenital stenosis or absence of the vas deferens or vesiculæ. In order to cause infertility the lesion must be bilateral, there being conclusive evidence to show that one testis is sufficient to ensure procreation. Imperfect development of the testes is nearly always accompanied by imperfect descent of the

glands. Clinically, the want of descent is more easily recognized than the want of development. Even in its worst degrees, the abdominal testicles of cryptorchids, a few cases are known in which the subjects thereof were fertile. Seed-production is certainly rare in them, but it may occur; and when it does it is delayed until twenty to twenty-two years of age, and lasts one, two or three years.

Acquired Infertility.—This subject can be considered best at the various ages in which it may be acquired.

(a) *In the young.* Before puberty imperfect development and even atrophy may be caused by attacks of inflammation in the gland, such as after an injury or a specific fever, *e. g.* mumps. But, fortunately, in these cases the lesion is usually, if not always, unilateral; whilst a bilateral one is requisite to bring about infertility. Tuberculous disease unfortunately is prone to affect the epididymis, and, if bilateral, will probably sterilize the patient. Syphilitic disease acts differently in preventing the development of the body of the gland, the testis, and therefore by no means so certainly sterilizes the patient as tuberculosis does, which affects the epididymis.

(b) *In the middle phase of life.* The most frequent cause of acquired infertility at this period is undoubtedly chronic epididymitis, which is recognized clinically as a hard nodule in each globus minor or cauda epididymidis. Tuberculous disease of the epididymis is another factor. But next frequent to a chronic epididymitis is an urethral stricture which maintains the posterior urethra, the vesiculæ seminales, and vasa deferentia in a state of chronic infective inflammation, preventing the natural secretion and causing the ciliated epithelium to be shed.

(c) *In old age.* The changes in the prostate in later life, if they occur, are practically two—enlargement and diminution. They act by obstructing the ducts of the vesiculæ seminales, which become chronically enlarged and inflamed; in consequence, the infective changes slowly advance up the vasa deferentia to the epididymis, causing epididymitis. Besides these prostatic changes, there is a physiological decline in both potency and fertility.

E. M. C.

PART III.—OBSTETRICS AND GYNÆCOLOGY

I.—OBSTETRICS

SIGNS, SYMPTOMS AND DIAGNOSIS OF PREGNANCY

Cessation of Menstruation.—The most important symptom of pregnancy is the cessation of menstruation. (It is the symptom for which the woman who suspects the possibility of pregnancy looks and from which she estimates the date of her confinement, and without it pregnancy may be excluded.) It is true that cases are quoted where women are said to have menstruated throughout pregnancy, but it is obviously impossible that any true periodic loss of the nature of menstruation can occur from the body of the uterus after its cavity is entirely occupied by the ovum. During the first three months when there is an area of the mucous lining free from contact with the ovum, a loss of the nature of menstruation is possible and occasionally is present for the first month after impregnation, rarely for the second, and still more rarely for the third month. Thus it is not uncommon for a patient to seek advice as to the time to expect her confinement, because after a normal period of say six to seven days she has had a slight period of, perhaps, one or two days, exactly at the proper time, and followed by complete cessation of menstruation with other evidences of pregnancy; when full term is reached it is found that the period of ordinary duration is the one from which reckoning ought to have been made. More rarely two or even three periods of diminishing amount may occur, and in such cases we can only surmise that the decidual change in the endometrium has not been sufficiently developed to interfere with the ordinary menstrual changes. In those cases of intra-uterine pregnancy where menstruation is said to occur after the third month, the hæmorrhage, if it comes from the body of the uterus, must come from some separation of the ovum from its attachments and must be looked on as of the nature of a threatened abortion. Instances are quoted where such losses have been precisely similar in character and duration to the normal and with the exact periodicity, and if such observations are correct, it can only be assumed that there must be some special tendency to hæmorrhage into the foetal envelopes at the times when a period is due, and that when this occurs it gives rise to some separation

of the membranes so as to permit of the escape of the blood. That under such circumstances it should be indistinguishable from a normal period throughout the pregnancy is almost unthinkable. On the other hand, erratic losses of varying amount and duration, commonly but incorrectly described by the patient as "periods," are not uncommon, especially during the first half of pregnancy, and though they must be looked on as warnings of the possibility of abortion or premature labour, gestation often proceeds to full term without further complication to the mother or detriment to the foetus. Besides such cases where the value of this all-important symptom may be diminished by the occurrence of uterine hæmorrhage at intervals, there are conditions where it may be of no assistance because the patient has become pregnant at a time when menstruation is absent, as during lactation, from anæmia, tuberculosis or other illness. Apart, however, from such conditions, it may be stated that the sudden cessation of menstruation in a healthy woman in the child-bearing period of life who has previously been quite regular is strong presumptive evidence of the pregnant state.

Morning Sickness.—Some degree of sickness is generally present in the early months, varying from a slight nausea on rising in the morning to actual vomiting not only in the morning but throughout the day. This symptom is often absent, but is most common and best marked in highly strung women of a nervous temperament. It usually begins about the fourth or fifth week and lasts for two or three months, but may persist to some extent throughout the pregnancy. It is frequently accompanied by other digestive disturbances, salivation, heartburn, constipation, etc. When present to an excessive degree and sufficient to cause malnutrition, it may require treatment, and may be a symptom of the toxæmia of pregnancy; special care ought to be taken in the investigation of those cases in which vomiting becomes worse or returns, or begins in the later months.

Other Minor Symptoms. Some frequency of micturition may be noted in the second and third months owing to the enlarging anteverted uterus lying on the bladder. Sometimes women complain of vague sensations in the

pelvis, tingling and shooting pains in the breasts, neuralgic pains in the head, dreams and psychic disturbances, all of which may be of moment in difficult or doubtful cases, especially where experiences of a like character have occurred in previous pregnancy.

Quickening.—The next reliable symptom besides the cessation of menstruation is "quickening," or the feeling of the foetal movements, which occurs generally about the mid-term—the eighteenth to the twentieth week—the time at which the developing uterus comes firmly into contact with the abdominal wall. Quickening is generally described as a "fluttering" sensation in the abdomen, and is naturally of more importance as evidence of pregnancy in a woman who has been pregnant before and can recognize the sensation. A feeling of sickness or faintness sometimes occurs when it first becomes evident. Error is so common, however, even in multiparous women, that it is of little value except in conjunction with other evidence. After mid-term the patient will notice the enlargement of the abdomen and breasts, and the foetal movements will become marked, also certain pressure symptoms may be noticed—varicose veins of the legs and vulva, swelling of the feet, shooting pains and suchlike.

Signs. The simplest and most practical method of considering the signs of pregnancy is to take them as they would be found in investigating a case clinically. The history—in other words the symptoms as described above—having been elicited by questioning the patient, the systematic examination for the signs would naturally follow, and this is best carried out by looking for first the mammary, then the abdominal and finally the vaginal signs.

Breast Changes.—Examination of the breasts is of great importance in primigravidae. In women who have had children and especially in those who have suckled children the mammary signs are of little value, for the breasts never go back to their shape and appearance after a pregnancy which has advanced beyond the first few months. This is especially the case in women who have recently been nursing or who have had a recent pregnancy. Where several years have elapsed since the last pregnancy the signs are more reliable.

From the second month onwards changes may be seen in the breasts and nipples. The breasts become larger and fuller, so that in the later months, fresh striae due to the overstretching of the skin may be seen. Unmistakable striae are almost diagnostic of a first pregnancy, for, except that rare hypertrophy of the mammae which sometimes occurs at puberty, there is nothing except the physiological

enlargement, which will be rapid and great enough to cause cracking of the skin. The skin generally cracks radially from the nipple and more markedly in the upper than in the dependent segment, and if care is taken not to confuse them with pressure marks from garments, considerable reliance may be placed on the presence of striae. Unfortunately, they are not often present till the later months, when there is little doubt as to the nature of the case. Blue veins coursing under the skin giving a marbled appearance to the breasts are also a common sign, but the most striking changes are usually those in the nipple and its areola. The nipple itself is more erect and moister than in the non-pregnant state and often covered with fine branny scales due to dried secretion. The areola becomes deeply pigmented, the degree of this depending on the complexion of the patient. In very fair patients it may be so slight as to be unnoticeable; it is most marked in dark women and may be seen best in women with dark blood, like Eurasians. For this reason in estimating the reliance to be placed on the pigmentary change the colour of the patient should be noted. Besides the darkening of the areola, other changes are often seen in it. It is generally somewhat swollen so that it stands out a little above the level of the breast surface; it is moister, and the small sebaceous glands in it are more evident. These glands when enlarged during pregnancy are known as Montgomery's tubercles and form a ring of small papules round the nipple, usually between ten and twenty in number; they are a fairly constant and reliable sign. From the fourth month onwards the secondary areola becomes evident; it is a fainter pigmentation round the edge of the primary areola, as if the latter were spreading out on to the skin and is dappled with light spots of a leucodermal character as if the pigment had been washed out in patches. Like the primary areola its appearance is much more characteristic in dark women. After inspection, the breast should next be examined by palpation. By pressing the breast between the flat of the hand and the chest wall the gland lobules will be felt to be firm and hard, and by pressing from the periphery of the breast towards the nipple a little clear serum can be expressed. In women who have had children before some involution fluid generally remains in the breast, but it is not usually so clear as the secretion present during pregnancy. Often as early as the second month and generally from the third month onwards some trace of moisture can be squeezed from the nipple, and in first pregnancies is a valuable sign though occasionally found apart from gestation.

Abdominal Signs. During the first three

months, that is until the uterus rises out of the pelvis and becomes an abdominal organ, there is nothing to be noticed on abdominal examination. A slight flattening of the lower abdomen and some depression of the navel is described, but it is quite an uncertain sign and of little value. A dark line of pigmentation, the *linea nigra*, running in the middle line from the umbilicus to the pubes may be sometimes seen as early as the third month in dark patients, but is not usually distinct till the mid-term. From the fourth month the developing uterus can be felt or seen in the abdomen and the abdominal examination from this time onwards must be directed towards discovering whether the abdominal tumour presents the characteristics of the pregnant uterus. These are—

1. It should correspond in size with that of the period of pregnancy reached, *i. e.* with the number of months of amenorrhœa.

2. It should be contractile, hardening on manipulation and becoming softer again.

3. It should give some signs of the presence of the foetus, at any rate after the mid-term; and until these signs are unmistakable, pregnancy cannot be diagnosed with absolute certainty.

The pregnant uterus forms a median tumour rising out of the pelvis and displacing the intestines to the sides and by mid-term it comes in contact with the abdominal wall and forms a visible prominence in the lower half of the abdomen.

The first thing, therefore, on palpation of the abdomen is to discover whether there is an abdominal tumour, and this is to be expected from the end of the third month onwards. About the twelfth or the thirteenth week the fundus can generally be felt in a primigravida just above the level of the pubes; in multiparæ it is slightly higher. From this time the increase in size is regular, at four and a half months it is above midway between the pubes and the umbilicus, and by the fifth month it is just below, and by the sixth just above the umbilicus. At seven and a half months it is midway between the umbilicus and xiphisternum, and near term it is right up under the ribs, sometimes dropping a little in the last two weeks or so. Where there is a definite history of the cessation of menstruation, the uterine tumour will be expected to correspond roughly in size to that mentioned as usual for the duration of pregnancy. In cases when pregnancy has occurred during amenorrhœa or where there have been losses of blood this evidence may not be available. Also the possibility of error from complications of pregnancy, such as hydatidiform mole or hydramnios, making the tumour larger than it should be, or fleshy mole and death of the ovum making it smaller, or uterine or abdominal conditions such as the fibroids or ovarian or

other tumours pushing up the fundus, must not be forgotten. Generally speaking, however, an abdominal tumour approximating to the size expected is very strong evidence of pregnancy.

The pregnant uterus has an elastic, cystic feel; when first it rises into the abdomen it is soft and its boundaries often ill-defined. On manipulation, however, it may be noticed to become harder and more defined, this sensation again passing off into the softer ill-defined condition noticed at first. This change is due to the intermittent painless contractions of pregnancy which are readily excited by manipulation. In the later months these contractions may be felt, and sometimes seen apart from manipulation, but in the early months usually only occur after stimulation of the uterus. When recognized beyond doubt they form very strong evidence of the tumour being uterine and of the uterine enlargement being due to pregnancy. Practically speaking, uterine tumours are the only abdominal tumours that contract in this way. I have twice seen a matted mass of intestine—due to tuberculous peritonitis—form a rounded soft cystic median tumour the size of a four months' pregnancy, which to the hand gave the exact sensation of intermittent uterine contractions. Such tumours are resonant to percussion and so ought not to be mistaken for pregnancy, but if percussion is not done and amenorrhœa is present, the error is quite easily made, and, indeed, was made by the medical attendant in one of these cases mentioned.

Other uterine tumours besides pregnancy may give these intermittent contractions, but much more rarely. Occasionally in uterine fibroids, especially when the tumour is submucous and undergoing extrusion into the cavity of the uterus or through the cervix, very similar contractions may be discovered. However, in these cases the symptoms will be quite different (*e. g.* excessive loss), the tumour harder and not so evenly enlarged and the other indications of pregnancy will be absent.

Presence of the Fœtus.—The presence of the fœtus can first be ascertained about mid-term by external ballottement, and from the sixth month the fœtal parts can be recognized, and movements felt and the fœtal heart heard. As the earliest evidence of the fœtus can be obtained by ballottement, this is a very important sign. It is obtained by placing the tips of the fingers on different parts of the uterine tumour and pressing them suddenly and sharply downwards so as to displace the fluid and come on to the fœtus. In this way a sensation of coming down on to something hard is obtained for a moment, or the sensation of something bobbing about in fluid. Sometimes by placing

the fingers of one hand on one side of the uterus and the fingers of the other hand on the other side and pressing sharply from one side to the other, the hard body can be tossed from the fingers of one hand to those of the other. Again by placing the patient on her side with the abdomen projecting over the edge of the bed or table and placing the fingers on the most dependent part and giving a sudden jerk upwards the hard foetus is felt to float away and drop back on to the finger again.

As a sign of pregnancy this is most valuable evidence and there is only one condition which will give any similar sensation to the fingers and that is a solid tumour associated with ascites, more especially solid tumours of the ovary. In such cases, the finger may come down through the fluid on to a hard nodular mass which will feel exactly like the ballottement in the pregnant uterus. Here, however, the absence of a circumscribed tumour and the presence of free fluid in conjunction with a consideration of the other signs and symptoms of pregnancy should prevent error. The same condition may give rise to a distinct mimicry of the foetal parts; a rounded tumour may feel like the foetal head and small nodules like small foetal parts, and that is why hearing the foetal heart-sounds and the feeling or seeing undoubted foetal movements have been considered as the only absolute and positive signs of pregnancy. External ballottement can be practised up to the end of the seventh month, but after this the foetus is too large relatively to the amount of liquor amnii to give the "bobbing" sensation to the fingers, but by this time it is quite easy to make out the foetal parts, and generally to obtain more positive evidence of the presence of a foetus. Thus during palpation of the uterus slight taps and knocks may be felt due to movements of foetal limbs and in patients with thin abdominal walls the stronger movements may be seen.

Auscultation.—Auscultation of the uterine tumour gives several signs of which one, the foetal heart beat, is positive evidence of pregnancy. Commonly the foetal heart-sounds are best heard in vertex presentations on a line midway between the umbilicus and the middle of the groin, to the right or left side according as the back of the child lies. The sounds are recognized from their rapidity—from the sixth month 140 to 150 per minute, falling to 120 to 130 as term is approached—from there being a single and not a double sound as in the adult heart, and by comparing the rhythm with that of the maternal pulse at the wrist and noting the absence of synchronism. The foetal heart-sounds will rarely be heard before the twenty-fifth week, and about this period the whole front of the uterus will have to be auscultated

for some time in order to find them. In doing this the stethoscope should be placed on the abdominal wall at different spots and gradually pressed more deeply so as to try and get the abdominal wall, uterine wall and foetal back in contact, and thus facilitate the conduction of the sound. When it is definitely recognized it is a certain proof of pregnancy and of the life of the foetus, but naturally when it is not heard it is of no value in excluding pregnancy. The uterine souffle, or loud blowing murmur synchronous with the maternal pulse heard in both sides of the uterus over the curling uterine arteries is only of value in showing that the tumour is uterine and not ovarian, for this murmur may be heard in other conditions, such as fibroids, when the uterus is enlarged.

The umbilical souffle, the faint blowing murmur heard on rare occasions when the umbilical cord is compressed by the stethoscope, and the various thuds and scratching sounds due to foetal movements are of no importance in diagnosis.

Vaginal.—The vaginal and bimanual examination is chiefly of importance in the early months; in the second half of pregnancy, a vaginal examination is only necessary in difficult and doubtful cases.

Inspection of the vulva and vagina may show enlarged and varicose veins about the vulva and on opening the labia a bluish coloration of the vaginal wall is generally apparent from about the sixteenth week—its usual pink has changed to a violet or purplish hue like the change in the colour of the lips of a patient with slight cyanosis. On examination with the finger the cervix will be found to be softer than in the non-pregnant state—the softening being first noticed at the external os, and later involving the whole cervix. Marked pulsation of the vessels in the vaginal fornices is also suggestive of pregnancy.

The most important signs are discovered by the bimanual examination of the body of the uterus. Changes in its shape and consistence may be noted from about the sixth week of pregnancy onwards. Instead of the firm, hard body of the non-pregnant uterus a soft ill-defined swelling is felt, generally markedly anteverted and more globular in shape. Indeed, a difficulty in defining the uterine body in a patient in whom early pregnancy is suspected is always a very suggestive sign. Sometimes during such examination the uterus may for a time become more easily defined, and then pass back to its soft ill-defined feel—the result of the early slight contractions of pregnancy—and this when made out is valuable evidence. An undue amount of attention has been given to what is known as Hegar's sign, *i.e.* that during bimanual examination from the sixth

to the twelfth week, with the internal finger in front of the cervix and the external fingers sunk down over the posterior wall of the enlarged body, a sensation is obtained as if the fundus uteri were a cystic swelling almost separate from the cervix, due to the empty lower uterine segment being unusually compressible between the fingers. It is not always distinctly obtained, and it involves too much manipulation of the uterus at a time when abortion is easily produced to be recommended in routine examination.

The first evidence of the presence of the foetus may be obtained by internal ballottement: to elicit this sign the fingers are pushed suddenly and firmly up into the anterior fornix, when they may be felt to come on to the foetus which then bobs away, and, if the fingers are kept in position, may occasionally be felt to drop back on to them. This ought to be practised with gentleness and not persisted in for long, as it may result in injury to the pregnancy, and should only be tried from the sixteenth week till the twentieth to twenty-fourth week, after which other and more definite signs of the presence of a foetus are obtainable. From about the sixth to the seventh month the lower pole of the foetus—generally the round hard head, can be felt high up at the pelvic brim and pressed down on to the internal fingers by the external hand. It must not be forgotten that the head does not usually descend into the pelvic cavity till the last few weeks of pregnancy in primigravidæ, and in multiparæ with relaxed abdominal walls may not do so till labour has begun.

In any case where the diagnosis is uncertain the development of the uterus must be watched carefully for three or four weeks. J. S. F.

THE MINOR AILMENTS OF PREGNANCY

I.—Of the Alimentary Tract

1. **Salivation.**—This is of somewhat rare occurrence, but may be so profuse that the patient is unable to swallow the saliva, and consequently dribbling from the mouth takes place. Its cause is not clearly understood, but it is ascribed to a neurosis. The treatment consists in the use of an astringent mouth wash, and bromide of potassium internally. In some cases the use of belladonna has been tried with good effect.

2. **Toothache.**—The general neglect of care of the teeth in the middle and lower classes is well known, and may be the source of a general toxæmia arising therefrom by the infection of ingested food, and it is a much more common cause of general ill-health in women, and perhaps neurasthenia, than is commonly supposed. In those persons liable to dental caries pregnancy has a great tendency to aggravate this con-

dition, on account of the determination of lime salts in the blood to the formation of the foetal bones, and consequently the increase of the caries is very likely to produce an increased liability to toothache. This condition of caries is also aggravated by acid dyspepsia. It is generally thought that treatment of the teeth, especially if any painful operation is required, is liable to cause abortion or miscarriage. This idea, however, has probably been exaggerated, as, should any such operation be required, it can be easily performed under a local anæsthetic. There is no doubt that careful attention to the teeth, even during pregnancy, is a matter of much importance, not only for the sake of the teeth themselves, but also for the prevention of oral sepsis, which always has a deleterious effect on the general health of the patient.

3. **Nausea and Vomiting.**—This is usually considered a physiological symptom of pregnancy. It occurs during the early months, and in some cases as early as the tenth day after conception. It is more of the nature of possetting than vomiting, and is not usually associated with the feeling of sickness. It usually occurs in the morning shortly after rising, and is said to be due to reflex action of the sympathetic nervous system. As a rule no treatment is required, but if the condition becomes troublesome to the patient a cup of black coffee or tea taken in bed before rising is generally advantageous. In addition, careful attention to the condition of the bowels is essential, and the patient should be reassured and told that it is quite a usual symptom and will soon disappear.

4. **Indigestion and Pyrosis.**—Patients who live on simple diet, pay strict attention to their bowels, and take an ordinary amount of outdoor exercise, are seldom the subjects of these conditions. Should indigestion or acid dyspepsia occur, it should be treated by carbonate of magnesium and bicarbonate of soda, or an occasional drink of soda water, and for the treatment of pyrosis, or heartburn, there is nothing better than half a teaspoonful of prepared chalk, which, however, has the disadvantage of being constipating. If the patient is in the habit of taking alcohol in any form, this should be immediately discontinued.

5. **Constipation.**—Women at all times commonly suffer from constipation and more than ever during pregnancy. Constipation not only causes many of the minor ailments of pregnancy, but is also a potent factor in the causation of several of the grave complications. There is nothing more important than careful regulation of the bowels, the treatment of which should be principally prophylactic, and consist in a suitable diet, reasonable outdoor exercise, and, if necessary, the regular use of mild

aperients. It is essential to impress upon the patient that a daily movement of the bowels is of first importance. The diet should consist chiefly of those articles which leave a considerable residue, such as brown bread and vegetables. Fruits such as bananas, apples and pears are also helpful, and a plentiful supply of fluids at mealtimes. Small doses of cascara sagrada, liquorice powder, or pulv. rhei. co., should be taken regularly every day, and not in large doses once or twice a week as is generally the custom. Some of the aperient mineral waters cause a watery evacuation from the lower bowel only, so that their use in pregnancy is unsatisfactory, and, if they are persisted in, the patient's system is liable to become depleted.

II.—Of the Circulatory System

Varicosity of the veins of the lower extremities is usually greatly aggravated by pregnancy, and in some cases this condition may become extremely severe. Any radical operation for such a condition during pregnancy is generally contra-indicated, and relief should be obtained by palliative measures, such as elastic bandages or elastic stockings. Anything which is liable to aggravate this condition, such as tight lacing or garters, should be carefully avoided. Hæmorrhoids are sometimes very troublesome, but these can be greatly relieved by regular attention to the bowels; should they become inflamed or painful, rest in bed for a few days with the application of some cold astringent such as Hazeline Cream or Hazeline Snow will afford relief. During the early months of pregnancy a varicose condition of the veins of the vulva may cause a considerable amount of discomfort, but this can be immediately relieved by cold sponging and rest in bed. Palpitation is also fairly common and is generally of nervous origin; it is often caused by worry or excitement. Small doses of bromide of potassium or tincture of digitalis are indicated if the palpitation becomes troublesome.

III.—Of the Skin

The chief affection of the skin associated with pregnancy is pruritus. This condition may be general all over the body, and is then due to intestinal toxæmia or to some irregularity in diet. It occurs usually at bedtime and may occasion the patient a considerable amount of discomfort. It does not, as a rule, last longer than a few days. It is usually relieved by an aperient, but if it should exhibit a tendency to be protracted, the patient should be given small doses of salol, three times a day, and restricted to the simplest diet. Pruritus ani or vulvæ may also occur, and may become so severe as to cause considerable distress. Pruritus in this situation may be due to a

considerable number of causes, such as glycosuria, uncleanness, threadworms, abnormal vaginal discharge, or varicose condition of the veins. The cause should be carefully investigated and, if found, should be treated accordingly. Pruritus ani is more common in patients who take coffee, and in such cases they should be recommended to take tea instead. Should no definite cause be found for the pruritus, the patient should be urged to avoid scratching as far as possible, as this not only aggravates the condition but is liable to develop into a bad habit. Strict cleanliness is essential, with the use of carbolie soap night and morning, and in case of leucorrhœa, a vaginal douche of borie lotion once daily. Should these measures not afford relief, antipruritics should be tried, such as liq. carbonis detergens (two drachms to the pint) with liq. plumbi subacetatis (one drachm to the pint), or tar and other antipruritics may be prescribed in ointment form. A condition of the vulva and vagina which occurs during the later months of pregnancy, and is known as white spotty vaginitis, sometimes causes an intolerable itching. This condition is due to infection by the *Oidium albicans*. It can be easily recognized by its very white colour, and can be speedily cured by the use of carbolie acid ointment.

R. P. R. L.

THE OBSTETRICAL KIT

In choosing his obstetrical kit, it is essential for practical purposes that the practitioner should not overburden himself with a number of instruments and appliances which he will seldom, if ever, use. At the same time he should carry with him sufficient to be able to conduct not only ordinary midwifery, but also to meet the more common emergencies which may arise in his practice. It is unnecessary for him, besides being very inconvenient, to carry a sterilizer for his instruments; moreover the use of cases for his forceps or other instruments or appliances is not recommended, as they are very liable to infection and difficult of sterilization by a practitioner with a busy practice.

The midwifery bag should be of moderate size, about eighteen inches long, and should have a removable lining.

It should contain the following—

1. Chloroform, 3 oz., with chloroform mask and tongue forceps.
2. Cyllin, 2 oz.
3. Lysol, 2 oz.
4. Corrosive sublimate tabloids, 25.
5. Liquid extract of ergot, 2 oz.
6. Brandy, 2 oz.
7. A hypodermic case with tabloids of sulphate of morphia and sulphate of atropine combined. Ergotinine. Digitalin. Strychnine.

8. A tabloid emergency case, containing tabloids of opium 1 gr., ergotin 3 gr., calomel 1 gr., quinine bisulphate 2 gr., grey powder 1 gr., jalap 5 gr., and sodium chloride.

9. A nail brush.

10. A binaural stethoscope.

11. A siphon douche, in a small battiste bag.

12. A mackintosh apron.

13. Battiste, two pieces, 2 feet by 3 feet.

14. Two sealed glass tubes, each containing a curved perineorrhaphy needle with catgut suture.

15. Two compressed packets each containing two ounces sterilized cotton-wool.

16. Two compressed packets each containing one ounce iodoform gauze.

17. Neville's axis-traction forceps. Large Bozemann's catheter. Pair of scissors. Pair of artery forceps and female catheter, all already boiled and sterilized, and wrapped in a piece of perfectly fresh boric lint, tied at both ends.

18. Rheinstädter's flushing curette. Vulsellum forceps. Plugging forceps. Small Bozemann's catheter and glass vaginal nozzle, ready sterilized.

19. An apparatus for subcutaneous infusion, in a small battiste bag.

20. A pair of rubber gloves.

In any case where it is required to apply the forceps, or to perform curetting, the instruments for either operation are by this means ready sterilized and suitable for immediate use. The instruments have only to be lifted off the boric lint and dipped in the warm boric or lysol solution for the purpose of warming them. After use they should be carefully washed and dried, and wrapped either in the boric lint or in the piece of battiste which the practitioner carries with him. On returning home the practitioner can boil all the instruments used, and wrap them in another piece of perfectly fresh boric lint, so that they will be again ready for immediate use.

The siphon douche and the infusion apparatus can be easily sterilized, first by washing, and then by immersing in a solution of 1 in 1000 corrosive sublimate, the battiste bag being at the same time immersed in this solution. The apparatus is then put into the wet sterilized bag and hung up to dry. When properly dried it can be returned to the midwifery bag, and is then ready for immediate use. The rubber gloves should always be boiled immediately before use.

The advantages of this method of sterilization of the forceps, the curette, the douche and infusion apparatus, are that it is extremely simple, it is efficient, and in any case of necessity they are ready for immediate use; besides, it saves the practitioner the inconvenience of carrying a sterilization apparatus with him.

R. P. R. L.

MANAGEMENT OF NORMAL LABOUR

Synopsis.

- A. Mechanism of first stage.
Mechanism of second stage.
Mechanism of third stage.
- B. Diagnosis.
By abdominal palpation.
By vaginal examination.
- C. Antiseptics.
Methods.
Application.
- D. Management of first stage.
Management of second stage.
Management of third stage.
Management of stage of after delivery.

The province of the physician in attendance on labour is twofold. Firstly he is present to watch over the progress of the labour and to anticipate or to correct any abnormality connected therewith, and secondly to guard his patient against preventable illness. The first requires accurate diagnosis and a knowledge of the normal mechanism of labour, and the second an understanding of hygiene and especially of the principles of antiseptics and their practical application.

Mechanism of Labour.—"Premonitory stage of labour" is the term used to imply a series of indefinite changes occurring before the actual onset of true pains. It begins with the sinking of the uterus during the last fortnight or three weeks of pregnancy. Its symptoms are those of easier respiration, of increased frequency of micturition, and of discharge of clear cervical mucus. The patient may notice some pelvic discomfort and a sense of insecurity due to relaxation of the pelvic joints. The observer will detect that the uterine contractions are firmer, more frequent, more easily elicited and are occasionally painful. The cervix becomes softer and shorter and the canal more relaxed. These latter changes are brought about by the polarity of the uterus (*viz.* that contractions of the upper segment produce relaxation and absorption of the lower) opening up the lower uterine segment.

Stages of Labour.—Labour is divided into three stages: the *first* includes the dilatation of the lower uterine segment and cervix, its duration being from the onset of regular pains till the complete dilatation of the os; the *second* from this point to the birth of the child; and the *third* comprising the separation and expulsion of the placenta.

Mechanism of First Stage of Labour.—*The first stage of labour* commences with the onset of rhythmical uterine contractions and ends with the full dilatation of the cervix. Dilatation of the lower uterine segment and canalization of the internal os are started by the polarity of the uterus, for unless a chink is formed in the internal os no protrusion of the membranes can take place, since the pressure inside the uterus,

represented as a closed sac, would act equally in all directions. With each contraction of the uterus the tension inside the bag of membranes rises and a slight detachment occurs at their lowest unsupported area. As the membranes are progressively loosened they bulge into the relaxed internal os and cervical canal and produce a radial stretching of these parts. Between the pains the membranes recede, but retraction ensures some advance with each contraction. Sooner or later the cervical canal is completely canalized, forming a circle of about three and a half inches diameter. When this limit is reached the membranes, being unsupported both below and laterally, rupture and the escape of the forewaters take place.

The first stage of labour is characterized by these phenomena—

1. Regular and rhythmical uterine contractions, becoming increasingly frequent and longer. At first the pain is felt over the sacrum, later in the abdomen. It usually is not severe and causes but little physical disturbance. The duration of the contractions is from five to thirty seconds.

2. Real shortening of the cervix, its upper part becoming incorporated with the lower uterine segment; a valuable sign that labour has begun.

3. Discharge of blood-stained mucus, commonly known as "the show." This is derived from the cervical canal and is blood-stained from the rupture of small vessels during the separation of the chorion from the decidua.

The Mechanism of the Second Stage of Labour is better understood by consideration, firstly of the expelling forces, secondly of the passages, and thirdly of the various movements of the child in its expulsion due to the interaction of these two forces.

1. *The expelling forces* are the uterus, the diaphragm and the abdominal muscles.

The muscular fibres of the uterus are longitudinal and circular, each with its definite function. The longitudinal fibres act by approximating the fundus and the cervix. As the latter is fixed, the action of these fibres must be to expel the contents of the uterus. The nature of the contraction is a peristaltic wave starting at the fundus. This force is sometimes known as the "foetal axis pressure." In ordinary labour it is estimated at from five to fifteen pounds. The circular fibres prevent any sagging or bulging of the uterus and keep the foetal axis rigid, thus permitting the pressure to act advantageously. The action of the circular fibres is called the "form restitution of the muscular force." The contraction fibres in the round ligaments causes the body of the uterus to tilt forwards, so as to bring the long axis of the uterus approximately into line with the axis of the brim of the pelvis.

The diaphragm and abdominal muscles act

by increasing the intra-abdominal pressure and drive the uterus and its contents downwards towards the pelvis.

2. *The passage* comprises the bony pelvis and soft tissues.

The axis (*i. e.* the line drawn through the approximate centres of the planes of the pelvis) is a curve—the curve of Carus—and it will be seen that the axes of the brim and outlet are approximately at right angles. The greatest diameters of the pelvis vary according to the plane; thus the transverse is the largest diameter at the brim, the antero-posterior at the outlet.

The depth of the pelvis measures one and a half inches in front, whereas posteriorly it is four and one-third inches; in other words, the front and sides of the bony pelvis are absent below, and the tissues closing those spaces are soft and elastic.

Soft tissues. The method of dilatation of the lower uterine segment and cervix has already been described. The anterior wall of the vagina and the bladder are very loosely connected to the pelvis. Hence, as labour progresses and the upper uterine segment acts more powerfully, there is no hindrance to the drawing up of these structures.

The other important soft tissues are the pelvic floor and perineum. The pelvic floor may be said to be composed of the levator ani muscle and its fascia. This muscle has a wide fascial and tendinous origin from the front and side walls of the pelvis. Comparatively insignificant in front, it ends as a thick fleshy muscle in an attachment to the coccyx, rectum and central perineal region. The fibres of the muscle run backwards, downwards and inwards, and the two halves together form a gutter-shaped depression whose action will be to turn forward anything which may impinge on it from above.

The Fœtus. For the purpose of this chapter the head and neck of the fœtus are alone considered. From the obstetrical point of view the head has a long diameter, measured from behind forwards, varying from three and three-quarter inches (suboccipito-bregmatic) to four and a quarter inches (occipito-frontal), depending on the amount of flexion present. The short diameter is measured from one parietal eminence to the other and is about three and three-quarter inches. The circumference of the head measures about thirteen inches.

The head is free to move on the neck either by extension or flexion, or laterally, *i. e.* lateral flexion, a movement which approximates the ear to the corresponding shoulder, and, lastly, by a limited amount of rotation, which allows the chin and occiput to swing away from the mid longitudinal line of the body.

The fœtus presents by the head in about

ninety-seven per cent. of all cases, of these in seventy-five per cent. with its back to the left and in front. The probable explanation is as follows:—(1) The line of the centre of the specific gravity of the foetus is at the level of the shoulders, nearer to the right than left and rather posterior than anterior. If immersed in fluid of its own specific gravity the foetus tends to lie with its right shoulder lower and its back to the left. (2) The foetal ovoid places its long axis in the long axis of the ovoid containing it. This will bring the head into the lower uterine segment. (3) The shape of the inner aspect of the uterus being convex posteriorly and concave anteriorly, the convex surface of the foetal back fits into the concave anterior aspect of the uterus. All these reasons will tend to produce a first vertex presentation.

The *movements* of the child may now be followed.

1. *Descent with increasing flexion.* As the uterus contracts and retracts the foetus is driven downwards through the pelvis, the foetal head jointed on the spine being comparable to a lever with unequal arms, a shorter posterior and a longer anterior. The effect of friction of the pelvic walls will necessarily cause the shorter arm of the lever to descend, in other words, will produce increasing flexion of the head. The usual obliquity of the uterus upwards and to the right will tend to increase this result if the back of the foetus is to the left.

2. *Internal rotation.* The foetal head has now reached the pelvic floor, the action of the muscles of which is to push forward that part of the foetal head which first reaches it from above.¹ The head can only accommodate itself to this force by rotating. Since the occiput nearly always leads owing to flexion of the head, it will be turned forwards under the pubic arch and the sagittal suture will lie parallel to the antero-posterior diameter of the outlet. In addition, the long diameter of the head will naturally tend to lie in the largest diameter of the canal through which it is passing, which at the outlet is the antero-posterior.

3. *Birth of the head.* There are probably two distinct movements by which the head escapes from the pelvis. It has been shown by frozen sections, as well as by rectal examination, that the chin does not leave the chest until the suboccipito-bregmatic diameter has been born. The first movement is probably slight extension of the cervical spine, which thus acts as a connecting-rod. Force transmitted along the foetal spine in the axis of the brim will propel the occiput forwards in the axis of the outlet without loss of power, and at the same time will keep the head flexed.

¹ Paramore, *Journal of Obstetrics and Gynaecology*, vol. xvi., p. 213.

Directly the suboccipito-bregmatic diameter is born extension of the head takes place, the forehead and face pass over the perineum, and the head is delivered.

Restitution. As the shoulders do not follow the internal rotation of the head, the latter, directly it is born and free to move, rotates back again into its normal relation with the trunk.

External rotation. This movement of the head is caused by the shoulders rotating from the oblique to the antero-posterior diameter of the outlet of the pelvis. The head, being free, rotates with the shoulders, its long diameter lying parallel to the transverse diameter of the outlet.

The shoulders follow the movements of the head, and for the same reasons. They descend to the floor of the pelvis, make a short internal rotation so as to bring the junction of the anterior shoulder and neck beneath the symphysis, when by lateral flexion of the body the posterior shoulder passes over the perineum, followed by the anterior from beneath the symphysis. If the child is small, or if the vaginal orifice is relaxed from frequent child-bearing, the anterior shoulder may be born first.

Mechanism of Third Stage of Labour.—The placenta may be detached in one of two ways, known respectively as Schultze's and Matthews Duncan's.

1. *Schultze.* During relaxation of the uterus a clot forms between the uterine wall and the placenta. During contraction this clot presses against and detaches more of the placenta; during relaxation further hæmorrhage increases the size of the clot and ultimately detaches the placenta from centre to periphery. The placenta is expelled by the uterus, inverted and dragging the membranes after it.

Clinically this mechanism can be recognized by the absence of external hæmorrhage and by the uterus not appreciably diminishing in size, though hard and firm, during a contraction. When delivered the placenta is inverted, with a large clot between the maternal surface and the membranes.

2. *Matthews Duncan.* As the uterus contracts and retracts the placental site necessarily diminishes in size. The placenta, being inelastic, is unable to accommodate itself to this diminished area. Hence the placental site, so to speak, slips away from beneath the placenta and detaches it from without inwards. Probably the placental site never shrinks sufficiently to detach the placenta completely, but as the uterus becomes smaller the fundus will act powerfully on the semi-detached placenta and complete the process. Hence it may be said that the placenta is loosened by shrinkage of the placental site and detached by detrusion. This method can be recognized by a constant slight trickle of blood during detachment, the

uterus remaining small and diminishing in size with contractions. The placenta is born folded upon itself with the edge of the maternal surface presenting.

Amount of blood lost. This varies greatly; about ten ounces is the average, over twenty ounces is to be considered pathological.

Diagnosis.—The diagnosis of the position and presentation of the child is of the utmost importance, otherwise intelligent prognosis is impossible and labour may be unnecessarily prolonged, especially in occipito-posterior cases. Two methods of examination are used, viz. abdominal and vaginal. Both are important, but with practice the physician will learn to rely more and more on the abdominal method and use the vaginal route only for confirmation.

The Abdominal Method.—The advantage of this method is that information of importance can be derived not only during labour, but also during the last month or so of pregnancy. Every pregnant woman should be examined during the last month of her pregnancy, especially if a primipara. The slight trouble entailed is more than counterbalanced by the anticipation of a straightforward labour, or by the timely recognition of some abnormal condition. The following points should be ascertained—

1. The lie of the child, *i. e.* the relation of its long axis to that of the mother.
2. The position, *i. e.* the relation of the child's back to its mother's abdomen.
3. The presentation, *i. e.* that part of the child which occupies the brim of the pelvis.
4. The adaptation of the presentation to the pelvis.
5. The presence or absence of flexion of the head if the vertex presents.
6. The condition and approximate size of the child.
7. The size of the pelvis by the use of the pelvimeter.

It may be difficult at times to make out all these points, especially if the patient has rigid abdominal muscles and is unable to relax them or if the uterus is irritable and contracts during the manipulations.

The patient should be lying on her back in a good light with her abdomen fully exposed, the physician standing on her right side.

Inspection.—The height of the uterus and its relation to the long axis of the patient should be noted. One or other side of the uterus will look the fuller, indicating the position of the child's back, the obliquity of the uterus being disregarded. A spherical shape of the uterus accompanies over-distension with fluid, *e. g.* hydramnios.

Palpation.—The examiner should either sit or stand facing his patient. He should ascertain the following points in order—

- (a) *Pelvis.* By placing his thumbs on the

anterior superior iliac spines and iliac crests, and the palms of his hands on the outer surface of the ilia, and sliding his hands to and fro in this position, he will arrive at a useful idea of the pelvis as a whole. The stunted shallowness of a rickety flat pelvis is made obvious by this means. The inclination of the iliac crests in a normal pelvis is downward, forward and inward to the anterior superior iliac spine. In a flat pelvis they are continued forwards and slightly outwards, so that the anterior superior spines are farther from the mid line of the body.

(b) The height of the fundus should be noted, especially before labour, to ascertain if the height of the uterus corresponds with presumed duration of the pregnancy. The part occupying the fundus should be made out.

(c) *Position of back.* By placing the hands one on either side of the long axis of the uterus and pressing them together a resistance will be found on one or other side indicating the back. If the foetal limbs are very distinctly felt an occipito-posterior presentation should be suspected, in which case the resistance of the back may be felt posteriorly, often feeling more like an edge than a flat surface.

(d) *Foetal head.* The examiner should now face his patient's feet and dip his fingers into the sides of the pelvis, pressing rather firmly. By this manœuvre he will grasp the presenting part between his fingers unless it has sunk out of reach. In vertex presentations the forehead will be felt. If this is alone detected the certainty of a well-flexed head is established, for the more the flexion the lower is the occiput and the more prominent the forehead. Sometimes a prominence of about equal size can be felt on either side of the head. This indicates deficient flexion, the occiput also being palpable. But in vertex presentations the forehead is always the more prominent of the two.

(e) *Adaptation of presenting part to pelvis.* The only real difficulty is to determine whether a head which is lying high is above, or engaged in, the brim; if freely movable it must be above the brim. The adaptation of the presenting part to the pelvis is most important and must be accurately ascertained in all cases. If the foetal head in a primigravida is found above the brim it is to be regarded as pathological.

(f) *Size of the child.* With a little practice, by feeling the back and head of the child a fair estimate of its size can be made.

(g) *Auscultation. Condition of the child.* It is important that the foetal heart-rate should be counted at the *beginning* of all labours. Normally it is about one hundred and forty beats per minute. A quickening or, still more important, a distinct slowing of the rate indicates foetal distress and probable operative interference in the child's interest.

The position of the maximum intensity of the fœtal heart is of diagnostic importance. In vertex presentations the heart is best heard through the back of the child's left shoulder, hence, in the first position (LOA), the maximum intensity will be somewhere in a line between the mother's umbilicus and the middle of Poupart's ligament or the left anterior superior iliac spine. In the second position (ROA), an inch to the right of the middle line between the umbilicus and pubes. In the third position (ROP), in the right iliac fossa a little below and internal to the right anterior superior spine. In the fourth position (LOP), the thickness of the mother's spinal muscles prevents the heart from being heard in the expected position, but it will probably be detected either over the left lateral aspect of the uterus, or in the middle line in front, when, if the stethoscope is pressed deeply, it will come down on the chest of the child.

As labour progresses the fœtal heart will be heard nearer the pelvis, and it is a useful guide as to the advance the child is making.

(h) *Pelvimetry.* In a normal pelvis three measurements of the false pelvis should be taken. The interspinous distance between the anterior superior spines should measure about ten inches. The fossa between the origins of rectus and sartorius, which will be constantly found a little below and external to the spines, is a convenient spot into which to press the points of the callipers. The intercrystal diameter is about one inch longer and is measured from the two most distant points of the iliac crests. The external conjugate (or diameter of Bandelocque) is measured from the depression below the last lumbar spine to the nearest point on the symphysis pubis. The former point will be found about one inch above a line joining the posterior superior iliac spines, though it varies with the shape of the pelvis. This diameter should measure seven and a half inches, but unless it is less than seven inches, there is no justification for assuming contraction of the brim; nor of deducing the conjugate of the brim by subtracting three and a half inches from the external conjugate.

Vaginal Examination.—The first vaginal examination should be conducted systematically and the following points noted—

1. *The size of the pelvis.* The sacral promontory should always be felt for. In a normal pelvis it is out of reach unless the attempt made to reach it is very forcible. If felt, contraction of the pelvis is present. In the small round pelvis the outline of the brim can be felt anteriorly almost as far as the transverse diameter.

2. The presence of tumours in the pelvis. These are very rare and commonly in Douglas's pouch.

3. The condition of the bladder and rectum, whether distended or not.

4. The size and lubrication of the vagina.

5. The amount of dilatation and shortening present and the texture of the rim of the os, whether soft and dilatable or hard and resistant. The os may be considered to be fully dilated when its posterior margin cannot be felt on ordinary examination. Prolapse of the anterior lip of the os will easily be detected.

6. Presentation or prolapse of the cord.

7. The presence of a pathological vaginal discharge with excoriation of the skin of the perineum and other signs of inflammation.

8. The presentation and position of the child. The vertex will be recognised as a hard, rounded body, on the surface of which certain ridges or sutures and depressions or fontanelles can be felt.

The *sagittal suture* can be distinguished as a ridge running in one of the oblique diameters, which becomes more prominent in the second stage of labour owing to the moulding of the head. In the first stage of labour it can be felt through the vaginal walls.

The *fontanelles* may be recognized by their position and shape. As a result of abdominal examination the position of the back can be determined in nearly every case. The fontanelle at the corresponding extremity of the sagittal suture *must* be the posterior; it is formed by the junction of sagittal and coronal sutures, and the angle of junction is a relatively wide one. This fontanelle is frequently very difficult to recognize as an actual depression. The anterior fontanelle is a definitely diamond-shaped depression into which the anterior end of the sagittal suture gradually merges. The entrance of the coronal suture into the fontanelle is usually marked by a small, easily recognizable triangular notch.

The relative levels of the fontanelles is important. With good flexion of the head the anterior is much higher up and is out of reach. Hence if the anterior fontanelle is easily felt, insufficient flexion of the head is present, an important point, especially in the management of occipito-posterior cases.

Lastly, if for any reason, *e.g.* large caput succadaneum, the landmarks on the vertex are obliterated, the helix of the ear is a useful guide, as it must necessarily point to the occiput.

Antiseptics.—The mortality from sepsis in childbirth is officially stated to be about two per thousand. It is probably greater than this, for deaths from continued fever in childbed may be registered as due to other causes than septic infection. Similarly, patients really suffering from septicaemia may die with the symptoms and signs of pneumonia. In the favourable surroundings of our lying-in hospitals septicaemia would be non-existent were it not that patients already infected from outside are admitted. In these institutions, which are training schools

as well, delivery in straightforward cases is effected by untrained pupils under close supervision, and with strict antiseptic precautions good results are only to be expected. Equally good results are obtained in the "districts" of the London hospitals, among all the squalor and dirt of the very poor. In this instance the patients are attended by medical students already efficiently grounded in the principles and practice of antiseptics. The wholly admirable way in which they carry out the details of their knowledge is shown by the low mortality and absence of serious illness in this "district" midwifery practice. The moral to be drawn from these two illustrations is obvious. The one is analogous to the practice of midwifery among the favourable surroundings of the rich, the other to the conditions of practice among the poor. Both can be made equally immune from septic diseases if only antiseptic precautions are honestly taken.

Practically all cases of septic puerperal fever are the result of infection by organisms introduced from without during labour; it follows that if no vaginal examinations were made there would be no infection, and that the risk of infection must increase with the number of examinations; also that every care should be taken to prevent the tip of the examining finger from touching the external parts unnecessarily during the process of examination. Lastly, that if the examining finger be surgically clean, and also wet with an efficient antiseptic solution, it will do less harm by reason of the antiseptic than if this latter be lacking.

It is not necessary to enter into the details of the first two points beyond saying that in normal cases two vaginal examinations are amply sufficient, the first to ascertain how far labour has progressed when the patient is first seen, and the second at the commencement of the second stage to make certain of the diagnosis. In making an examination the patient should be fully exposed on her left side and the labia separated with the index finger and thumb of the left hand, so that the right forefinger can be passed straight into the vagina.

As regards the preparation of the hands it is difficult to lay down hard-and-fast rules. If one's hands are clean enough to perform a surgical operation they are clean enough to make a vaginal examination, no less will suffice, and the simpler the methods are to obtain this end the better. The use of rubber gloves makes the antiseptic technique easier, and for that reason they should be employed. They can be readily sterilized by boiling, and when not in use can be kept immersed in some strong antiseptic solution ready to be slipped on again when wanted. The great advantage that the use of rubber gloves confers is the readiness with

which they may be sterilized by means of disinfecting solutions while they are being worn. The drawback to their use is the diminution of the sense of touch, but this largely disappears with practice.

It is equally important that the patient's external genitals should be as clean as possible. To this end the nurse should be instructed to cut the vulval hairs as short as possible and to wash thoroughly the external genitals with soap and water, followed by careful swabbing with some antiseptic solution. During the actual course of labour a sterilized pad should be worn, and whenever a vaginal examination is to be made the externals should be reswabbled.

It may be mentioned here that inexpensive obstetric outfits containing all necessary articles both for patient and doctor can be obtained ready sterilized in tins.

As regards antiseptic solutions there can be little doubt but that either the perchloride or biniodide of mercury is the most reliable for hand disinfection. For swabbing and douching one or other of the coal-tar derivatives, cyllin, lysol, etc., may be used, chiefly on account of their non-poisonous properties.

Management of Labour.—The room should be as large and airy as possible; all unnecessary furniture should be removed. The bed should preferably be a single one and not too low, the mattress being sufficiently hard to prevent the patient from sinking into a hollow. The effects of a soft mattress can be overcome temporarily by inserting a few boards under it. It is advisable that the patient's night-dress be pinned up out of the way above her waist, and over this she should wear a loose flannel garment. For his own use the physician will require three basins—one for scrubbing his own hands and forearms, one containing clean water to remove the soapsuds, and a third with the antiseptic solution. On a table placed at the bedside should be arranged a basin containing an antiseptic solution and absorbent wool swabs, a smaller vessel with boracic acid solution, in which is immersed sterilized thread for ligaturing the cord and small squares of gauze or linen for wiping out the child's nose and mouth. It is advisable to have a small tray in which to place instruments and material for suturing any laceration of the maternal soft parts. In addition there must be a fire and good supply of hot water.

Management of the First Stage.—The physician can do little in a normal case. He should assure himself of the lie and presentation and should note the rate of the foetal heart. He should give directions to his patient not to strain during the pains, lest she should rupture the membranes prematurely. The patient should be advised to remain up for as long as

she can, so that gravity may assist in the dilating process. Lastly it is very important that the bladder and lower bowel should be kept empty.

Vaginal examination is hardly necessary during the first stage, since presentation of the cord is the only abnormality to be feared, and it is exceptionally rare. By noting the frequency of the pains and their effect a sufficiently accurate guess can be made as to how far labour has progressed. But if it is important to know this fact an examination must be made. Unless the cervix has been taken up and obliterated it is unnecessary to wait in the house. After this stage has been reached it is safer to wait if the patient is a multipara, in a primipara eight hours, at least, will certainly elapse before the birth of the child. Great care must be taken to avoid rupturing the membranes, the finger must remain passively in the vagina should a pain start and the membranes bulge during an examination.

Management of the Second Stage.—As soon as, or a little before, the second stage commences the patient should be put to bed and should be encouraged to strain down with the pains and to rest in the interval between them. A pulley or towel fixed to the end of the bed will help. If the membranes have not already broken they should be ruptured and a final diagnosis made of the position and presentation. In a normal case there is no need for further examination unless the head is not distending the perineum within two hours, but the foetal heart should be auscultated from time to time. The question of administration of chloroform must be left to the individual, but it is advisable to delay giving it until as late as possible. The exception to this rule is when a patient, being afraid of the physical pain, will not help herself by straining. If she is lightly anæsthetized and the worst of the pain abolished she will often bear down with her pains better and so expedite matters.

Delivery of head. Though rupture of the perineum may not be completely avoidable in all cases, yet the extent of the rupture can with care be materially diminished.

It is essential that time should be given for the perineum and vulva to distend slowly, and also that the head be kept flexed to allow of a small diameter passing. To ensure these two points the attendant should stand behind his patient, and with the palmar surface of two or three fingers of his right hand prevent the frontal end of the child's head from slipping too fast over the perineum. Or, standing in the same position, he may pass his left hand between his patient's thighs and control the forward movement of the head with the fingers of his left hand. If the head seems to be extending too soon before the occiput has fully escaped

(i.e. failure of the connecting-rod action of extension of the cervical spine), a finger may be slipped between the head and the symphysis. By pulling the occiput downwards and backwards it can often be disengaged from under the symphysis, allowing the suboccipital region to take its place. This manœuvre often fails, but it can be readily accomplished with the forceps.

The largest diameter has escaped when the suboccipito-bregmatic diameter is born. If a foetal skull is examined it will be seen that the two parietal eminences form points on the circumference of the circle of which the suboccipito-bregmatic is the diameter. Hence when either the anterior fontanelle or a parietal eminence is seen, the head may be safely allowed to escape. In the actual delivery of the head attention must be paid to two points, to wait for the interval between two pains and then to feel just below the coccyx for the chin and push it forwards towards the symphysis. By this manœuvre all pressure possible is taken off the perineum and the normal extension of the head favoured.

Directly the child's head is completely born it should be ascertained whether the cord is round its neck. If so, the loop should be pulled down and slipped over the child's head, or, failing this, as the shoulders descend enough of the cord should be pulled down to enable the shoulders to be delivered through the loop.

The child's eyelids should be at once swabbed, before they are opened, with 1 in 2000 mercurial solution, and its nose and mouth wiped with gauze to remove any excess of mucus. Time should be allowed for the shoulders to descend and rotate unless the child attempts to breathe, which is shown by movements of its nose and mouth. The correct way to deliver the body is by expression and not traction; the left hand should grasp the fundus and push downwards and backwards in the axis of the brim, while the right hand guides the neck of the child upwards under the symphysis. Care must be taken to deliver the shoulders correctly, with the bis-acromial diameter in the antero-posterior of the outlet, otherwise a slight tear of the perineum may be converted into a serious one. Sometimes, especially with large babies, there may be great difficulty in the delivery of the shoulders. In these cases the shoulders are lodged squarely on the brim, instead of the anterior being the lower. Directly this delay is noticed the head of the child must be pulled forcibly backwards over the perineum, thus dislodging the anterior shoulder and allowing it to descend. Another method of pulling down the shoulder by hooking the finger into the axilla and pulling is not to be recommended, as being liable to damage the soft structures in the axilla or even the upper epiphysis of the

humerus. When the cord has ceased pulsating (placental end) it should be divided between ligatures and the child removed to a safe place.

Management of the Third Stage.—The third stage should always be conducted with the patient on her back, as the uterus can thus be more easily controlled. The attendant should place his left hand on the abdomen, with his fingers behind and his thumb in front of the uterus. It will be noticed that the uterus alternately contracts and relaxes, and may become so soft that its outline is indistinguishable. Such relaxation is perfectly physiological, provided that no undue hæmorrhage occurs, or that the uterus does not dilate from hæmorrhage into its cavity. The first will be seen at once and the second will be detected by the uterus raising the hand if it is being held in the way described above. The uterus can only act on the placenta while it is within its cavity, hence as soon as the placenta has left the uterus it should be delivered by expression. The following signs indicate that the placenta has left the uterus—

1. The uterus becomes smaller and harder and rises higher in the abdomen.

2. While the placenta is in the uterus the supra-pubic region looks flat and feels empty. When the placenta has left the uterus there is a distinct bulging of this region and it feels fuller.

3. There is frequently a slight gush of blood accompanied by protrusion of the cord.

4. If a gentle attempt at expression be made more of the cord will appear. If the placenta is still attached in the uterus the cord will recede when the pressure is taken off the fundus, on the other hand, if the placenta has left the uterus the cord will not move back.

Expression of the placenta. This manœuvre is accomplished by holding the uterus in the left hand as described above and pressing it downwards and backwards in the axis of the brim (*i. e.* in an imaginary line joining the umbilicus and tip of the coccyx) and at the same time squeezing it between the fingers and thumb. As the placenta emerges it should be taken in the right hand and gently twisted round and round two or three times, so that the membranes may follow coiled like the strands of a rope. No traction should be made on it, it should be allowed to fall out by its own weight, aided by expression from above.

Except in cases of post-partum hæmorrhage no attempt at expression should be made until the placenta is detached, otherwise there is a risk of some of it or of the membranes being retained; and, secondly, the uterus must be firmly contracted, as if not expression may start an inversion.

Examination of the placenta and membranes. The placenta and membranes should be placed

in a bowl of water for examination. By holding the maternal surface upwards in the palms of the two hands and making this surface slightly concave the cotyledons should fit together, and the absence of one will be easily detected. The membranes should next be split into their component sacs. The chorion can be traced to the placental edge and the amnion to the insertion of the cord. A deficiency in the chorion with a pair of vessels torn across denotes the presence of a retained placenta succenturiata. It not infrequently happens that the membranes are torn and ragged when born, so that only an approximate guess can be made as to their entirety, but if they slipped out easily at their delivery they will probably be intact.

If examination leaves no doubt but that part of the membranes is retained, a vaginal examination should be made to discover the whereabouts of the missing piece. If it is found hanging down into the vagina it should be removed, as otherwise it is certain to become infected and give rise to sapræmia. It is best detached by clipping it with a pair of Spencer Wells forceps and twisting the handles round and round, repeating the process as more of the missing piece appears; simple traction nearly always fails. But if the piece of membrane is retained completely inside the uterus, and none of it can be found in the vagina, it is safer to leave it. Attempts at its removal will almost certainly fail, as it is difficult to feel if adherent to the uterine wall, and it is still more difficult to make certain of its complete removal. A small piece of membrane retained in the uterus comes away in shreds in the lochia, if it is larger it will usually be passed as soon as the patient sits up. In neither case will it cause any symptoms except a slight persistence of the red lochia. If it should become infected the case becomes one of sapræmia and should be treated as such, when removal of the retained membrane is very much easier.

The prejudice against leaving retained pieces of membrane is great, and if a search for it is determined on it is better to anaesthetize the patient and give a very hot intra-uterine douche, 120° F. at least. This renders the membrane much tougher, probably by coagulating its albumin, and at the same time causes it to shrink. Aided by the powerful contraction of the uterus which the douche will cause, the membrane may be detached and washed out. If not, it will be more easily felt by the finger and removed.

Suture of perineum. The perineum and posterior vaginal wall should be inspected for lacerations, and if present they must be sutured. For ordinary lacerations a purse-string suture will be found both efficient and easy of application. The patient should be on her back with

the knees separated and either at the edge of the bed or a bed bath. An anæsthetic is not usually required. Placing the index finger of the left hand at the apex of the tear, a threaded half-curved needle should be passed from the skin edge deep to the vaginal mucous membrane under the left index finger and out at the corresponding point on the opposite side of the perineal tear. Two or three such stitches should suffice. The two essential points are that the suture must be completely buried in its entire course in the sub-vaginal tissues and that the top stitch must pass above the apex of the tear in the posterior vaginal wall. Otherwise a hole will be left between the apex of the tear and the top stitch, down which the lochia can pass, and may possibly infect the sutures. Needless to say, it is equally important that the sutures should not be passed into the rectum. If the tear is only a slight one it is a good plan to pass the sutures while waiting for the placenta, but they must not be tied until the completion of the third stage. The patient being more or less under the influence of chloroform, the pain is hardly felt. The sutures should be of silkworm gut and they should be removed about the eighth day.

Douching. In ordinary straightforward labours douching is quite unnecessary. It may be given after instrumental labours or if there have been any manipulations. The temperature should be about 118° F. in the douche can, and the douche should be of salt solution or of some mild antiseptic. The action of the douche is mechanical and not chemical, so strong antiseptic solutions are not indicated.

Management of After-Delivery.—Provided that the uterus remains well retracted and that no undue hæmorrhage takes place, it is unnecessary to give ergot. But if the labour has been tedious and prolonged through inefficiency of the pains, or if the uterus has been over-distended, it is safer to assume a possible failure of retraction and to give the drug. It is administered by deep intramuscular injection into the gluteal region of some standardized and sterile preparation. If given by the mouth the liquid extract of ergot, not exceeding a drachm in water, may be used. In multiparæ, especially if they have suffered from after-pains on previous occasions, it is well to hold the uterus for twenty minutes to half-an-hour after the placenta has been expelled. This procedure certainly has the effect of preventing severe after-pains, but the reason is unknown. After the completion of labour patients often complain of feeling very cold and may actually shiver. Probably this is due to the diminution in the intra-abdominal pressure, blood leaving the surface for the splanchnic area. Hot fluid to drink is always acceptable; she should be

covered up warmly and hot bottles placed beside her, and every inducement to sleep given.

The attendant should next examine the baby for hæmorrhage from the cord, which should be retied if necessary, and for any obvious deformities, cleft palate, talipes, etc. He should remain in the house for about an hour, by which time any unfavourable symptoms should have shown themselves. Provided that the patient is not losing too much and that the pulse rate has not risen, the attendant may take his departure. J. A. W.

THE NORMAL PUERPERIUM

The puerperium begins with the completion of labour and ends with the completion of involution, a period, all told, of some eight to ten weeks. As there is no indication of the end of involution as a whole, the size of the uterus is taken as the criterion. The physician must consider himself responsible for the health and well-being of his patient for the early part of the puerperium, for some fourteen to twenty days, by which time any damage due to labour will be apparent and the dangers of the puerperal period are at an end.

Physiology of the Puerperium.—At the close of labour the condition of the patient is one of fatigue. The alteration in the blood pressure leads to a sensation of chilliness and is often accompanied by shivering. It is not associated with any rise of temperature or pulse-rate.

The Heart. The apex beat, which during pregnancy had been displaced outwards partly by hypertrophy and partly by the enlarged uterus, gradually returns to its normal position. The pulse should be full and of about the normal rate. It is uncommon to find a marked slowing, although this has been thought to be typical of the puerperal period. A marked rise in the pulse-rate indicates either hæmorrhage or fever and should never be disregarded.

Varicose veins, which so frequently accompany pregnancy, usually disappear fairly rapidly, but small patches of thrombosis in them are not uncommon.

Temperature. The normal puerperium is afebrile. There are, however, certain conditions which, though they cause an elevation of the temperature, cannot be considered morbid. A common illustration is the so-called reactionary fever, which is noticed during the first twenty-four to thirty-six hours. It may reach 101° F.; it falls rapidly and does not cause any constitutional symptoms. Another cause is, for want of a better term, known as emotional. Any trouble such as bad news, domestic worries, etc., may be sufficient to bring it about. The rise of temperature is quite transient and does not cause any other symptoms. For this reason

it is always advisable not to allow the patient's friends to see her too soon nor to stay too long with her in the early days of the puerperium. These evanescent rises of temperature cannot be considered as evidence of "morbidity," hence the committee of the British Medical Association have defined as a standard of morbidity any case in which the temperature rises to 100° F. on one or two occasions between the second and eighth day of the puerperium. Nevertheless it is far safer to assume at the onset of a rise of temperature that its cause is septic until the contrary can be proved.

The Excretions. Large variations occur in the amount of *urine* excreted. As a rule, however, it is increased for the first two or three days and then gradually falls to the normal. Small quantities of sugar (lactose) and peptone are frequently found, while the uterus is involuting rapidly. There is undoubtedly a close connection between these two; the quantities of urea, phosphates and sulphates are commonly less than normal.

The bowels are usually constipated, partly from the lack of exercise, and partly from the nature of the diet. The management of this point will be discussed later.

The skin acts freely, and it is not uncommon to find that the sebaceous glands in the axilla swell up and secrete freely with the establishment of lactation.

The Blood. The normal deficiency of red blood and hæmoglobin of pregnancy is soon made up, and at the same time the leucocytosis of pregnancy rapidly disappears. The quantity of the lochia seems to bear some relation to the diminution of the leucocytosis.

Involution of the Uterus. By this term is meant the return of the uterus to its normal size, a process which requires from eight to ten weeks for its completion. After delivery the uterus weighs some two pounds and reaches to the sacral promontory. During the first week of the puerperium it loses half its weight (Whitridge Williams), and diminishes in size by about half an inch per diem. Webster has shown from examination of the cadaver that the total length of the uterus diminishes more rapidly than the length of the cavity, owing to the rapid diminution in the thickness of its walls. The clinical guide to the rate of involution is the daily height of the uterus above the symphysis. From measurements made by Griffith and Stevens, at Queen Charlotte's Hospital, the average height of the uterus above the symphysis on the first day is five and a quarter inches; on the sixth day three and a quarter, and on the twelfth day one and three-quarter inches. Roughly speaking, involution takes place more rapidly during the first week of the puerperium, so that on the seventh day the fundus should be slightly less

than midway between the pubes and umbilicus, and by the end of the second week it should be just palpable above the pubes, and the third week should disappear behind the symphysis. The rate of involution varies with different patients, and is delayed by intra-uterine or other pelvic sepsis, by retention of blood clot, by over-distension of the uterus during pregnancy, and lastly by multiparity. The exact process of involution is unknown. The old theory of fatty degeneration has been disproved by Helme. The anæmic condition of the uterus would point to simple atrophy and degeneration, and among the degenerating muscle fibres Helme has noticed numerous multinucleated phagocytes, which may be engaged in removing effete products. The presence of peptone in the urine suggests peptonization (auto-digestion) as a possible cause. There is no evidence that the products of uterine disintegration are in any way utilized in the production of milk, attractive though this theory is.

The Lochia is the discharge which escapes from the uterus during the first two or three weeks of the puerperium. For the first three or four days it is composed of almost pure blood and is derived from the raw surface of the uterus and partly from any lacerations there may be. Its colour then changes to pink and it is much diminished in quantity, showing that less blood and more mucus is entering into its composition; two or three days later it becomes still less in quantity and brownish in colour due to admixture of the blood with the secretion of the vagina, which has by this time regained its normal acid reaction. By about the tenth day the lochia should be colourless, and its amount gradually diminishes, so that by the end of the third week the patient should be able to dispense with a pad. The total amount lost is from ten to twelve ounces. It has a sickly animal odour, but is not offensive.

General Management of the Normal Puerperium—

Diet. For the first forty-eight hours anorexia is common, and during this time any light nutritious food which the patient fancies may be given. Within reason no limit should be placed on the quantity of fluid imbibed. When the aperient has acted, on the second or third day, the appetite usually returns and the patient may then have her ordinary full diet. In addition, porridge, gruel, etc., are useful adjuncts, supplying not only highly nutritious, easily digested food, but their residue is of great use in stimulating intestinal peristalsis.

Sleep and Rest. Sleep is most essential for the puerperal woman. Not only does she recover much more rapidly if she sleeps well, but insomnia is one of the early signs of puerperal

insanity. Hence every precaution should be taken to ensure her sleep, especially during the first few days. If insomnia should persist there should be no hesitation in having early recourse to hypnotics. During the night she should not be disturbed between 10 p.m. and 6 a.m. if she is a poor sleeper, as the baby can have one feed from the bottle without harm. If nursing causes her very little disturbance she may nurse the baby once during the night. She should be encouraged, as far as possible, to sleep for a couple of hours in the afternoon. It is essential for the subsequent well-being of the patient that she should have a sufficient period of rest during the puerperium. How long this period should be varies with individuals, but the three essentials to be fulfilled before allowing a patient out of bed are: (1) that the lochia is colourless, (2) that the uterus has sunk to the level of the symphysis, (3) that the temperature has been below 100° F. for at least seven days. If on getting up the red lochia returns, or if the patient should complain of backache or pelvic discomfort, a further period of recumbency is clearly indicated. Ideally at the end of the puerperium a patient should be absolutely fit and well in every respect; and to attain this end there is no more certain way than a sufficient period of rest. After the first three or four days the patient need not keep flat in bed, but she may be propped up with pillows or a bed-rest if she prefers. This position has a definite advantage in promoting drainage from the uterus and vagina.

Bowels. Constipation is such a common and rather troublesome complication that a few words about it are necessary. The difficulty arises from the fact that certain drugs, especially vegetable laxatives, are to a certain extent excreted in the milk, and may upset the infant's digestion. The two most certain drugs—calomel, or other mercurial preparation, and castor oil—are neither very suitable for continued use. If a patient has been in the habit of taking laxative drugs it is usually sufficient to increase the dose of the drug by one half. As a matter of practical experience it has been found that if the drug acts in the desired way no harm results, but that if it fails to do so and is retained it is quite probable that the infant will suffer. The best plan to follow is to give the drug at night, and if it has not acted before midday on the next day to follow it with a soap-and-water enema. The too frequent use of enemata is to be avoided, as being likely to commence the enema habit, with the possible immediate risk of producing an excessively irritating urticarial rash.

Antisepsis. The same scrupulous care must be taken during the puerperium as during labour. A clean and preferably sterilized

vulval pad must be worn so long as there is any discharge, and the pad must be changed frequently. It must never be allowed to become soaked. The pads should be burnt at once unless there is any reason to preserve them for inspection later. During the first three or four days the vulva should be frequently swabbed with some mild antiseptic solution (lysol or cyllin 5 i to O i), and always after defecation and urination. Care must be taken that the hands are surgically clean before any manipulations about the vulva are undertaken. If any perineal stitches have been inserted extra attention will be required. After action of the bowel or bladder the perineum must be swabbed between each suture with small pieces of cotton wool wrung out of the solution, carefully dried, and a strip of fresh gauze laid on either side of the sutures. If these precautions are taken it is quite unnecessary to pass a catheter to empty the bladder.

Douching as a routine practice is better omitted. Should, however, it become necessary, the same care must be exercised to see that a sterile glass nozzle is passed with clean hands directly into the vagina after the vulval orifice has been cleaned with soap and water and an efficient antiseptic.

Binder. The patient will be a great deal more comfortable if she wears a binder, as it affords considerable support to the overstretched abdominal muscles. The material of which it is composed, or the presence or not of straps and buckles, is immaterial. Perhaps the most comfortable and efficient is an ordinary many-tail (three or four) surgical abdominal bandage, made either of domette or flannelette, as by this means the lowest tail can be undone without disturbing the rest. The use of the binder is to prevent the flaccid abdominal muscles from yielding to the constant pressure of the flatulent and distended bowels which is so common during the puerperium. Should this not be prevented, before the abdominal muscles have regained their tone, stretching and elongation of the mesentery is likely to be followed by a permanent enteroptosis. It is only in this respect that the binder restores a patient her figure, and it is obvious that by applying it too tightly it will tend to weaken the abdominal wall and produce the very evil it was designed to prevent.

Special Points in Management—

The Uterus. The rate of involution of the uterus should be recorded on the temperature chart. Taking the 100° line as the symphysis pubis and each degree above as one inch, the involution curve can be easily and graphically recorded. It is essential that the height of the uterus should be charted at the same time daily and that the bladder be empty.

For the first week or ten days the uterus should be palpated on every visit to the patient, partly to correct the involution curve if this is being kept by the nurse, and partly to note other abnormalities if present, *e.g.* flabbiness, tenderness, etc. On the occasion of the first visit the uterus will be approximately at the level of the umbilicus and in the middle line of the abdomen. If not found in this situation it will be probably discovered in one or other lumbar region, displaced by the over-distended bladder. The only symptom which this dislocation causes is a rather too free lochial discharge. On emptying the bladder the uterus rapidly regains its natural situation. If such is not the case a concealed hæmorrhage should be suspected; the patient's appearance and pulse-rate will afford additional evidence.

The size of the uterus varies with the individual, but it will be found to decrease *pari passu* with the height.

The puerperal uterus should always feel firm, and in the early days should respond to stimulation by contraction. In addition it should never be tender, but care is required in ascertaining this fact. For if the uterus be roughly grasped the pain produced may be in the bruised abdominal muscles, or even in the sutured perineum if the uterus is pushed downwards as well. The hand should be lightly placed over the uterus and a gentle squeeze given to it. If pain is elicited the surface of the uterus should be palpated with the fingertip. Tenderness under such conditions is confined to quite a small area, and is usually caused by a clot or piece of membrane in the uterus.

After-Pains. The contractions of the uterus should be no more noticeable to the patient during the puerperium than they were during pregnancy. Sometimes the contractions are painful, the severity varying from a mere twinge to excruciating pain. These after-pains are far more common in multiparæ, and they are due either to spasmodic colicky contractions of the uterus attempting to expel a clot, or else to a cramp of the uterine muscle. It is common knowledge that any muscle which has been over-exerted is very liable to cramp while resting, and such is probably the case with the uterus. The treatment will depend on the cause. If from the size of the uterus and excessive loss a retained clot is probably present, especially in a multipara, a hot fomentation over the hypogastrium, a hot (118° F.) vaginal douche, and a full dose of ergot should be administered; or if this is not sufficient it may be necessary to wash out the uterus, though this is rarely necessary. In such cases the uterus is too tender to permit of attempts at expressing the clot, as one is often advised to do. In the other instance a hot fomentation with hyoseyamus

and other antispasmodics are usually quite sufficient. Narcotics are better avoided.

At any time, but especially during the first week of the puerperium, it may be found that the uterus has ceased involuting; associated with this condition there is usually some tenderness of the uterus and a slightly irregular temperature, the maximum not necessarily reaching 100° F. The most common of all causes of subinvolution is sapræmia, even in its mildest degree. Retained blood clot, pieces of membrane, etc., are also causes of subinvolution. For treatment ergot and hot vaginal douches usually suffice, though it is often advantageous for the patient to be propped up in bed to ensure better drainage of the uterus. Subinvolution is a condition and not a disease, hence the cause must be sought for and treated in all cases.

The Lochia. The course of the lochia has already been described; it is only necessary here to mention some of the common abnormalities.

If too profuse, and especially if largish clots are present as well, failure of retraction has occurred. This condition is uncommon and is usually met with during the first three or four days. Occasionally the loss is so profuse as to be termed late post-partum hæmorrhage. The treatment will depend on the amount of the loss. If really severe the uterus must be explored and washed out; for milder cases ergot and hot vaginal douches suffice; it should be a matter of routine to make sure that the bladder is empty and is kept so.

If the lochial discharge is scanty it may be due to the habit of the patient, or to the fact that the uterus has been washed out after labour. If unaccompanied by other symptoms or signs the condition may be disregarded.

If persistent and red there is probably a piece of membrane or adherent blood clot retained in the uterus. The former may be passed at any time, commonly when the patient sits up, and the discharge of lochia will then resume its normal course. Ergot should certainly be given. Not uncommonly persistent red lochia is associated with a rise of temperature towards the end of the second week, the objective disease being a flushed breast.

The Bladder. Of all minor ailments of the puerperium trouble with micturition is one of the most common, especially during the first three or four days. The physician should always be sceptical of the reports given to him by either the nurse or the patient. He may be told that the patient has passed her water and rest satisfied, whereas further interrogation would have revealed the fact that small quantities at frequent intervals was the true state of affairs, characteristic of an over-distended bladder.

The causes of retention of urine and over-

distension of the bladder fall under the following heads—

1. *Posture.* For many, if not most, patients the first puerperium is the first occasion on which they have been rigidly confined to bed on the back. Such being the case, they are unable to empty the bladder in this position solely from inexperience. After a day or two no further difficulty is encountered.

2. *Laxity of Abdominal Walls.* The patient's abdomen having been occupied by a large swelling in the shape of a full-term uterus, the abdominal muscles are not sensitive to the much smaller distended bladder; hence the impulse to micturate is not noticed.

3. *Bruising and Swelling of the Urethra.* It often happens, especially in first labours, that the passage of the head causes considerable pressure upon, or even damage to, the urethra, and that this is followed by marked oedema and swelling of the urethral mucous membrane. In such cases a temporary occlusion of the urethral canal may occur. If the urethra is actually lacerated the passage of urine over the raw area may give rise to spasm of the urethra and consequent retention of urine.

4. *Secondary to Perineal Suture.* As after operations on the perineum or rectum patients are sometimes unable to micturate, so the same reflex inhibition may be present in puerperal patients after perineal suture.

Treatment of Retention of Urine. It is advisable to avoid passing a catheter if possible, hence other measures should be taken first. Hot fomentations over the hypogastrium or hot water in the bed-pan should be tried first; if these fail, rolling the patient on to her hands and knees, or even propping her up with her legs over the edge of the bed, will usually succeed. Should these measures fail and the distended bladder has reached higher than midway between the pubes and umbilicus, the catheter must be passed under the strictest antiseptic precautions, with the patient exposed and on her back. Retention of urine seldom persists after the first forty-eight hours. Should it still remain a large soap-and-water enema may be given, as when this acts the patient will nearly certainly pass her water, and the habit once broken further retention is improbable.

Management of the Breasts. Early attention should be given to the breasts, and especially the nipples. If the latter have been neglected during pregnancy they will probably be found covered with dried secretion and dead epithelial scales, and the skin beneath will be soft and readily chafe or crack. To remove the dried crusts nothing is so satisfactory as a warm oil fomentation, followed by careful washing with soap and water and then the application of some hardening fluid. Of the various preparations

nothing is better than 1 in 4000 solution of perchloride of mercury. A small strip of gauze or lint may be soaked in the solution and applied round the nipple, and allowed to remain. If the nipples are depressed attempts should be made to draw them out with a breast exhaustor.

In ordinary cases the first trouble with the breasts is associated with the influx of blood on or about the third day. It may vary from a sensation of weight and fullness to the most intense pain. It is only in these extreme cases that a rise of temperature is noticed. If it is realized that the engorgement is due to blood and not to milk the folly of putting the baby to the breast or of applying a breast-pump in the hope of exhausting them is obvious. The right treatment is to support the breasts with a sling if they are pendulous and to apply frequent large fomentations. Sometimes gentle massage from base to apex with the finger-tips moistened with warm oil or glycerine relieves the pain more than anything else.

Cracked and Sore Nipples. These may give rise to great pain while nursing the baby. The cracks in the skin may be superficial, or sometimes, especially if situated at the base of the nipple, may resemble deep fissures. Besides the pain they cause they are the point of entrance of infection in mammary abscesses.

Causation. In all cases cracked nipples are due to one of three causes. As before stated, if the nipples have not been properly attended to during pregnancy the skin over them is soft and very liable to crack or chafe when put into the baby's mouth. Or if the nipple is ill-formed, small or depressed the baby is unable to grasp it properly, and in its attempts to do so is very liable to damage the epithelium. Or, lastly, if there is an insufficient supply of milk for the infant's needs it will exhaust the supply in five or six minutes and spend the remainder of the time at the breast in champing and pulling at the nipple in its vain attempt to obtain more, and cracks will soon appear.

Treatment. If these three causes are kept in mind the prevention of cracked nipples is not difficult. Much may be done in the first three days, before lactation is established, in cleansing and hardening the nipples. If small or depressed a nipple shield should be used, especially if the baby has any difficulty in grasping them. Until lactation is fully established the baby should not be put to the breast for more than five minutes every six hours. If the milk supply be insufficient the baby can be fed from both breasts alternately with the bottle.

Local. If, however, despite all care a crack should appear, the first essential is to keep it clean. A small strip of gauze soaked in any dilute antiseptic solution (e. g. boracic acid, hyd. perchlor., sulphurous acid) and kept over the

crack usually suffices. Sometimes these cracks are extremely painful, in which case, or again if they do not show signs of rapid healing, a nipple shield should be used. Finally, resting the breast for twenty-four to forty-eight hours will heal any crack, and if the breast becomes engorged during this time the excess of secretion can be readily removed by massage.

Flushing of the Breast. The exact pathology of this rather rare condition is not known. It may occur at any time, but is usually seen towards the end of the second week. It is ushered in by a sudden rise of temperature with marked constitutional symptoms. On inspection the skin over a limited area of the breast is seen to be red, and feels hot, and the underlying portion of the breast hard and knotty and maybe a little tender. The rest of the breast is healthy. In some cases it is definitely associated with sapræmia, in others persistent red lochia is the only abnormality discoverable. The condition commonly lasts for about forty-eight hours and then passes off. As regards treatment, if it occurs early and is associated with sapræmia the interior of the uterus should be explored and washed out. Locally hot fomentations to the affected breast suffice, nor is it necessary to wean the baby from the breast.

J. A. W.

ABNORMALITIES OF PREGNANCY

Abortion, Miscarriage, and Premature Labour

Definition. These terms indicate the premature expulsion of the ovum. This may take place at any period of pregnancy, and is usually preceded by cessation of foetal life. If this occurs in the early months of foetal life the condition is called "Abortion" or "Miscarriage."¹ If the foetus survives up to the twenty-eighth week it becomes viable, and expulsion after this period is termed "Premature labour."

Frequency. It is hardly possible to estimate with precision the exact frequency of abortion, inasmuch as the earliest cases may follow a few days' amenorrhœa and are characterized only by the occurrence of a somewhat profuse menstrual period.

According to Dr. Malins, who analysed 4,000 cases of parous women, the frequency of abortion amounts to 18·9 per cent., or one abortion to every five pregnancies. This would show a general abortion rate of twenty per cent. Doléris found that the frequency varied from three to ten per cent. in the Parisian maternity hospitals.

¹ The attempt to distinguish between abortion and miscarriage, limiting the latter to the termination of pregnancy between the fourth and sixth months, appears unnecessary.

The greatest number of abortions occur during the second and third months.

Etiology. The causes of premature expulsion of the ovum are numerous and varied.

Recent observations on the early foetus have demonstrated that in a large proportion of cases the embryo shows pathological lesions incompatible with a continuance of intra-uterine life. Degenerative changes in the decidua, leading to hæmorrhage, with thrombosis of chorionic villi are also responsible for many cases of early abortion. Local conditions of the uterus, such as deficiency of development and various forms of endometritis, also tend to interfere with the healthy implantation of the ovum. Displacements, especially retroflexion and prolapse, are common causes. It must also be borne in mind that deep lacerations of the cervix, usually the result of injury in preceding labours, strongly predispose to abortion.

Certain general diseases, such as albuminuria, anæmia, cardiac affections and especially syphilis are very frequent causes of abortion. It is also generally known that the acute infectious diseases, such as acute pneumonia, typhoid fever, smallpox, etc., are followed by the death of the foetus and its expulsion, usually as a result of the poisonous toxins circulating in the maternal blood, together with a high degree of pyrexia.

Exceptionally, injuries such as a fall or blow may cause intra-uterine hæmorrhage, due to separation of placenta or decidua, and this is speedily followed by abortion.

In rare instances, also, emotional factors, such as shock, grief or fright, may be responsible for extrusion of the ovum.

Placenta prævia commonly causes abortion, slight hæmorrhages occurring each month at a time corresponding to the missed menstrual period. In many cases the contents of the uterus are expelled spontaneously about the end of the fourth month.

Attempts to bring about criminal abortion, usually by the introduction of some instrument, must always be remembered as a possible cause.

Recurrent abortion is usually either syphilitic in origin, or may occur as a result of endometritis. The repeated occurrence of abortion at three to four months strongly suggests the existence of retroflexion of the uterus.

Pathology. In the early months the ovum is usually expelled along with the decidual lining, which is separated from the wall of the uterus by hæmorrhage. During the third month the ovum is also often extruded as an ovoid mass, with the developing placenta showing as a thickened area over the decidua serotina.

In some instances the ovum is expelled with the amnion intact, the cord being torn across at the point of insertion.

After the fourth month the decidua diminishes in thickness, and the foetus is often expelled alone. This may be followed by the placenta and membranes, though in some cases these may be retained for a considerable period.

Symptoms. These are mainly two in number:—(1) Pains felt either in the back or the abdomen. These are due to contractions of the uterus and are intermittent in type. (2) Hæmorrhage. This usually points to partial detachment of the decidua and is attended with some degree of dilatation of the cervix. If pain and hæmorrhage are slight the condition is known as one of "threatened abortion," and under favourable conditions the pregnancy may still continue. If, however, the hæmorrhage and pain persist, abortion must be regarded as being "inevitable."

Complications—

1. **Excessive Hæmorrhage.**—This is exceptional in cases pursuing a normal course. Even if free bleeding occurs the risk of a fatal result is slight, as with the onset of faintness hæmorrhage ceases.

2. **Incomplete Abortion.**—In some cases, after escape of the foetus and amniotic fluid, the membranes with the decidua remain in the uterine cavity. This tissue may be retained for some weeks, giving rise either to continuous or recurrent hæmorrhage, which only ceases after complete evacuation of the uterus. Retention of the placenta is particularly liable to occur after the third or fourth month, as at this period it is firmly united to the uterine wall and shows few signs of the degenerative processes which are present at full term.

3. **Infection.**—If the cavity of the uterus is not completely emptied the cervix remains patulous, often containing blood-clot. Organisms thus readily ascend into the uterine cavity and multiply rapidly in the retained products. This is usually followed by infection of the toxæmic type, which, as a rule, rapidly subsides after evacuation of the uterine contents. In other cases, usually as a result of criminal procedures or neglect, septicæmic infection of the uterus develops, which may terminate fatally.

4. **Decidual Endometritis.**—The retention of even a small portion of decidua prevents the complete involution of the uterus. This often leads to hyperplasia of the mucosa, which is associated with menorrhagia of a persistent type.

5. **Placental Polypi.**—In rare instances a mass of retained placental tissue becomes covered with blood coagula which may undergo some degree of organization. A mass is thus formed in the uterine cavity, often becoming pedunculated. This condition is termed a fibrinous or placental polypus. Recovery only follows on its complete removal.

Diagnosis. As a rule this presents little

difficulty, though in each case a careful local examination must be made. Hæmorrhage may be due to some local lesion of the cervix, or to an early tubal gestation. The pain during the early weeks of pregnancy may also arise from the enlarging uterus producing traction on old peritoneal adhesions.

In many instances it may be questionable as to whether the contents of the uterus have been expelled completely or not, especially if no opportunity has been afforded for examining the products of conception. If the pain and hæmorrhage continue, with enlargement of the uterus and a softened or dilated cervix, the retention of material in the uterus may be safely assumed.

Prognosis. The results of abortion depend much upon the careful management of the patient. The mortality does not exceed five per cent. of those taking place spontaneously. Criminal attempts at the induction of abortion must always cause anxiety as to life, and often become the source of permanent ill-health to women.

Treatment of Abortion—

Threatening Abortion.—If the symptoms are confined to slight pain, with bleeding in small amount, there is some prospect of checking the expulsion of the uterine contents.

The essential principles of treatment are: (1) rest in bed for some days, (2) the administration of a sedative, such as tincture of opium in twenty-minim doses, thrice daily. If hæmorrhage is slight, small doses of ergot may be administered in order to promote contraction of the uterus and thus prevent further separation of decidua.

Unavoidable Abortion.—If hæmorrhage is profuse and the cervical canal is dilated, abortion must be regarded as unavoidable. In many cases the contents of the uterus are expelled spontaneously within a few hours. If, however, hæmorrhage is severe, the cavity of the uterus should be evacuated at once, either manually or by the use of an ovum forceps or curette. If the cervix is not sufficiently dilated to admit of this procedure, gauze packing may be introduced for a few hours, or instrumental dilatation may be carried out and the uterus emptied. If the symptoms are those of incomplete abortion, and especially if these are associated with any signs of infection, the uterine cavity should be explored at once and all retained products removed. As a rule these procedures should be carried out under general anaesthesia.

In the treatment of abortion it is essential to ascertain that the uterine cavity is completely free of contents. This can best be carried out by the introduction of the finger and palpation of the interior of the uterus.

It is also important to pack the uterus firmly with sterile gauze in order to prevent hæmorrhage.

Molar Pregnancy.—The death of the ovum is not always followed by early expulsion. The blood poured out in the decidua coagulates. The fœtus may be absorbed, or remain suspended in the amnion by a short loop of umbilical cord. In some instances the decidua forms irregular projections into the amniotic cavity. To this the title *tuberous subchorionic hæmatoma* has been applied. This mass may be retained up to the later months of pregnancy, or even to full term.

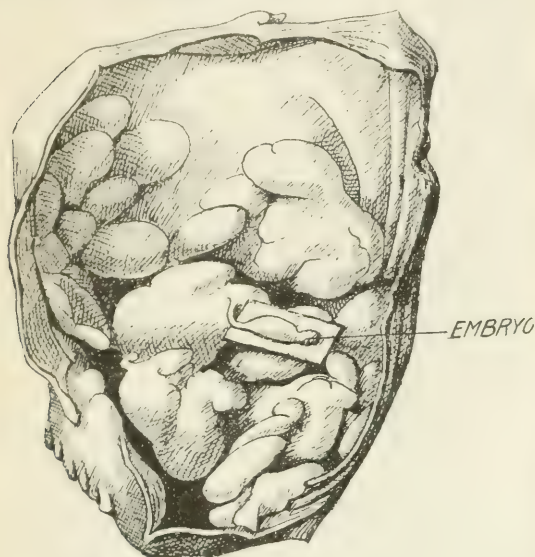


FIG. 1.—Molar Gestation. Tuberous hæmatoma of the decidua, retained to full term.

In other cases the gestation is represented by a mass of blood-clot, which may contain an amniotic cavity or not.

This is termed a *carneous or fleshy mole*; microscopic sections show the remains of chorionic villi, embedded in decidua and clot.

Diagnosis. This is not always easy. There is a history of amenorrhœa and the signs of advancing pregnancy subside. Slight hæmorrhage or brown discharge may occur from time to time, and the body of the uterus ceases to increase in size.

Treatment. If the presence of a mole be suspected the cervix should be dilated and the mass removed by the finger or ovum forceps.

Death of Fœtus with Retention (Missed Labour).—The child may die *in utero* from many causes. These are often of maternal origin, such as albuminuria, excessive vomiting with toxæmia, endometritis and, most commonly, syphilis. In some instances, for unknown reasons, habitual death of the fœtus occurs, usually after the sixth month of pregnancy.

In rare cases the fœtus after death may be retained for weeks, or even to full term. Very exceptionally the child may remain in the

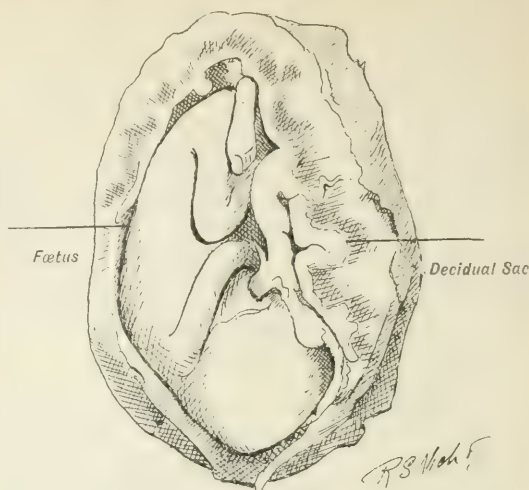


FIG. 2.—Fœtus in the Amniotic Sac with Decidua, retained *in utero* to the eighth month. Amniotic fluid completely absorbed.

uterus beyond this period. Such cases are designated "Missed Labour."

Under these circumstances a series of secondary changes takes place in the fœtus and placenta.

In the early months the ovum may undergo complete dissolution, the uterine contents being converted into a mole.

In the later months the death of the fœtus is usually followed by maceration. The skin is softened and peels readily. The subcutaneous tissues become infiltrated with reddish serum. The viscera are softened and may become diffuent.

The placenta shows thrombosis with areas of coagulative necrosis.

Mummification of the fœtus is very uncommon.

In rare cases the fœtus undergoes putrefaction. This is probably always due to the invasion of the amniotic cavity by anaerobic vaginal bacteria, which may even penetrate the intact membrane.

The fœtus becomes much swollen from the formation of gas in the tissues. The liquor amnii is usually very offensive in odour.

The placenta may decompose and, in some instances, physometra may develop. This is possibly due to the *bacillus aerogenes capsulatus*.

Symptoms. Death of the fœtus in the early months may not produce any definite symptoms at first.

After a variable time the reflex signs of pregnancy disappear. The uterus ceases to

enlarge and does not correspond to the period of gestation.

The fundus often feels soft on palpation, the normal elasticity being entirely absent.

In the later months of pregnancy, after foetal movements have once been noted, the symptoms are more definite. The heart sounds stop, and the uterus diminishes in size from absorption of the liquor amnii.

The activity of the breasts subsides, although small quantities of clear fluid may exude from the nipples.

If, as rarely happens, putrefaction ensues, the uterus becomes distended with gas, and the general condition of the patient is serious, as a result of toxic absorption.

Diagnosis. This must be based upon a careful study of the history of pregnancy. It may often be difficult to decide positively as to the death of the child.

Prognosis. As a rule, if the membranes are intact, and there is no infection of the amnion, the general health of the patient does not suffer. If, however, bacterial invasion takes place, the risk to life becomes greatly increased, much depending on the virulence of the organisms.

Treatment. If the diagnosis has been established, the best course is to evacuate the contents of the uterus as soon as possible. This is to be carried out by dilating the cervix and rupturing the membranes.

The foetus is generally expelled completely. In the later stages, and if maceration has occurred, much difficulty may be met with in extracting the child, owing to the softening of the tissues. The contents of the uterus may be removed by hand or craniotomy forceps. This should be followed by thorough irrigation of the uterine cavity.

Premature Labour.—A considerable proportion of premature labours occur spontaneously, as a result of death of the foetus, after the seventh month of pregnancy.

The number of infants born prematurely in this way has been estimated as not less than five per cent. of the total number.

The induction of premature labour may be advisable in the interests of the mother or of the child. Thus, in certain cases of contracted pelvis a living child may be obtained by inducing delivery at the thirtieth to thirty-fourth week of gestation, the exact time being determined as the result of careful measurements of the pelvis and child. The results of this measure in selected cases are excellent.

This procedure may also be required for serious conditions of the general health of the pregnant woman: in cardiac disease, with failure of compensation, and, possibly, in some cases of tuberculosis. Various constitutional

diseases, such as pernicious anæmia and diabetes, may also justify evacuation of the uterus.

If, as is sometimes the case, prolonged gestation occurs, with increase in the size of the child, it is advisable to induce labour in order to avoid difficulties in delivery.

In some cases of habitual death of the foetus in the later months of pregnancy, the prospects of obtaining a living child are rendered much more hopeful by the induction of premature labour before the anticipated time of death.

Certain local affections of the uterus, such as hydramnios, placenta prævia and accidental hæmorrhage, are also best treated by premature induction of labour.

Methods. The simplest method of inducing labour is by rupture of the membranes. This has been practised for many years and has recently been strongly recommended as being free from risk (Von Herff). Many prefer the introduction of a bougie. This was first used by Krause in 1855. After careful disinfection of the vagina and cervix the bougie is placed between the wall of the uterus and the bag of membranes. Large-size laminaria tents have also been used for this purpose by Sir W. Sinclair and others. The time required for the commencement of labour pains is variable; usually twenty-four to forty-eight hours at least elapse before pains set in.

If for any reason evacuation of the uterus is urgently necessary, the cervix may be dilated by Hegar's dilators, or a hydrostatic bag, such as that of Champetier de Ribes should be introduced. This is the method of election in placenta prævia, or severe accidental hæmorrhage. The course of labour is often rapid owing to the small size of the child.

Delivery is accomplished on the same principles as are applied at full term.

A. W. W. L.

ECTOPIC GESTATION

In this type of pregnancy the fertilized ovum becomes implanted at some point in its path between the ovary and the uterus. In rare instances the ovum is fertilized whilst still within the corpus luteum of the ovary.

In the great majority of cases the ovum is arrested in some portion of the Fallopian tube. This may be ampullary, isthmic or, very rarely, in the portion of the tube passing through the uterine wall, which is termed "interstitial" gestation. Pregnancy may also occur in the horn of a bicornuate uterus.

These various positions are of much pathological interest, but are often difficult to distinguish by clinical methods.

Primary intraperitoneal abdominal gestation is extremely rare.

The varieties and results of ectopic gestation may be shortly tabulated as follows—

Varieties and Results

I. Ovarian Gestation. Sac develops in substance of ovary : results usually in early rupture.

II. Tubal Gestation.

i. Isthmic. ii. Ampullary. iii. Rarely in (a) accessory Fallopian tube, (b) on ovarian fimbria.

(a) May develop in Fallopian tube to advanced stage of pregnancy without rupture. Very rare.

(b) *Intraperitoneal Rupture.* Common : results in—

(1) Death from diffuse bleeding.

(2) *Hæmatocele.* May undergo (a) absorption, (b) suppuration.

(3) Fœtus may develop in peritoneal cavity, placenta remaining in tube (secondary abdominal pregnancy). May go to full term, or sac may rupture at any time. Fœtus may undergo secondary changes—(a) mummification, (b) adipocere, (c) calcification, (d) suppuration.

(c) *Tubal Abortion.* Expulsion through abdominal ostium before occlusion occurs, *i. e.* before eighth week. As a “tubal mole.”

i. Complete. *Hæmatocele.*

ii. Incomplete. Recurrent intraperitoneal hæmorrhage : may be fatal.

(d) *Hæmatosalpinx.* Death of embryo without rupture; tube fills with blood clot. May become infected—pyosalpinx.

(e) *Rupture into Broad Ligament.*

i. May continue to develop till term, as an intraligamentous pregnancy.

ii. May develop for a time, and then “secondary” rupture into the peritoneum occurs.

iii. May form a *Hæmatoma*, following death of fœtus : results in (a) absorption, (b) suppuration.

iv. Suppuration of gestation sac : result of infection. Rupture of abscess into (1) bowel, (2) bladder, (3) vagina, (4) abdominal wall.

III. Interstitial Gestation develops in portion of tube in uterine wall—sac ruptures fourth month or later.

(a) Into peritoneal cavity—may be fatal, from hæmorrhage.

(b) Into uterine cavity—rare.

IV. Cornual Gestation. Rare. Ends in intraperitoneal rupture after third month.

V. Primary Abdominal Pregnancy. Very rare.

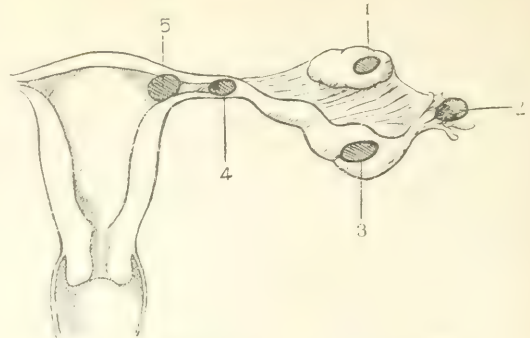


FIG. 3.—Diagram showing varieties of Ectopic Gestation.

(1) Ovarian pregnancy. (2) Tubo-abdominal pregnancy. (3) Ampullary pregnancy. (4) Isthmic pregnancy. (5) Interstitial pregnancy (after Brindeau).

Ovarian Pregnancy.—For many years the existence of primary ovarian pregnancy was questioned, but a number of cases have now been recorded which demonstrate its existence beyond doubt.

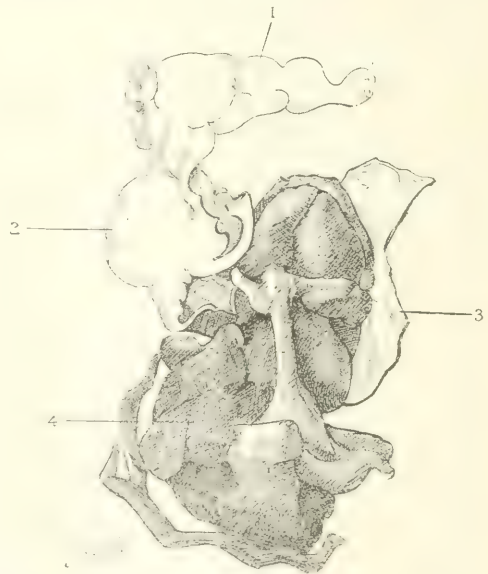


FIG. 4.—Ovarian Pregnancy. The Fallopian tube and ovary, showing rupture of blood cyst with adherent clot.

(1) Fallopian tube. (2) Ovary. (3) Capsule of cyst. (4) Blood clot.

Ovarian gestation appears to be a result of fertilization of the ovum before its escape from the Graafian follicle when this has approached the surface of the ovary. Very rarely the

pregnancy has continued to the later months, or even to term, but usually it does not develop beyond the second or third month. Frequently the sac is situated superficially, and rupture with intraperitoneal bleeding occurs at a very early period. Occasionally the foetal sac is found embedded in the ovary.

The *symptoms* of ovarian pregnancy can in no way be distinguished from those of tubal pregnancy until operation is carried out. It is essential that a careful investigation of the specimen should be undertaken in order that its nature may be precisely determined.

Tubal Pregnancy—

Etiology. We possess little definite knowledge of the causes of tubal gestation. It occurs at all ages and in apparently healthy individuals, and no facts hitherto observed fully explain its existence. It appears more likely to take place in a Fallopian tube which has been the seat of inflammatory changes. In rare instances also mechanical factors, such as polypi, the presence of adhesions, or diverticula, may be responsible for the retention of the ovum.

Pathology. The ovum, wherever it is arrested in the tube, produces a local reaction. In its growth it rapidly destroys the epithelium of the tube and becomes embedded in the muscular wall. This is attributable to the actively growing cells of the syncytium, which forms the capsule for the ovum. These cells permeate the muscular and connective tissues, causing degenerative changes and opening up maternal blood spaces.

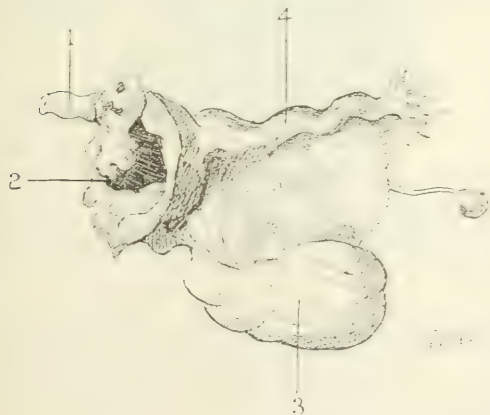


FIG. 5.—Isthmic Rupture of Fallopian Tube with intraperitoneal hæmorrhage.

- (1) Isthmic portion of the tube. (2) Site of gestation sac. (3) Ovary. (4) Fallopian tube. (Manchester University Museum.)

The further progress of the pregnancy depends largely upon the portion of the tube in which the ovum becomes embedded.

Isthmic pregnancy is peculiarly apt to

terminate in early intraperitoneal rupture, even as early as the sixteenth day. In the ampullary portion the foetal sac frequently develops for six to eight weeks before rupture or abortion occurs.

There is no definite formation of decidua in the Fallopian tube, though, in some cases, a slight decidual reaction has been noted. A well-developed decidua usually forms in the uterine cavity. This is associated with enlargement of the fundus, slight softening of the cervix, and other changes rendering the uterus almost indistinguishable from that of early intra-uterine pregnancy.

The ovum and its membranes develop in the tube much as in the uterine cavity. The tube becomes distended, forming an ovoid swelling with thin walls. This is generally followed by rupture, either into the peritoneal cavity or into the lumen of the tube, as in tubal abortion. It must be remembered, however, that in rare instances the pregnancy may reach a very advanced stage in the Fallopian tube, which in these cases undergoes marked hypertrophy of its walls.

The results of *intraperitoneal* rupture are various. In some instances this is rapidly fatal from diffuse hæmorrhage. If, however, the blood is poured out more slowly, a localised collection forms in the pelvis, which is termed an *hæmatocoele*. As a rule intraperitoneal rupture is fatal to the embryo, but in rare cases this may survive and develop in the peritoneal cavity as a *secondary abdominal pregnancy*. For this to occur it is usually necessary for the amnion to escape rupture. The pregnancy may now continue to full term, or rupture may take place at any period. The foetus lies in a sac formed by the amnion, surrounded by a capsule of fibrinous adhesions to the bowel. The foetus is very liable to perish and to undergo degenerative changes, such as maceration, mummification, or, more rarely, suppuration.

Tubal Abortion with the Formation of a Mole.—

This is the most frequent result of gestation in the tube, and takes place usually before the tenth week. This is followed by hæmorrhage in the tube, leading to more or less complete separation of the ovum. In many cases the ovum is expelled through the ostium, if this is patent, as a mole. If the ostium is occluded the condition usually becomes one of *hæmatosalpinx*. In some instances the ovum is incompletely extruded from the ostium, and a localised peritubal hæmatocoele may then develop around the outer portion of the tube.

Rupture into the Broad Ligament. *Extra-peritoneal Rupture.*—This takes place in a relatively small number of cases. It usually results in death of the ovum, with the formation of a hæmatoma between the layers of the broad

ligament. Occasionally the foetus may survive the primary rupture. The development of the placenta and foetus then continue, forming an intra-ligamentary gestation sac. The peritoneum is elevated above the pelvic brim. The placenta usually develops in the base of the broad ligament, but occasionally, if situated in the upper portion of the sac, it may lie in the abdomen, becoming adherent to the coils of intestine.

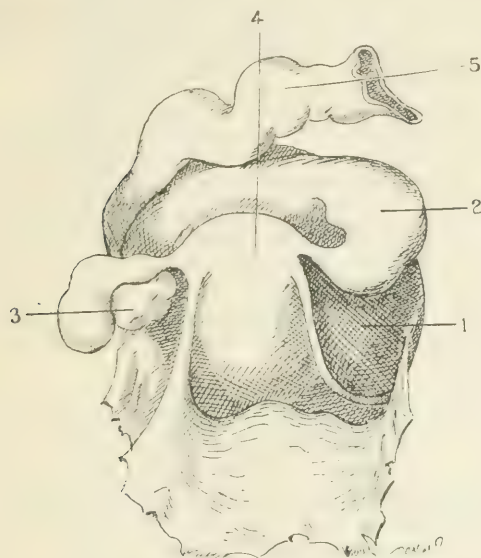


FIG. 6.—Hæmatoma of left Broad Ligament, the result of tubal rupture. Death occurred from intestinal obstruction.

(1) Mass of exudation in broad ligament. (2) Distended left Fallopian tube. (3) Right Fallopian tube with hydrosalpinx. (4) The uterus. (5) The rectum. (Manchester University Museum.)

Both types of secondary abdominal pregnancy may continue to full term, but rupture may occur at any time. At full time, spurious labour ensues and is followed by the death of the foetus. This may be retained in the abdomen for months or even years. There is, however, a constant risk of infection occurring from the bowel, which may be followed by the formation of an abscess. This may rupture in various directions, into the bowel, vagina or rectum, or through the abdominal wall. If the sac escapes infection a *lithopædion* may be the final result.

Hæmatocele.—This, we have seen, may arise as a result of rupture of the tube or, more commonly, from a tubal abortion. The blood is poured out into the pouch of Douglas, which it fills; if the effusion is extensive it may extend to the brim of the pelvis and reach the anterior abdominal wall. Within a few days clotting occurs. If no further hæmorrhage takes place a local peritoneal reaction ensues which leads to the hæmatocele becoming encysted by

adhesions. The further course is variable. Gradual absorption often occurs, though in many instances peritoneal adhesions persist indefinitely. In other cases infection develops, which may be followed by suppuration.

Interstitial Pregnancy.—This dangerous form of gestation is fortunately very rare. In these cases the ovum is lodged within the wall of the uterus. The enlarging sac tends to follow the path of least resistance, and most frequently rupture occurs into the abdominal cavity not later than the third or fourth months. In other instances the sac has developed until the later months in the wall of the uterus, and may then rupture into the uterine cavity.

In a few cases this has been followed by spontaneous delivery with the birth of a living child. The uterine contractions are, however, severe, and rupture of the uterus is very liable to occur.

Cornual Pregnancy.—This is not strictly a form of ectopic pregnancy as it develops in the horn of a bicornate uterus. This is usually rudimentary in type, but many cases have been recorded in which the pregnancy has continued to full term.

Targett, Bland-Sutton and Hubert Roberts have all observed such cases.

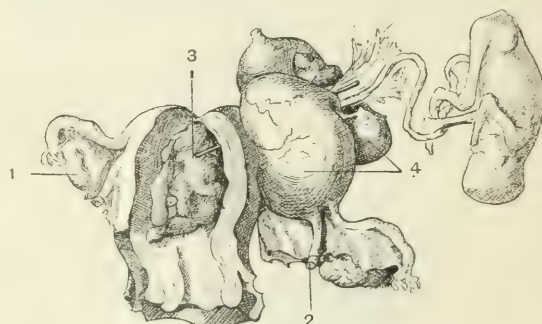


FIG. 7.—Left Cornual Gestation at fourth month. Rupture of the sac.

(1) Right ovary. (2) Left round ligament. (3) Uterus with decidua. (4) Fœtal sac and site of rupture. (Manchester University Museum.)

As a rule, there is some bleeding during pregnancy. An intraperitoneal rupture is most liable to occur at the fourth or fifth month with symptoms closely resembling those of tubal gestation.

The diagnosis of the condition is extremely difficult, though in some cases examination under anaesthesia has enabled it to be differentiated from the non-pregnant uterus.

The only treatment is to remove the sac; this is usually accomplished without difficulty.

Symptoms and Clinical Course.—The early symptoms of tubal gestation closely simulate those of intra-uterine pregnancy, and hence the

recognition of the condition, before complications have developed, is exceptional.

Amenorrhœa for a short period is present in about half the cases, but rupture often takes place without any history of having missed a period. In some instances more or less pain in one or other iliac region is complained of, and careful bimanual examination may reveal a swelling lateral to the uterus, beneath which a pulsating branch of the uterine artery may often be detected.

The onset of bleeding into the abdomen is usually attended by severe pain, which is followed by faintness, pallor and rapid breathing. This may be due to rupture of the tube, or to abortion, and it is rarely possible to distinguish between them at this stage. As a rule this is attended by slight continuous bleeding from the uterus, with the expulsion of the whole or portions of decidua. The hæmorrhage may be so severe that the life of the patient is threatened; especially is this the case in the diffuse intraperitoneal type. If the hæmorrhage is not sufficiently great to imperil life a peritoneal reaction ensues. The abdomen is distended. Vomiting may occur, and the temperature and pulse are elevated. These symptoms may gradually subside if the effusion becomes encysted. On the other hand, there is always a grave risk of recurrent hæmorrhage, with pain and renewal of the shock.

The recognition of hæmatocele is based upon the presence of a dense bulging swelling in the lower part of the abdomen, either median or lateral; in the early stages a fluid thrill may occasionally be detected.

On vaginal examination a mass is felt filling the floor of the pelvis, and pushing the uterus and cervix forward behind the symphysis. The consistence of the swelling is variable, often giving a doughy sensation from the presence of blood-clot.

The encysted hæmatocele is always attended by local peritoneal inflammation, as shown by a slight rise of temperature and quickened pulse.

The further progress depends on whether the blood is absorbed or not. This is a gradual process and may last for many weeks. Infection is possible at any time and is characterized by increase in the size of the swelling, with high fever and pressure symptoms.

In the later months of gestation, after rupture of the tube, a secondary abdominal pregnancy occasionally develops. The symptoms may at first closely resemble those of intra-uterine gestation. There is, however, a constant danger of rupture taking place. This is followed by severe hæmorrhage, which may be fatal. In rare cases the pregnancy develops to full term with a living child. Spurious labour then sets in, and is followed by death of the foetus, with

gradual diminution of the swelling. The placental circulation ceases, and secondary changes occur in the sac and placenta. The liquor amnii is largely absorbed, and the mass may be retained for months, or even years. In some instances infection occurs, leading to suppuration and the formation of an intraperitoneal collection of pus.

Diagnosis. This is often attended with some degree of uncertainty. If the patient presents the symptoms of early gestation and a unilateral swelling is found in the pelvis, the possibility of tubal pregnancy should be considered. It must be borne in mind, however, that old inflammatory conditions of the tube and ovary, or the presence of an ovarian cyst, especially if this has undergone torsion, may give rise to symptoms indistinguishable from tubal gestation.

An accurate diagnosis can often only be made by abdominal exploration. In the later stages, after the formation of a hæmatocele, the possibility of the condition being one of retroflexion of the gravid uterus must be considered. This is almost always attended by pressure symptoms on the bladder, which are exceptional in hæmatocele.

A careful bimanual examination will usually enable the two conditions to be differentiated.

In cases observed during the later months of pregnancy, or at full term, the diagnosis can only be made by careful palpation of the foetal sac.

The association of extra- and intra-uterine pregnancy is very rare, and is particularly difficult to diagnose until rupture of the sac, or

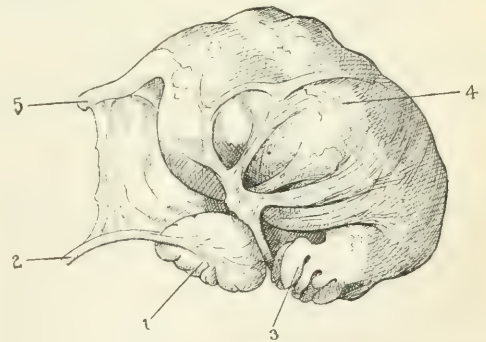


FIG. 8.—Tubal Gestation removed before Rupture of Sac.

(1) Ovary. (2) Ovarian ligament. (3) Abdominal ostium. (4) Gestation sac. (5) Isthmus of Fallopian tube. (Manchester University Museum.)

expulsion of the foetus from the uterus has taken place.

Treatment. If the existence of an unruptured tubal pregnancy is recognized immediate operation should be performed by abdominal section.

The same course should also be adopted if symptoms of diffuse intraperitoneal hæmorrhage have developed. If bleeding is obviously going on no object can be gained by delay. If the hæmorrhage has apparently ceased, but the shock is severe, it may, in some cases, be wise to wait a few hours in order that the patient may recover from this condition.

The abdominal incision should preferably be made with the patient in the raised pelvic position.

The tubal swelling can usually be detected by touch, and should be clamped on either side in order to prevent further bleeding. The tube should now be removed, but the ovary, if healthy, may be left. All blood coagula should be taken away as completely as possible; drainage is not usually required.

If the patient has lost much blood saline transfusion into the basilic vein will often be of great value.

The vaginal route is quite unsuitable for a recently ruptured tube or tubal abortion.

If the symptoms have developed more gradually, and an encysted hæmatocoele has formed, it is advisable to defer operation for a time. Absolute rest in bed must be maintained and an ice bag may be applied to the abdomen.

If the mass increases in size, or pressure-effects become severe, it is advisable to perform abdominal section and remove all the clot.

If symptoms of infection arise a free incision in Douglas's pouch, with the establishment of drainage, is the wisest course.

If pregnancy continues into the later months there is always a risk of secondary rupture of the sac with intraperitoneal hæmorrhage. Under these circumstances it is best to operate by abdominal section without delay.

Up to the fourth or fifth month the fœtus and placenta can usually be removed without difficulty from the abdominal cavity.

In the later months, if the child has survived, the separation of the placenta is often attended by severe hæmorrhage. This may be usually controlled by seizing the bleeding points after removal of the placental tissue; in some cases it may be necessary to pack the cavity with gauze.

The plan of stitching the borders of the sac to the abdominal wall and allowing the placenta to come away piecemeal has been adopted, but has the obvious disadvantage of prolonged healing, and there is always some risk of decomposition and infection, or secondary hæmorrhage.

If the pregnancy has developed in the broad ligament an attempt should be made to operate extraperitoneally, the placenta being removed and the cavity packed with gauze.

A. W. W. L.

ACCIDENTAL HÆMORRHAGE (RETRO-PLACENTAL HÆMORRHAGE)

This may be defined as an effusion of blood between the placenta and the uterine wall, as the result of detachment of part or the whole of the placenta. In these cases the placenta occupies its normal position in the uterus. The blood, as a rule, coagulates rapidly, and may be entirely retained in the retro-placental area. A small quantity of fluid blood is often expelled through the cervix.

This condition exists in two forms (1) *external* accidental hæmorrhage, in which the blood escapes through the cervix, and (2) *concealed* accidental hæmorrhage, in which the blood is retained in the uterine cavity. In some instances both forms of bleeding are present.

Etiology. In many instances there is a history of injury, such as a fall, a blow, or sudden strain, and occasionally some emotional condition appears to conduce to it. It arises almost always in a uterus which shows signs of endometritis or muscular degeneration. It is peculiarly apt to occur in elderly multiparæ who are exhausted or anæmic. It has also been noted that albuminuria is present in a large proportion of cases (Weiss, Hoffmeier).

Symptoms. In slight cases of detachment the symptoms are not well marked, but examination of the placenta after delivery shows an area with adherent blood-clot at the site of detachment.

In more severe cases a large quantity of blood may be poured out, the placenta being almost entirely separated. The onset is often sudden, the patient being seized with intense uterine pain. The face becomes pallid, the pulse quick, and all the signs of internal hæmorrhage are obvious.

Palpation of the abdomen reveals that the uterus is tense and distended, thus rendering it difficult to detect the fœtal parts. In rare

instances the blood ruptures into the amniotic cavity. This is almost always associated with a certain amount of vaginal hæmorrhage, though exceptionally the bleeding may be entirely concealed.



FIG. 9.—Accidental Hæmorrhage. Separation of normally situated placenta from uterine wall. Fatal result from hæmorrhage. (Bumm.)

If the bleeding is excessive the general condition speedily becomes one of collapse. Expulsive pains are feeble and labour tends to be prolonged. If this continues for some hours there is some risk of decomposition of the intra-uterine coagula.

The existence of internal concealed hæmorrhage may be recognized if the general symptoms are more severe than would be anticipated from the amount of blood coming through the cervix. This form of bleeding is rarely met with, but is a very grave complication.

Diagnosis. This is not usually attended with difficulty, though it is not always easy to determine how much internal bleeding is going on.

Placenta prævia sometimes closely resembles accidental hæmorrhage, but it is usually possible to feel the structure of the placental tissue through the cervix.

Rupture of the uterus also presents very similar phenomena to those of accidental hæmorrhage, but this very rarely takes place in the early stages of labour.

Prognosis. In slight cases of apparent bleeding the risk to the mother is small, though the life of the fœtus is sacrificed if a considerable area of placenta is detached.

In severe forms of concealed hæmorrhage the maternal risk is very great, this being one of the most dangerous complications met with in obstetrics.

Treatment. In the comparatively mild cases, in which the hæmorrhage is mainly external, coming on during labour, and where the general symptoms do not cause alarm, the simple procedure of puncturing the membranes, with the application of an abdominal binder, will suffice. If hæmorrhage is alarming, and especially if it is internal, active measures must be adopted without loss of time. The only method of checking the hæmorrhage is to empty the uterus.

There has been much discussion as to the best method of effecting this without undue risk to the patient. If the cervix admits a finger, manual dilatation by the gloved hand should be performed, followed by the introduction of a hydrostatic dilator, such as Champetier de Ribes' bag.

The child should then be delivered by version or forceps.

The Vaginal Plug. Much stress has been laid by the Dublin school on the advantage of firm plugging of the vagina to check the hæmorrhage by pressure upon the cervix and lower uterine segment. This method may be of value in external hæmorrhage, but it can have but little influence on concealed internal bleeding into the uterine cavity. It is also useless if the membranes have ruptured.

Rupture of the Membranes is good treatment

if labour is in progress, and the pains are strong, showing that the uterus is contracting well.

At the present time there is a general expression of opinion that dilatation of the cervix and extraction of the child without loss of time is the safest course in cases of concealed hæmorrhage. This view is held by Drs. Whitridge Williams, Hermann, Eden and others.

One of the greatest dangers in accidental hæmorrhage is that, after evacuating the uterus, post-partum hæmorrhage ensues. In many cases the uterine wall is thinned out and possesses feeble contractile power. The uterine cavity may be plugged to check this bleeding, but this is not always efficient.

For these cases during the last few years Cæsarean section has been practised with a moderate degree of success. The uterus can be removed rapidly by the supra-vaginal method.

In Germany vaginal hysterectomy has been adopted, although one drawback of this route is the large size of the uterus.

There is, however, certainly less risk of infection than by the abdominal operation. The uterus should be removed by securing the broad ligaments with clamps. A. W. W. L.

PLACENTA PRÆVIA

Placenta Prævia.—By this term is understood the implantation of the placenta in the lower segment of the uterus. The condition renders the patient particularly liable to hæmorrhage during the later months of pregnancy and in the course of delivery.

The varieties of placenta prævia are classified as follows—

1. The placenta extends over the internal os; it is defined as *central*.

2. The lower edge of the placenta only partially overlaps the internal os; it is spoken of as *marginal*.

3. In other cases the placental tissue extends into the lower segment of the uterus, but does not reach the internal os. This can only be recognized by the introduction of a finger into the cervix. The insertion is termed *lateral*.

Frequency. This has been variously estimated. In hospital practice the proportion of cases varies from one in three hundred to one in five hundred, but it is probable that some degree of placental attachment in the lower uterine segment is much more common. This position of the placenta occurs most frequently in middle-aged multiparæ, and it is also relatively often met with in twin pregnancy.

Pathological Anatomy. The placenta is usually thinner and presents a more extensive surface of attachment than in normal cases. It is often

irregular in shape and manifests signs of degeneration with areas of thrombosis.

Many theories have been suggested to explain the low insertion of the placenta. Hoffmeier holds the view that the placental tissue is formed from an area of chorion situated on the decidua reflexa.

It seems probable that the main cause of placenta prævia is usually the implantation of the ovum in the lower segment of the uterus.

Symptoms and Clinical Course. The characteristic symptom is hæmorrhage. This occurs between the sixth and ninth month, though not uncommonly there is a history of slight bleeding during the earlier months of gestation. The hæmorrhage usually occurs suddenly, without obvious cause, and is unattended by pain. As a rule the first hæmorrhage is not serious, but there is a constant danger of a recurrence of the bleeding, which may be severe, or even fatal. The mode of production of the hæmorrhage has been widely discussed. There can be little doubt that the source of the blood is mainly the sinuses in the uterine wall, and that this results from the detachment of the placenta from the cervix and lower uterine segment. In some instances it is possible that the circular sinus, which may be torn across with little separation of placenta, may be the source of the bleeding.

lies high in the pelvis and the presence of the placenta in the lower segment may be recognized by a sensation of thickening of the tissues, with occasional pulsation of vessels. If the cervix is patulous the spongy fibrinous mass of the placenta may be readily detected. During labour the leading symptom is again hæmorrhage. In the early stages this is most abundant during the pains, but if the body of the fœtus has descended, bleeding may cease during a contraction, the result of the compression of the lower uterine segment.

The course of labour is variable. In some cases the uterine contractions are strong, and if the presentation is normal delivery rapidly ensues, with little hæmorrhage. If, however, premature rupture of the membranes has taken place dilatation of the cervix is often slow, with feeble pains. In rare instances the whole of the placenta is detached and expelled before the delivery of the child.

During the progress of delivery there is a greatly increased risk of severe bleeding.

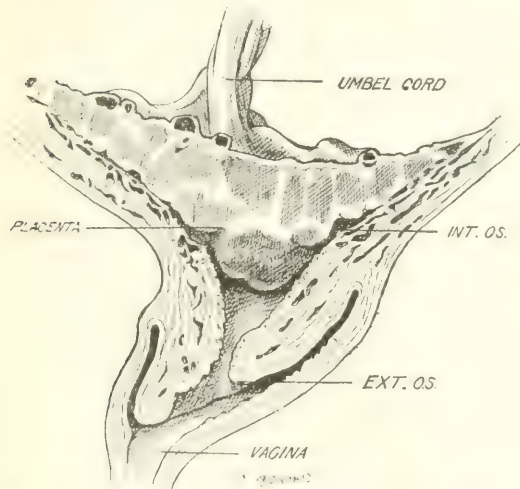


FIG. 10.—The source of Hæmorrhage in Placenta Prævia.—Placenta centrally placed over the cervix. Hæmorrhage from utero-placental sinuses and also from placental tissue. (Bumm.)

In the investigation of a case abdominal palpation rarely gives precise information, although the mobility of the head above the brim of an apparently normal pelvis suggests the condition. Vaginal examination often affords valuable help. The fœtus generally

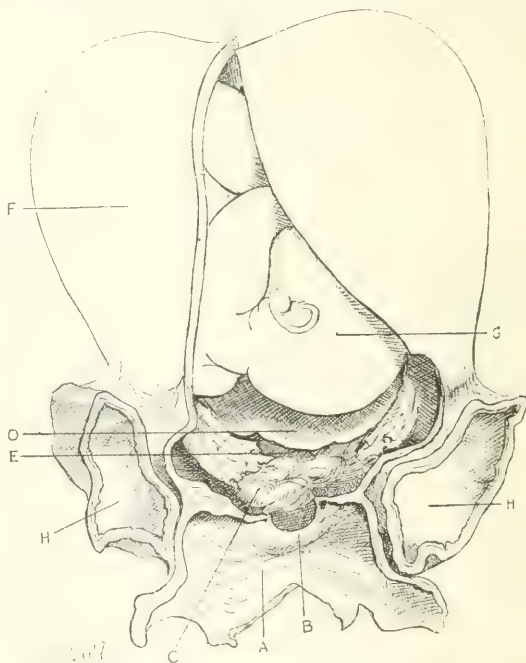


FIG. 11.—Placenta Prævia. Death from hæmorrhage before delivery, probably as a result of failure to rupture the membranes.

(A) Vaginal wall. (B) External os. (C) Blood coagula in lower uterine segment. (D) Placenta, situated centrally. (E) Edge of membranes. (F) Fundus uteri. (G) Fœtus. (H) Bladder. (Manchester University Museum.)

This is often due to tearing of the softened and congested lower segment and cervix, and it is specially liable to occur if any manipulations are undertaken.

In the absence of lacerations bleeding invariably ceases after the birth of the child and expulsion of the placenta.

Diagnosis. Hæmorrhage, in the later months of pregnancy, is strongly suggestive of the existence of placenta prævia, and demands a thorough local investigation.

Occasionally hæmorrhage may be due to varicose veins of the vulva or vagina, or to the presence of polypi, cancer, or deep lacerations of the cervix.

All these conditions are readily recognized by vaginal examination.

Blood-clots may occasionally form in the cervix in the absence of placenta prævia; these can be distinguished by the friability of the coagula, which contrasts with the firm structure of the placenta.

If the after-birth is not felt over the cervical canal, it is advisable to introduce a finger with the object of ascertaining if it is present in the lower segment of the uterus.

Prognosis. This is always somewhat grave. The maternal mortality has been variously estimated as from ten to thirty per cent. It must be acknowledged, however, that recent figures are much more favourable, and series of cases have been published with a mortality as low as five to eight per cent. This is due to improved modes of treatment.

The chief danger is hæmorrhage during delivery. In many instances this is due to deep tears occurring in the lower uterine segment or cervix. At a later period the risk of infection is considerable, owing to the proximity of the placental site to the vagina, which affords facilities for bacterial invasion. The infection is often of the thrombo-phlebitic type.

Mortality of the Children. This is necessarily high and, even with modern methods, amounts to over fifty per cent. For this there are several reasons. Many of the children are born prematurely; malpresentations and prolapse of the cord are common. Operative delivery, such as is often inevitable, is also attended by considerable danger to the life of the child. The preservation of the child's life, however, is not of much importance in comparison with that of the mother, and hence cannot be considered as the leading factor in deciding upon the most suitable treatment.

Treatment during Pregnancy. If, after the sixth month of pregnancy, a diagnosis of placenta prævia has been established, the patient should be most carefully watched. Even if the bleeding has only been slight, there is no certainty that the next hæmorrhage may not endanger life. The safest course is to arrange, in every case, for induction of labour as soon as possible. For this purpose, if there are no urgent symptoms, a bougie may be introduced

and allowed to remain in position twenty-four to forty-eight hours. If hæmorrhage ensues, the membranes should be ruptured at once and the cervix dilated by the introduction of a hydrostatic dilator. If the cervix is sufficiently dilated to admit two fingers, bipolar version is the most suitable treatment, as recommended by Braxton Hicks many years ago.

Management during Labour. The essential object to be aimed at is the control of hæmorrhage. This may be secured by pressure on the lower uterine segment, which can be effected in various ways.

The simplest procedure in vertex presentations is the rupture of the membranes, as this is often followed by descent of the child's head.

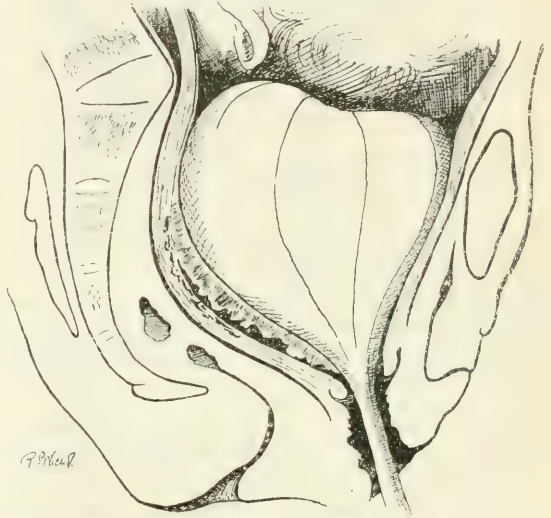


FIG. 12.—Placenta Prævia, hydrostatic dilator introduced into the lower uterine segment, showing the method of controlling hæmorrhage. (Bumm.)

If this does not speedily occur, the introduction of Champetier de Ribes' bag, or the performance of version, with extraction of the breech, are efficient methods of applying pressure, and rarely fail to check the bleeding.

In those cases in which the cervix is only slightly dilated, firm tamponage of the vagina may be beneficial.

Great care should be taken not to extract the child forcibly until the cervix is fully dilated, owing to the serious risk of producing deep laceration of the lower segment and cervix. During the last few years vaginal Cæsarean section has been proposed and carried out in the treatment of placenta prævia. The incisions in the cervix are, however, attended by severe hæmorrhage, and this operation has not met with any general measures of approval.

Abdominal Cæsarean section in placenta prævia has also been adopted, although the scope for such a measure is limited. Cases

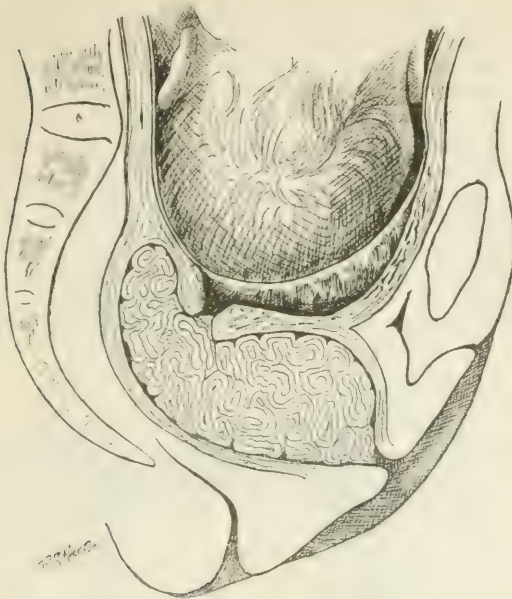


FIG. 13.—Method of Tamponage of Vagina in Placenta Prævia. (Bumm.)

possibly suitable for this procedure are those in which hæmorrhage is excessive, with rigidity of the cervix, which cannot be safely dilated. By this method also the infant mortality is much diminished.

One of the most serious factors in placenta prævia is the high degree of anæmia which may rapidly develop. This either arises from deep lacerations of the cervix, or from post-partum bleeding at the placental site. This can best be controlled by ensuring firm contraction of the uterus, followed by gauze packing of the area of placental attachment.

A. W. W. L.

THE TOXÆMIAS OF PREGNANCY

Recent researches have demonstrated that digestion is not completed in the alimentary canal, and there is reason to believe that the food particles have to be united with their special antibodies after entering the circulation. It is probable that it is this alteration which prevents the food acting as a deadly poison.

The hypothesis which attributes the auto-intoxication of pregnancy to interference with the more minute combinations of digestion has, certainly from a practical point of view, much to commend it, and treatment founded on this hypothesis yields the best results.

Many complications, heretofore classed as

reflex in origin, are more correctly attributed to auto-intoxication. Thus, among the toxæmias of pregnancy we should include such ailments as pruritus, abnormal tastes in the mouth, salivation, so-called physiological vomiting, hyperemesis, chorea, and acute yellow atrophy of the liver. Some of these have been stated to be due to reflex irritation, and such an origin cannot be altogether ignored. It is undoubtedly true that pregnant women suffer from a marked degree of excitability, and it is easy to understand that this condition may be an active factor in the production of symptoms. A dose of alcohol which has no apparent effect on one person will cause symptoms of collapse in another. Similarly a degree of toxæmia that only gives rise to a slight headache in one woman may produce violent vomiting in another. Just as some women are seasick before the boat journey has actually started, so the knowledge that she is pregnant may induce an exaggeration of symptoms out of proportion to the dose of toxin.

There are certain characteristics common to all forms of toxæmia. The patients are usually constipated, they do not drink enough water, possibly eat too much and too frequently, and persist in drinking milk and eating, despite the increased severity of their symptoms. Those suffering from the severest forms of toxæmia frequently have their stomachs and bowels loaded with indigestible material, as is demonstrated by gastric and rectal lavage.

In this article the following toxæmias will be considered:—eclampsia, pernicious vomiting, chorea gravidarum, hydræmia, and albuminuria.

Eclampsia.—It is now generally believed that eclampsia is a toxæmic disease, and that the toxin or causative agent is a complex proteid of unknown composition, not one of the normal excretions of the body of determined chemical arrangement such as urea or allied substances. Furthermore, it is unlikely that these toxalbumens can be excreted without previously undergoing considerable chemical change. In this as in other respects the condition is more closely allied to that of snake poison than to diseases caused by inorganic or bacterial poisons. There is much evidence forthcoming that the poisons of eclampsia have their origin in the food ingested, and that pregnancy is the predisposing cause of this alteration in metabolism. Eclampsia begins with such symptoms as constipation, headache, bilious attacks, dimness of vision, œdema and albuminuria, and culminates in the convulsive seizure. Albuminuria after the onset of the fit or coma is the only one of these symptoms that is constantly present. Eclampsia without fits is now well recognized, as is also eclampsia without any

premonitory symptoms or physical signs, but after the onset of the attack the presence of albuminous urine is necessary to establish the diagnosis. True eclampsia is seldom seen before the sixth month of pregnancy. Before this time uræmia due to chronic kidney disease is the more common condition. It is usually at or near full term that eclampsia occurs, and if the patient is not in labour or has not been delivered, labour generally, but not always, follows in a short time.

The death of the child or the delivery of the woman is frequently followed by amelioration of symptoms, but this is not an invariable rule. Eclampsia which starts or continues after delivery has in my experience proved the most serious form; this, however, is not in accordance with generally accepted views.

The urine of a pregnant woman should be examined at frequent intervals, but it is said that only two per cent. of patients with albuminuria develop convulsions. The estimate of the total output of urea in urine, and the amount of nitrogen which appears in the form of ammonia, is of very little practical value. Diminution in the amount of urine voided is a more unfavourable sign than diminution in the urea output. High blood pressure generally accompanies the toxæmias which predispose to eclampsia.

Death may occur during a fit, or some hours or days afterwards, from heart failure, cedema of the lungs, internal hæmorrhage or degeneration of the liver. Eclampsia is one of the most serious affections which can attack a pregnant woman, and if she be wrongly treated or left without treatment the maternal mortality is about thirty-five per cent. and the foetal mortality over sixty per cent.

Treatment. During the last two years and ten months of my mastership of the Rotunda Hospital I treated there twenty-nine patients without a single death. The method was as follows—

Immediately on being seen the patient was given half a grain of morphia hypodermically. The stomach was then thoroughly washed out through a soft rubber tube with a warm solution of bicarbonate of soda (half a drachm to a pint). Before withdrawing the tube a strong purgative, such as three ounces of castor oil with two or three drops of croton oil, or three ounces of Epsom salts, was poured through the tube and washed down with an equal quantity of the soda solution.

Difficulty in passing the stomach tube is sometimes experienced, and care should be taken when introducing it that the end is pushed well to the back of the pharynx. The inhalation of a few drops of chloroform (fifteen to twenty) facilitates this procedure. Although the use of

chloroform is strongly condemned in all forms of toxæmia because of its deleterious effect upon the liver, in such small doses as fifteen to twenty drops it is probably harmless.

The next step in treatment is lavage of the rectum. The patient is turned on her left side and her hips pulled well out to the edge of the bed, and a rubber tube is passed into the rectum under the eye of the operator. This is an important rule, for it is quite easy to insert the nozzle by mistake into the vagina, with consequent danger of sepsis. The tube is passed as far as possible without kinking, and the bowel thoroughly washed with a pint to a pint and a half of water at a time. Many gallons of hot water may be used in this way before faecal matter actually appears, and a satisfactory movement of the bowels may not occur for some hours. The prognosis is much improved by the occurrence of a free action of the bowels. Lavage should be persisted in until large quantities of faecal matter come away, and then one and a half pints of bicarbonate of soda solution may be left in the rectum as this will prove beneficial to the kidney secretion.

Eclamptic patients suffer from thirstiness of the tissues even though marked cedema is present. Greater dilution of the blood is required, and for this reason the intake of alkaline fluid is to be encouraged. When the patient can swallow, hot water may be given freely. No fluid should be put into the mouth of an unconscious patient, for as swallowing is in abeyance it will be likely to enter the larynx and trachea, causing spasm of the glottis and predisposing to cedema of the lungs.

A most useful method for supplying fluid to patients unable to swallow is by sub-mammary infusion. A pint of bicarbonate of soda solution can be passed by gravitation beneath each breast. A simple and efficient apparatus consists of a funnel to which is attached three to four feet of rubber tubing, at the end of which is a sharp hollow needle with a calibre slightly larger than the lead of a pencil. To expedite the operation two needles may be used, one for each breast, a Y-joint connecting the main tube with the tubes leading to the needles. Great care is necessary in disinfecting the skin, in sterilizing the instruments and solution, and in maintaining asepsis throughout the infusion. Breast abscesses and even fatal sepsis have followed this extremely simple operation. If the fluid does not run freely the needle must be moved about in the breast until the desired effect is obtained.

The indication for sub-mammary infusion is found in the amount and colour of the urine. A catheter should be passed immediately after the bowel is washed out, and the urine measured and carefully examined. If the quantity is

small and the colour high, infusion is always indicated. The adoption of this measure as a routine treatment will result in fewer patients with marked urinary symptoms.

Warm poultices to the loins aid kidney secretion, but great care is necessary to avoid too much heat, as the skin of an eclamptic patient is readily burned. These poultices should be changed every three or four hours.

During every fit a large quantity of fluid collects in the mouth. If the patient is permitted to lie on her back this fluid trickles into the trachea and lungs. To avoid such a complication it is best to keep her lying on her right side. By so doing the mucus trickles into the cheek and runs from the side of the mouth. Lying on the left side is open to the objection that the heart, already depressed by the toxæmia, may become unnecessarily embarrassed.

The quieter the patient is kept the fewer will be the fits, and the greater the number of fits the greater the danger. For this reason a quiet room is imperative and the patient should be disturbed as little as possible. Disturbance is only necessary for the administration of morphia, the passage of the catheter, the application of poultices, the renewal of efforts to open the bowels and to supply fluid to the system.

Morphia is administered at first in half-grain doses, followed by quarter-grain doses after each fit for the first three doses and then at two-hourly intervals. We do not advise under any circumstances that more than two grains should be given within twenty-four hours. Even when administered in this moderate manner it sometimes causes surprising slowness of the respirations. Should the number fall to seven or eight a minute inhalations of oxygen and the exhibition of atropine or scopolamine will usually increase the respiratory rate. If they do not do so artificial respiration may be necessary to tide over the depression.

Except for the administration of morphia and changing the poultices the patient should not be disturbed for eight hours after the first treatment. Then the whole routine with the exception of gastric lavage is repeated unless a free action of the bowels has taken place in the meantime. The amount of urine excreted indicates whether or not a repetition of the infusion is advisable. If the patient is conscious and can swallow the infusion is only indicated if the quantity of urine is less than four or five ounces in the eight hours. Treatment is persisted in every eight hours until the patient recovers consciousness.

Heart failure and death supervene from toxæmia and not from inanition. For this reason food in any form, even milk or whey, should not be started for many hours (twenty-four to forty-eight) after the patient has

recovered consciousness. Then only small amounts should be given at long intervals and the effect closely watched.

As the toxins in eclampsia are not eliminated by the excretory organs it is obvious that sweating is fraught with more harm than good, since it tends to concentrate the blood without removing the toxin. Bleeding is also of doubtful value, in some cases it effects immediate good, but the loss of strength entailed by the withdrawal of blood becomes very apparent in the more severe cases.

Chloroform is harmful, as it causes a degeneration of the liver closely simulating that resulting from eclampsia. Like chloral and veratrum viride it has a tendency to cause death by heart failure, and as depression of the heart is one of the causes of fatal termination of eclampsia all these drugs should be avoided.

Accouchement-forcé of any description is, I think, to be condemned. When the os is fully dilated delivery may be expedited with forceps, but in the majority of my patients natural delivery has been permitted. It is by no means easy to conduct an aseptic delivery in eclampsia, and one must remember that many patients have recovered from eclampsia only to die of sepsis.

For the delirium that occasionally follows convulsions, bromide in large doses and a continuance of the starvation or light diet are advised.

Much stress has been laid on the high arterial tension which has been associated with eclampsia, and those who advocate bleeding claim that by lowering the tension, rupture of the blood-vessels is avoided. It is probable, however, that the internal hæmorrhages are due to the degenerative action of the eclamptic poison (the endotheliolytic toxin) rather than to mechanical causes.

Finally no disease so well repays the personal attention of the physician. The patient should not under any circumstances be left in the care of an uninstructed attendant. On several occasions I have seen deaths due, I believe, to the neglect of this precaution. When a patient dies during a fit it is frequently the result of choking from spasm of the glottis, a condition induced by the fluids lodged in the mouth and naso-pharynx running down into the larynx. The only quick way to remove this mucus is to turn the patient well over on to her side with her face turned down and head and shoulders hanging over the edge of the bed. Grasping the back hair facilitates this manœuvre, and in the presence of marked cyanosis it should never be neglected. In this position the mucus runs freely out of the nose and mouth. If the manœuvre has been too long delayed, the patient may be *in extremis*, and then artificial respiration.

and inhalation of oxygen are valuable aids in restoring the respiratory function.

Pernicious Vomiting.—Sickness is so frequently experienced in the early months of pregnancy that this symptom may be considered physiological, and it is hard to draw the line between severe symptoms of pregnancy sickness and the condition known as hyperemesis gravidarum or pernicious vomiting. The ordinary vomiting of pregnancy occurs as a rule early in the day and only during the first three months of pregnancy. It has been considered of reflex origin, the result of the growth of the uterus, with its accompanying congestion of the pelvis. It is doubtful, however, if reflex irritation is anything more than a contributory cause, for rapidly growing pelvic tumours have little tendency to give rise to sickness. Probably the true explanation is that which assigns even the milder degrees of vomiting to toxic disturbances. Certainly treatment based on this hypothesis is very successful. The improvement which follows when the uterus rises out of the pelvis can be explained on the supposition that tolerance of the toxins has been established as a result of increased formation of antibodies, and the suggestion has been advanced that changes in the syncytium may furnish the appropriate antidote. That the severe forms of sickness are seen in neurotic subjects is explicable on the supposition that these women more easily succumb to the influence of toxins. For this reason we prefer to class all forms of pregnancy vomiting under the head of toxæmias.

In hyperemesis retching is incessant, the patient is incapable of retaining anything swallowed. If allowed to persist in eating and drinking the most deplorable condition results. The victim becomes emaciated, and has some fever, with a rapid thready pulse, headache, rheumatic pains, dry tongue, and retracted abdomen, and complains of sleeplessness and of utter prostration. Constipation is a marked feature of the illness. With such symptoms the prognosis becomes very grave and the mortality is high; even induction of abortion or premature labour may fail to prevent a fatal termination. In a less advanced condition the induction of abortion is frequently attended by rapid amelioration of symptoms.

Some writers, denying this toxic origin, classify hyperemesis as a nervous disease. There is no doubt that hysteria enters largely into the condition, and it is quite understandable that certain women when once they know themselves to be pregnant will exaggerate all the symptoms which they feel and which they have learned to associate with pregnancy. But even under such circumstances it is safer to consider toxæmia as an important factor in the etiology.

Treatment. In mild cases symptoms are

readily overcome by keeping the patient in bed and on a light and rigidly regulated diet. Provided the bowels are kept open and a sufficient amount of fluid imbibed, regular meals may be given at intervals of not less than five hours. Over-eating is to be discouraged. Milk is a food and not a drink, and if given it should take the place of some other article of diet. Coffee and tea are to be avoided. Frequent draughts of very hot water amounting to two or three pints in twenty-four hours are most beneficial. Aperient mineral waters taken in the early morning, with an occasional blue pill administered the night before, prove as a rule efficient.

If the attack is a mild one absolute rest in bed may be dispensed with, but breakfast in bed with a rest for at least half an hour after should be insisted on.

A bimanual examination is always a necessary part of the treatment; a retroverted uterus should be replaced and a pessary inserted. Slight erosions are frequently present in early pregnancy, and the treatment of these with caustics is said to do good.

Pepsin and hydrochloric acid are drugs of general utility, for the irritation of undigested food adds to the severity of the symptoms. If patients are treated in this way pernicious vomiting should be one of the rarest conditions. I have seldom observed a severe case without finding that a most lamentable lack of physiological knowledge has been exhibited in the management of the case. The patient is nearly always surrounded by fussy, anxious relatives, each attempting to procure some new and untried nutritious nostrum. The bed is surrounded by patent foods and different animal extracts. Milk and soda, tea, coffee, alcohol of different kinds, and iced beverages are freely administered, and nothing taxes a young doctor's moral courage more than the effort to enforce a rigid abstinence from food with a woman already starving. If he does so, however, he will be rewarded by success in all but the most advanced cases, and even in these he offers the patient the best prospect of recovery.

A pregnant woman with advanced symptoms of hyperemesis should be placed in a dark, quiet and well-ventilated room which should be kept at an equable temperature. Friends and relatives should be excluded and the patient left entirely in the hands of skilled nurses; where this is not possible nursing should be done by one or two trustworthy friends, who can be relied on to carry out with absolute precision the doctor's orders.

If water cannot be retained the stomach must be washed out and two ounces of castor oil or Epsom salts poured through the tube before it is withdrawn. A hypodermic injection of one-

sixth of a grain of morphia quiets the patient and increases the chance of the purgative being retained. Proctoclysis is the most valuable remedy we possess in such cases. Half a pint of bicarbonate of soda solution (half a drachm to a pint) at a temperature of 105° F. may be continuously injected during the first hour and followed by a quarter of a pint each succeeding hour.

When the bowels act the tube has to be taken out, but it should be inserted again. It is not always possible to keep the tube in continuously for ten or fifteen hours, but the longer it is retained the greater will be the benefit. The patient becomes quiet, her tongue moistens, vomiting ceases and she loses her shrunken appearance. Particularly is this so if the stomach has been previously washed out. During this treatment neither ice water, nor any other form of nourishment are to be administered by the mouth.

If marked relief has not followed after twenty-four hours of this treatment the uterus should be emptied as expeditiously as possible. This, however, is rarely necessary, and personally I have never seen starvation and continuous rectal irrigation fail to bring relief.

After twelve hours of complete freedom from retching a dessert-spoonful of albumin water, milk or whey, may be administered, and the effect watched. If it is retained and occasions no discomfort the quantity given may be increased to an ounce or two after three hours, and repeated in increasing doses every three hours for half a day. After that food such as arrowroot or milk pudding will probably be well borne, and from this time onwards three regular meals may be partaken of each day. No restrictions need be made in these meals, for it is a mistake to make the woman consider herself something out of the common.

The body heat should be maintained, and rest in bed is imperative until solid food can be administered. Stimulants are rarely of value.

One frequently reads of marvellous cures brought about by methods which in reality act merely by suggestion. Spraying the abdomen with ether, administering iced champagne, blisters to the back of the neck, partial dilatation of the cervix with separation of the lower zone of membranes, and perhaps replacement of a retroverted uterus or cauterizing erosions probably belong to this category.

Chorea Gravidarum.—The chorea of pregnancy rightly considered is a manifestation of toxæmia.

It occurs, as a rule, in young primigravida, and before the third month of gestation, though these limitations are not invariable. Very neurotic women, and those who have at some previous period suffered from chorea, are most

liable to the attack. The symptoms of the disease differ but slightly from those seen in children. When mild the ailment usually lasts for two or three weeks, but it may persist much longer. In the severer forms hallucinations often develop, and there is a great difficulty in swallowing food which may result in the passage of particles into the lungs, thus setting up aspiration pneumonia.

Prognosis even in mild cases is grave, and the mortality from heart disease and pneumonia is said to be about four per cent. Severe forms of the disease, manifested by violent movements and high temperature, yield a still greater death-rate, which some have estimated at forty per cent.

Treatment should be similar to that laid down for hyperemesis, with the addition that the involuntary movements should be controlled by firm bandaging. Trional is highly recommended in ten-grain doses every two hours until either the symptoms have abated or a hundred grains of the drug have been administered.

Hydræmia.—Abnormal fluidity of blood is occasionally seen in pregnant women, especially those who have been ill-nourished.

The patient has a pale, puffy and unhealthy aspect and frequently suffers from marked œdema of the legs and lower abdomen. There may, in spite of this, be an absence of albumin in the urine. Headache, dimness of vision and other nervous manifestations are frequently experienced, whilst œdema of the lungs and heart embarrassment are noted in the worst types of the disease. An examination of the blood reveals a diminished number of red cells with increased fibrin. The blood clots with much serum around it. Prognosis is favourable when careful treatment can be carried out. Absolute rest, the administration of iron and arsenic combined with carefully selected diet given in sufficient quantity and at long intervals will generally produce a beneficial result. Occasionally it is necessary to induce premature labour or abortion, and relief of symptoms almost invariably follows the operation.

Albuminuria.—Many pregnant women suffer from slight traces of albumin in the urine, but when the quantity becomes large, or the condition persists, symptoms similar to those described in hydræmia invariably arise.

Up to the sixth month of pregnancy the condition is most frequently the result of chronic Bright's disease, but after this albuminuria more often indicates the acute nephritis of pregnancy. Rest in bed, an equable temperature, the administration of saline laxatives and the rigid maintenance of a milk diet is the treatment which has yielded the best results.

The occurrence of optic neuritis is a very grave complication and should always be looked

for, as its occurrence invariably indicates the immediate termination of labour by artificial means.

E. H. T.

DISPLACEMENTS AND MALFORMATIONS OF THE PREGNANT UTERUS

Retroversion and Retroflexion of the Gravid Uterus.—This displacement occurs in the early months of gestation, and is almost always a result of pregnancy developing in a uterus already retroflexed, although this condition may exceptionally arise in the early weeks, possibly from over-strain or injury.

A distinction has been made by some observers between retroflexion and retroversion, but no essential difference exists between the two conditions. In rare instances, however, sacculation of the posterior wall takes place, the fundus then rising into the abdomen.

The anatomical changes in this displacement are of importance. The cervix is drawn high up and is pressed forward against the symphysis pubis; it can often only be felt with difficulty. The posterior vaginal wall bulges downwards and almost occludes the vagina. The urethra is much elongated, often to three or four inches, and is compressed against the pubic symphysis. The bladder, when much distended, may occupy the greater part of the abdominal cavity.

Symptoms. The characteristic symptom is irritability of the bladder, which rapidly develops into retention of urine. The time of onset is usually the twelfth to fourteenth week. The bladder may become enormously distended. In some instances the muscular wall is much thickened, and there is risk of development of cystitis. In some cases this may be of a severe type and is followed by sloughing of the mucosa, or even gangrene. In rare instances rupture of the bladder has ensued.

If these symptoms are overlooked the patient becomes extremely ill, with high temperature, restlessness and general prostration.

Diagnosis. This can in many cases be made without difficulty, but there are several possible sources of error. The presence of an ovarian tumour impacted in the pelvis or a myoma may produce similar pressure-effects on the bladder and rectum. The effusion produced by hæmatocele also causes bulging of the posterior fornix.

An accurate diagnosis can usually be made by a careful bimanual examination, which is of great importance, as the treatment of these varying conditions is essentially different.

Prognosis. If the displacement is recognized early, and suitable treatment adopted, the outlook is usually favourable. In neglected cases the bladder symptoms may become very grave and even threaten life.

Treatment. The first step is to empty the bladder by catheter. If the symptoms are not urgent this treatment may be continued for two or three days, when, in some instances, spontaneous elevation of the uterus takes place. Re-position may often be brought about by manual pressure, the cervix being steadied by a volsella, an anæsthetic being usually desirable.

Sir William Sinclair has proposed the insertion of a large watch-spring pessary, which retains its oval shape, and by continuous elastic pressure is often a successful means of raising the fundus out of the pelvis. In other cases re-position of the uterus is best maintained by the introduction of a Hodge pessary.

In exceptional cases the uterus is firmly adherent through peritoneal adhesions to the pelvic floor. Under these circumstances it may be necessary to perform laparotomy, with elevation of the uterus after separation of adhesions. This usually effects a permanent cure.

This operation should not be carried out if infection has occurred or cystitis has developed. In these cases the contents of the uterus should be evacuated by dilating the cervix, after completely emptying the bladder, or in some cases by linear incision of the posterior wall of the uterus.

Posterior Sacculation of the Uterus.—This is a rare complication of pregnancy, but may follow some cases of retroflexion. The posterior pole of the uterus remains in Douglas' pouch, and is prevented from rising by adhesions or a projecting sacral promontory. Under these circumstances the anterior wall of the uterus develops, and the cervix is drawn up high in the pelvis, often reaching above the symphysis pubes.

In the later months of pregnancy the child's head comes to lie in this sacculated pouch.

Symptoms. These may not be marked during pregnancy, but when labour comes on the head of the child lies considerably below the orifice of the cervix. This may cause great difficulty in delivery.

Treatment. It may be possible in some cases to pull down the cervix with a volsella and to elevate the posterior uterine pouch by pressure. It will probably also be necessary to incise the posterior lip to admit of delivery. If it is impossible to raise the pouch it may be essential to perform Cæsarean section in order to secure a living child.

Pathological Anteversion of the Pregnant Uterus.—This is well known to occur in the early weeks of pregnancy, but at this time is not of any serious moment. In the later months, as a result of laxity of the abdominal walls or ectasia of the rectus muscles, the fundus may turn

forward, making an acute angle with the cervix.

This may lead to malpresentations of the fœtus and, the uterine axis being changed to a horizontal position, labour may be prolonged and difficult. This is also further promoted by the extreme weakness of the abdominal muscles, tending to the condition of "pendulous abdomen."

Treatment. In all these cases the abdominal wall should be firmly supported by a well-fitting belt or binder from the early months of pregnancy. In this way the progressive laxity may be largely prevented.

Anteflexion as a Result of Operative Procedures.—During recent years many child-bearing women have been submitted to various fixation operations for downward displacements of the uterus. These may be performed by the vaginal or the abdominal route. After either of these procedures difficulty may arise as a result of fixation of the upper part of the body of the uterus. If care is taken to leave the fundus free at the operation no difficulty is to be anticipated in subsequent deliveries. Since this has been generally recognized little trouble from dystocia and forward fixation of the uterus has been experienced.

If obstruction occurs during labour, usually from displacement upwards of the cervix, with adhesion of the anterior uterine surface to the abdominal wall, Cæsarean section will probably be required.

Lateral Displacement.—This occurring in the pregnant uterus is extremely infrequent. Cases, however, have been observed and have simulated ectopic gestation. A *diagnosis* can usually be made by careful palpation.

Prolapse of the Pregnant Uterus.—This is not uncommon, especially in multiparous women suffering from long-continued prolapse with secondary changes.

The condition usually occurs between the third and fourth months of pregnancy; the cervix and lower part of the body of the uterus lying outside the vulva. This is attended by marked œdema with hypertrophy of the cervix, already often lacerated. Much difficulty may be met with in micturition.

Treatment. This is, on the whole, satisfactory. The mass can usually be reduced without difficulty. A watch-spring pessary should now be introduced, supported if necessary by a pad and bandage. Rest in bed should be insisted upon until the swelling has subsided. In the later months of pregnancy the pessary is not required, since, as the uterus increases in size and rises in the abdomen, the prolapse disappears.

Malformations of the Uterus.—In rare instances pregnancy may occur in the rudimentary

horn of a bicornuate uterus. Under these circumstances the normal termination of pregnancy is almost impossible. There is also a danger of spontaneous rupture occurring into the abdomen during pregnancy. This is almost always fatal unless immediate laparotomy is performed.

The *diagnosis* of these cases is attended with much difficulty, especially in distinguishing them from tubal gestation. In the early months of pregnancy implantation of the ovum may occur in one of the cornua of a normal uterus. This has been termed "angular pregnancy." This produces marked asymmetry during the early months, and may simulate tubal gestation. The swelling can, however, usually be determined to be continuous with the fundus uteri.

A. W. W. L.

HYDRAMNIOS

In this condition there is an excessive amount of liquor amnii in the uterine cavity. It is often present in slight degree, but extreme cases of amniotic distension occasionally develop. It is usually first observed in the fifth and sixth month of pregnancy.

It is more frequent in multiparæ than primiparæ, and there is a tendency for it to occur in successive pregnancies. According to the figures of the Rotunda Hospital, hydramnios occurred in a proportion of 1 to 196·87 cases (Jellett).

Etiology. It is probable that circulatory disturbances, either of maternal or foetal origin, are responsible for the increase in the amount of amniotic fluid. In the foetus obstruction in the circulatory system, or in the umbilical cord, has often been noted.

According to Bar, syphilis of the foetal liver and spleen is often associated with hydramnios. Inflammatory changes in the placenta and decidua may also give rise to increased transudation of fluid. In many cases the foetus shows evidence of malformations such as hydrocephalus, spina bifida, talipes, etc.

It has also been observed that hydramnios is frequently present in twin pregnancy.

Symptoms. These are the result of uterine distension; if the fluid increases slowly, few symptoms are produced. In the rare cases of acute hydramnios, pressure-effects may, however, become very severe, causing difficulty of respiration and, unless relieved, some of these cases terminate fatally.

On palpation fluctuation is readily detected, but it is often difficult to feel the body of the foetus. If labour comes on the pains are usually weak, owing to the stretching of the muscular fibres and, as a result, there is a great liability to post-partum hæmorrhage.

Diagnosis. As a rule there is little difficulty in recognizing the existence of hydramnios.

It is important, however, to bear in mind that ascites during pregnancy may closely resemble it, as also the presence of an ovarian cystic tumour, or even a distended bladder. In rare instances a fibro-cystic tumour of the uterus may resemble hydramnios, but in these cases the usual signs of pregnancy are absent.

Treatment. Slight cases do not require any active measures. If, however, the pressure symptoms are severe, the artificial termination of pregnancy must be undertaken, preferably by puncture of the membranes. This is usually followed by contractions of the uterus and speedy delivery.

Oligo-hydramnios.—By this term is understood a scanty amount of liquor amnii, which, indeed, may be almost completely absent. This is usually associated with malformations of the foetus and placenta. As the result of the small amount of amniotic fluid the sac is contracted and adhesions are liable to form. These may become stretched into bands and are responsible for many cases of intra-uterine amputation of foetal limbs. Frequently the death of the foetus occurs.

It is not possible to diagnose this condition during pregnancy.

Hydrorrhoea Gravidarum.—This is characterized by the discharge of watery fluid during pregnancy. The flow commences sometimes as early as the third month, but more commonly in the later months. It usually comes away as a continuous stream, but may at times be retained in the uterus, forming cysts, which are evacuated at intervals.

The origin of the fluid is somewhat obscure. It is usually attributed to hyperplasia of the decidua glands, the secretion being poured out between the decidua vera and reflexa. It is possible that in some cases the fluid is derived from the amniotic cavity, this membrane being for some reason permeable to its own fluid.

In rare instances fluid may also collect between the chorion and the amnion.

Symptoms. These consist in the escape, at intervals or almost continuously, of a serous fluid, sometimes sanguineous and usually containing albumen.

Little effect is produced on the health of the patient, who suffers only from the inconvenience.

The *diagnosis* presents no difficulty.

Treatment. We possess no power of therapeutic control over this condition. It is generally advised that the patient should rest as much as possible, and that vaginal douches should be given to avoid any irritation.

A. W. W. L.

FIBRO-MYOMATA OF THE UTERUS AND PREGNANCY

The figures published by Pinard, based upon a large series of cases, show that the proportion of myomata in pregnant women amounts to a little under one per cent. Out of 14,000 patients, eighty-four had tumours in the uterus. Of these, sixty-four had natural delivery, thirteen premature labour. Abortion occurred in five cases only; three cases ended fatally. Similar figures have been recorded by Pozzi, Schauta and others. Thus a general agreement of opinion exists in view of these facts, that in the great majority of cases fibro-myomata cause little anxiety during pregnancy, labour or the puerperium.

At the same time many instances are recorded in literature in which various serious complications have arisen at all stages of this process. Much depends upon the situation, the size and character of the tumour. There is no doubt that a fibro-myoma almost invariably becomes much enlarged during pregnancy, partly as a result of oedema, partly associated with hypertrophy, increased vascularity, and a tendency to retrogressive changes.

The position of the tumour is the most important feature. *Subperitoneal* myomata growing from the upper portion of the uterus, unless they attain a large size, rarely produce any difficulty. Acute torsion may, however, occur, with the development of peritoneal symptoms and the formation of adhesions. Tumours projecting into the uterine cavity, *submucous* in type, often interfere with the area of placental attachment and may become polypoid in the later months. This is often associated with degenerative changes and may be followed by *abortion*. Intramural tumours, though growing rapidly, frequently lose their definite outline and are stretched out in the wall of the uterus. Hence they may not be easy to recognize.

The most serious complications arise from tumours developing in the cervix and lower segment of the uterus or invading the broad ligaments. These tend to displace the foetus, leading to various types of malpresentations. Under these conditions pressure symptoms occur on the bladder and lower bowel. Pain may also be very severe from pressure on the pelvic nerves.

There is also no question as to the liability of myomata undergoing retrogressive changes, especially those associated with the term "red or carneous" degeneration. Many cases of this type have been recorded by Fairbairn, Bland-Sutton, and others. They almost invariably cause abdominal pain and feelings of illness, together with rising temperature and

signs of *toxæmia*. In some instances bacteriological examination has revealed the presence of *micro-organisms*. These tumours certainly predispose to grave infection. Winter in his work calls attention to the occurrence of *inversion* of the uterus as a rare complication, caused by a submucous polypoid myoma.

It is thus clear that while many cases with even multiple tumours progress normally through pregnancy, labour and the puerperium, there are also a considerable number in which the assistance of an operation is required. Such are those in which the tumour is firmly impacted, and probably adherent in the pouch of Douglas, or lies between the anterior wall of the uterus and the bladder. Under these circumstances delivery of a living child by the natural passages is usually impossible. There is further considerable risk of the development of intestinal obstruction, with its dangers. The difficulty of evacuating the bladder may also lead to cystitis, followed now and again by ascending infection to the kidney and pyelonephritis.

Diagnosis. In many cases the recognition of the existence of a fibro-myoma during pregnancy presents no difficulty. The irregular shape of the fundus and the frequent displacement of the cervix strongly suggest the presence of a tumour. Subperitoneal myomata also are as a rule quite obvious on careful palpation of the abdomen. In some cases myomata grow rapidly during pregnancy, and the coexistence of the two conditions can only be solved by waiting for a time before coming to a definite conclusion.

A solid tumour of the ovary, especially if this is impacted in the pelvis, may also be difficult to distinguish from a myoma.

The cases in which a myoma grows from the posterior wall and is stretched out by the enlarging uterus may be difficult to differentiate.

In doubtful cases much assistance is afforded by an examination under anæsthesia, not omitting to make a digital investigation of the rectum.

The possibility of an extra-uterine gestation sac being mistaken for a myoma must also be borne in mind.

Treatment. It is well known that fibro-myoma may exist throughout pregnancy and labour without producing any symptoms. In these circumstances, provided that there is no obvious obstruction to delivery of the fœtus, no operative treatment is required.

If, however, the tumour is obstructing the pelvic canal, or is undergoing degenerative changes, treatment should certainly be undertaken without loss of time.

If the impaction is entirely mechanical, an attempt may be made to elevate the tumour

out of the pelvis under anæsthesia. This, however, is rarely successful, and is not free from risk of injuring the tumour in the course of the necessary manœuvres. As a rule *abdominal section* gives the most satisfactory results.

After opening the abdomen, a decision must be made as to the suitability of removing the tumour, or performing hysterectomy. If the tumour is single and readily exposed, good results have been obtained by myomectomy. Even if the incision exposes the decidua, careful suturing may enable gestation to continue to full term, as in a case referred to by Dr. Wallace.

If the tumours are multiple and the child is not viable, the path of safety lies in hysterectomy, either supravaginal or total, according to the anatomical relations of the growth.

If a large tumour exists and no urgent symptoms develop, full term should be awaited. The living child may then be delivered by *Cæsarean section*, followed by a complete hysterectomy. Experience has shown this to be the safest procedure. I have seen one case only of this type in which a large tumour of the lower uterine segment completely prevented the child reaching the pelvis, the body lying above the level of the umbilicus in a transverse position. The result was satisfactory to mother and child.

It is a rare event for vaginal removal of a myoma to be advisable during pregnancy or labour. This could only be suitable if the growth were polypoid or undergoing necrosis whilst projecting into the uterine cavity, or in the rare cases of cervical tumour.

Fibro-Myoma during the Puerperium.—In many instances this progresses normally, and generally if the tumour escapes the risks of infection a marked diminution in its size is subsequently to be noted.

At the same time it must be remembered that there is a real danger of infection of the tumour arising after delivery.

In three cases under my observation total abdominal hysterectomy was performed, and once vaginal hysterectomy, for suppuration of myomata at periods varying from three to six weeks after delivery. All made satisfactory recoveries.

Ovarian Tumours and Pregnancy.—The presence of an ovarian tumour is a serious complication of pregnancy. In view of the frequency of these tumours, it is remarkable how seldom they are met with in association with pregnancy. McKerron concludes from an analysis of observations by various writers that the proportion is 1 in 2,500 cases of pregnancy. Cripps in a series of 182 ovarian tumours had only two cases of pregnancy. My personal experience comprises eleven cases, in all of which operation was performed.

Although pregnancy exerts no influence on the origin or rate of growth of ovarian tumours, it much increases the liability to change in them.

Of these *torsion of the pedicle* is the most important. McKerron finds this to occur in twelve per cent. of cases. In other instances the tumour becomes impacted in the pelvis, producing pressure symptoms of varying severity.

Rupture of the cyst occurs, often secondary to acute torsion of the pedicle, and may result in severe intraperitoneal hæmorrhage.

Suppuration and necrosis rarely develop during pregnancy, but frequently arise in the puerperium as a result of injury during delivery and consequent infection.

The tumour is usually of moderate size, and proportionately often the tumour is a dermoid cyst. This is probably due to the comparatively small size of these tumours and their slow growth, which causes them to escape notice unless pregnancy or some complication occurs.

In 862 cases 204 were ovarian dermoids, *i. e.* a frequency of twenty-five per cent. (McKerron).

There is also a certain tendency to spontaneous interruption of pregnancy in these cases. Thus Sir J. Williams found that abortion or premature labour took place in 58 out of 461 pregnancies, that is 12.5 per cent. of cases.

The diagnosis of an ovarian cyst with pregnancy rarely presents any gross difficulty. If the tumour is situated in the pelvis or between the layers of the broad ligament it is readily detected by the displacement of the cervix and uterus thereby produced.

If the tumour is above the brim it is usually easy to palpate.

There is a possibility of an ovarian tumour being simulated by a retroflexed gravid uterus or even by an hæmatocele. The history is, however, different, and if necessary an examination under anæsthesia will settle the question.

Prognosis. This is on the whole excellent, as once the tumour is recognized suitable treatment is now-a-days always adopted.

Treatment. There should be no hesitation in promptly removing any ovarian tumour during pregnancy, even if no definite symptoms are present.

The results obtained have been most favourable as to life, and in a large proportion of cases pregnancy has continued to full term without interruption.

The abdominal route should be almost invariably selected. If, however, the tumour is small and lies low down in the pouch of Douglas, good results have been obtained by vaginal section during pregnancy.

Carcinoma of the Cervix in association with Pregnancy.—This is a somewhat rare complica-

tion, occurring not more than once in two thousand cases.

Pregnancy may exist along with carcinoma of the cervix, or the disease may arise in the course of gestation. The progress of pregnancy is not, as a rule, interfered with, though premature labour is not uncommon.

Almost always the growth of cancer is very rapid during pregnancy.

Symptoms. These are—irregular bleeding, with watery discharge, which often becomes offensive.

The diagnosis is usually made without any difficulty. The cervix is often hard in the early stages, and in questionable cases the friability test should always be tried.

Treatment. The induction of abortion or premature labour should be avoided, owing to the risk of infection.

In the early months, up to the fourth month, the most suitable treatment is vaginal hysterectomy. If the condition is only discovered at the time of labour, the course depends upon the extent to which the cervix is invaded. If the affection is limited, the cervix dilates and the child is readily delivered.

If, however, the cervix is deeply involved in the growth, severe lacerations result from the passage of the child's head, which may be followed by infection of the cellular tissue.

In advanced cases at full term Cæsarean section should be performed, as this affords a reasonable prospect of obtaining a living child. This should be supplemented, if possible, by an abdominal hysterectomy, an effort being made to remove the growth completely.

Mucous or Fibroid Polypi.—In exceptional cases a tumour of this type grows from the cervix during gestation. This results in irregular bleeding, often associated with profuse watery or mucoid discharge.

The condition is readily detected by vaginal examination.

The treatment is simple, and consists of division of the pedicle and gauze packing of the vagina.
A. W. W. L.

ABDOMINAL AFFECTIONS DURING PREGNANCY

Hernia.—Ectasia of the recti muscles is often present during pregnancy and, as the uterus enlarges, the separation of the muscles becomes very wide.

Umbilical hernia is also much aggravated during pregnancy.

On the other hand, inguinal and femoral hernias may diminish in size and even temporarily disappear.

Hernia of the uterus into the sac of an inguinal or femoral hernia is extremely rare, and usually

requires the induction of abortion or hysterectomy.

Appendicitis and Pregnancy.—There is no reason to believe that pregnancy predisposes to the development of appendicitis, although the disease in its anatomical relations is somewhat influenced by the enlargement of the uterus. The symptoms present no special characteristics, although in the later months the increased size of the uterus may lead to difficulty in recognizing the exact situation of the inflammatory area in the abdomen.

In some cases of pelvic appendicitis a collection of pus forms in the pouch of Douglas. This is usually treated satisfactorily by vaginal incision and drainage.

If appendicitis is of the abdominal type the wisest course is the immediate removal of the appendix by abdominal section.

In one case under my observation the symptoms were those of general peritonitis developing at the end of five months' gestation. Abdominal section revealed a gangrenous appendix, which was removed without difficulty. The distended coils of bowel were drained by incision, a large quantity of fluid fæces being evacuated. The incision in the bowel was then sutured; the patient made an uneventful recovery without interruption of pregnancy.

Cholecystitis.—This in an acute form has been occasionally observed in pregnancy, or in the puerperium, and has been mistaken for peritonitis. It is usually a sign of the presence of gall stones, and the diagnosis may be made by the consideration of the previous history of the patient. Prompt surgical treatment is required for this condition.

Pyelitis.—This is not an uncommon complication of pregnancy, commencing in the later months as a rule.

The symptoms come on suddenly and are characterized by a high temperature, often with a rigor and bladder irritation and pain, usually on the right side in the kidney area. The temperature commonly continues elevated and of a remittent type. The kidney can usually be felt, enlarged and sensitive; for some reasons it is usually the right kidney which is affected.

The urine contains a large quantity of pus.

The condition is probably due to the result of the enlarging uterus more or less completely locking up the ureter by pressure.

In addition to this, there must be bacterial invasion. The bacillus coli is the organism most often found, but streptococci and gonococci have also been observed on the urine.

The infection may ascend from the bladder, but it is possible it also arises from the bowel.

The mild cases may recover under suitable

treatment, but the severe ones continue throughout pregnancy and may terminate in pyonephrosis.

Diagnosis. This can be readily made by careful study of the history of the attack, by the character of the urine, and by the swelling and tenderness over the kidney.

Treatment. This should include absolute rest, milk diet, and alkaline mineral waters.

With regard to drugs, urotropine should be given, several times a day, in five to ten grain doses, also citrate of potash, which is inimical to the bacterium coli.

If no improvement occurs, premature labour should be induced, as this is always followed by great relief to the symptoms.

Varicose Veins during Pregnancy.—Various forms of varices are met with during pregnancy, as the result of compression exerted by the enlarging uterus.

Vulva.—The venous trunks increase greatly in size, especially in the labia majora, often causing oedema, which may be severe. There is also a possibility of rupture of one of the veins, which is followed by severe hæmorrhage.

In other cases hæmatoma may form, either during pregnancy or labour, and may attain an enormous size.

Treatment. If hæmorrhage occurs, an ice bag should be applied, together with firm pressure by a pad on the vulva.

In some cases it may be possible to pass a ligature beneath the vein and so control the bleeding.

Lower Extremities.—If a patient has varicose veins in the legs, these almost always become aggravated during the later months of pregnancy. They are most frequent in the left leg, and may attain great size.

The symptoms are those of discomfort and dragging pain, with incapacity for muscular exertion. The veins rapidly diminish in size after delivery, but there is a marked tendency to recurrence in subsequent deliveries.

Treatment. The only efficient relief is afforded by rest in bed with elevation of the lower limb. It may also be advisable to apply an elastic bandage.

A. W. W. L.

DISEASES COMPLICATING PREGNANCY

The association of pregnancy with many affections exerts a modifying influence on their course. The general tendency is for diseases to be aggravated during this period, owing to the increased demands which are made on the general metabolism of the body.

In all *acute infective diseases* there is a great liability to abortion or premature labour.

Smallpox occurring in pregnancy is particu-

larly serious, and has always been attended by a high mortality.

Scarlet Fever appears to have little liability to attack women during pregnancy, and many authorities, including Olshausen, have maintained that pregnancy affords a certain degree of immunity from the disease.

If scarlet fever develops, and especially if attended with a high temperature, abortion usually ensues.

Typhoid Fever is a grave complication of pregnancy; the high degree of pyrexia and exhaustion frequently leads to abortion or premature labour. The bacilli have also been found to invade the blood stream of the fœtus.

Acute Pneumonia is much aggravated by the existence of pregnancy, especially if it arises in the later months. The enlargement of the uterus tends to increase the dyspnoea and the strain on the heart muscle. The fœtus usually dies in the early stages, and it is worthy of note that pneumococci have been discovered in the foetal circulation.

Tuberculosis.—A general consensus of opinion exists that during pregnancy the progress of tuberculosis tends to advance rapidly, and that a very directly injurious influence is thus exerted. There is little tendency to abortion or premature labour; moreover the disease is very rarely indeed directly transmitted to the fœtus.

There is much evidence that the strain of labour and the puerperal condition have also a very definitely evil effect on phthisical individuals. It has therefore been advocated that the uterus should be evacuated in the early months, especially if fever exists, if the larynx is involved, or if the patient is losing strength in spite of every care being adopted (von Rosthorn).

Heart Disease and Pregnancy.—There can be no question that some disturbance of the functions of the heart is often present during pregnancy, although it is also well known that women with marked valvular disease are often capable of passing through pregnancy and labour without any signs of cardiac inadequacy.

Much depends upon the ability of the heart to withstand the strain of gestation. Failure of compensation is particularly liable to take place in the later stages. If this becomes worse, in spite of suitable treatment, the outlook is grave, and the question of the induction of premature labour must be seriously entertained.

Serious heart lesions also predispose to spontaneous onset of premature labour.

The most dangerous form of valvular disease is admitted to be mitral stenosis, which often leads to acute paralytic distension of the right ventricle immediately after delivery, with a fatal result.

Aortic regurgitation, if unaccompanied by mitral disease, is not attended with undue risk.

Asthma.—As a rule, asthma becomes much worse during pregnancy, and some patients are only liable to suffer from the disease at this time. Cyanosis, with great difficulty of respiration, may become extreme, especially in the later months. In these cases premature labour should be induced without loss of time. This is, in my experience, followed by complete relief of the symptoms.

Chorea.—This affection has a definite tendency to arise during pregnancy, though it occurs with relative infrequency.

As a rule, the symptoms commence in the early months of pregnancy, but may arise at any period, and usually continue throughout.

Etiology. This is not precisely known. In many instances there is a history of previous attacks in childhood, and it occurs most often in primiparæ and in relatively young women.

Many cases are of a mild type, but severe cases may also occur, leading to sleeplessness and exhaustion.

Treatment. There is some evidence that the affection is of toxæmic origin, and this point of view is confirmed by the study of eleven cases observed by Dr. Shaw, in which eliminatory treatment was followed by a large measure of success. This consists essentially in a light diet, chiefly fluid, rest, and saline purgation.

In rare cases the question of induction of labour must be considered, but the results have by no means always been favourable.

Nervous Affections.—Neuralgic pains of various types are frequently observed in pregnancy. This is especially noted in the abdominal nerves and along the sciatic and sacral areas. They are probably dependent upon the enlarging uterus, and persist throughout the later months of pregnancy.

Exceptionally mental aberration, such as acute nervous depression, or even maniacal symptoms, may arise during pregnancy.

Acute Infective Meningitis.—This is undoubtedly rare during pregnancy, but, in a recent paper, Commandeur has been able to collect fifteen recorded cases. The infection is usually of the purulent type, and the pneumococcus is the organism most frequently present. This organism has been detected in the cerebro-spinal fluid by lumbar puncture, as also on the surface of the brain after death.

The symptoms bear a general resemblance to those of eclampsia, for which indeed it is often mistaken. The patient complains of severe headache and vomiting, followed by expulsions.

The temperature is usually raised to 101° or 102°. If the patient survives a few days

definite signs of organic nervous lesions arise, such as incontinence of urine, paresis of the limbs, or unequal pupils. These cases almost invariably terminate fatally.

Syphilis.—The influence of syphilis in pregnancy chiefly depends upon the period at which infection takes place.

If the mother has syphilis at the time of conception the child is practically always infected. Abortion, or premature labour, is very likely to ensue.

If the mother is only infected in the later months of pregnancy the child often escapes the disease. Foetal syphilis may also arise as the result of paternal infection, as the child may show clear evidence of syphilis, whilst the mother may have apparently escaped infection or, at least, have had it in a very mild form.

It has long been observed that in abortion due to syphilis the date of occurrence is later in each succeeding pregnancy, so that eventually, with gradual attenuation of the disease, healthy children may be born.

If the mother is known to have syphilis during pregnancy, she should be immediately placed on vigorous anti-syphilitic treatment, which may reasonably be anticipated to exert a favourable influence on the unborn child.

Lead Poisoning.—This occurs with especial frequency in pregnancy, as the result of women taking a drug to procure the expulsion of the ovum. It may also develop among women industrially occupied with the use of lead.

The effect of the poison, as a rule, is to induce abortion or premature labour, and observations have also shown that a large number of children are stillborn, and that those who have survived come to an early death.

Hæmophilia.—This disease, as is well known, very rarely occurs in women. So far as we know it has no influence on gestation, but after delivery there is a very real risk of severe post-partum hæmorrhage, so that every precaution should be taken to control this.

Pernicious Anæmia.—This disease may appear during pregnancy, but perhaps more often in the puerperium. It presents the typical features of severe anæmia with prostration. The red blood corpuscles are much reduced in number and diminished in amount also of hæmoglobin. This affection tends to a fatal issue, though, occasionally, good results may be obtained by suitable treatment.

Leucocythæmia.—This is very rarely met with in pregnancy, but a certain number of cases have been recorded.

The diagnosis is made by the great increase of leucocytes in the blood and the enlarged spleen.

In the cases published, premature labour has often come on spontaneously, with good results.

This is probably the wisest course to pursue if the disease continues to be progressive.

A. W. W. L.

GENERAL CONSIDERATIONS OF MECHANISMS AND PRESENTATIONS

The Female Pelvis.—The *obstetric* or *true pelvis* for purpose of measurement is divided into brim, cavity and outlet. The part of the pelvis above the brim, named the *false pelvis*, admits of certain measurements which serve as a rough estimate of the bony canal through which the child has to pass. The measurements of the false pelvis are easily taken by a pelvimeter. They are:—the interspinous, ten inches; the intercrystal, eleven inches; and the external conjugate, eight inches. The interspinous measurement is the distance from the outer border of one anterior superior spine to the outer border of the other. The intercrystal measurement passes between the most distant points of the crest of the ilium. These points lie two inches behind the anterior superior spine. This diameter has been found to be about twice that of the transverse diameter of the brim. It is one inch longer than the interspinous measurement if the pelvis is normal in shape, but this ratio is less if the pelvis is flattened, and in extreme cases of rickety pelvis the two measurements may be equal. The external conjugate is taken with the patient lying on her side or standing. It lies between the last lumbar spine and the central point of the upper border of the symphysis pubis. This measurement is estimated to be three and a half inches more than the true conjugate if the pelvis is normal, but the writer has found that the pelvis may be contracted in the true conjugate even when the external conjugate measures eight inches.

A point every practitioner should bear in mind is that even when all the external measurements are normal there may be contraction of the antero-posterior diameter of the brim. This contraction may be enough to render induction of labour advisable, therefore in all cases of first labours the internal as well as external measurements should be taken before the seventh month of gestation. The true conjugate is approximately estimated by finding the diagonal conjugate and deducting therefrom half an inch. The diagonal conjugate is taken from the centre of the rounded sacral promontory to the centre of the lower border of the symphysis pubis. It measures five inches in the normal pelvis. Experience teaches that it is often difficult to reach the promontory with the two examining fingers even when the head is not in the brim, but failure to do so may be taken as a good sign, since if contraction of even half

an inch is present the promontory is easily reached. The articulation between the first and second sacral vertebrae must not be mistaken for the more rounded promontory higher up, or too liberal an estimate of the size of the true conjugate will result. If by a sweeping movement of the examining fingers the sides of the pelvic brim are easily reached it should be taken for granted that the pelvis is generally contracted. The measurement of the normal pelvis may be shown in tabular form as follows:—

	Conjugate.	Oblique.	Transverse.
Brim . . .	4.25	4.75	5
Cavity . . .	4.75	5	4.75
Outlet . . .	5	—	4.25

The arrow indicates the course taken by the passage of the head during internal rotation. The figures given are easily remembered, as it will be noticed that they make up three measurements only, viz $4\frac{1}{4}$, $4\frac{3}{4}$ and 5.

The Fœtal Skull.—Since the head of the fœtus is the least compressible part of the child, it is the most important part of its anatomy from the obstetric standpoint, as it will offer most resistance during birth. The imperfectly ossified membranous plates which make up the vertex are capable of a considerable degree of overlapping as the result of pressure, so that the head is rendered adaptable to variable proportions in size between its own diameters and those of the maternal passages.

The moulding of the compressible vertex by pressure is well tolerated by the cerebral hemispheres, whilst the ganglia are protected by the rigid base of the skull from all extracranial pressure.

Eminences, Sutures, Fontanelles, Regions.—There are two frontal and two parietal eminences and one occipital protuberance on the cranial vault, whilst the facial landmarks are the chin, ears and root of the nose (glabella).

The *sutures* are the frontal and sagittal in the antero-posterior line, the coronal between frontal and parietal bones and lambdoidal suture between the parietals and the occipital bone.

The *fontanelles* are the anterior or bregma which is a large lozenge-shaped membranous space between frontal and parietal bones at the junction of the sagittal and coronal sutures.

The *posterior fontanelle* is a small sulcus between the parietal and occipital bones; it forms the apex of the lambdoidal suture.

Regions. The vertex lies between the anterior and posterior fontanelles; it is bounded laterally by the parietal eminences.

The *sinciput* or brow lies in front of the anterior fontanelle and comprises the anterior parts of the two frontal bones.

		inches.
Diameter, antero-posterior	suboccipito-bregmatic	4
	occipito-frontal	$4\frac{1}{2}$
	occipito-mental	5
	cervico-bregmatic	4
	cervico-vertical	$4\frac{1}{4}$
	mento-vertical	$5\frac{1}{4}$
	transverse	
	biparietal	$3\frac{3}{4}$
	subparietal super.	
	parietal	$3\frac{1}{4}$
Circumferential,	bitemporal	3
	bimastoid and bixy-gomatic	$2\frac{3}{4}$
	occipito-mental	16
	occipito-frontal	14
	suboccipito-bregmatic	11-12

The caput succedaneum is an oedematous swelling of the scalp covering the presenting part and surrounded by the zone of resistance or girdle of contact.

Presentations and Mechanisms.—The “presenting part” is that portion of the fœtus which lies in the axis of the parturient canal. The head presents in ninety-six per cent. of cases, and normally the part that lies between the two parietal eminences lies in the centre of the birth-canal. In head presentations we shall include the vertex, face and brow varieties.

Vertex Presentations.—The position of the occiput in relation to the pelvis determines four varieties; we have:—1. Left occipito-anterior. 2. Right occipito-anterior, when the occiput points to the left or right ilio-pectineal eminence. 3. Right occipito-posterior. 4. Left occipito-posterior, when the occiput points to the right and left sacro-iliac joints respectively.

The mechanism in vertex presentations is described as consisting of:—1. Obliquity. 2. Flexion and descent. 3. Internal rotation. 4. Extension. 5. Restitution and external rotation.

1. *Obliquity.* The long antero-posterior diameter of the head lies in one or other of the oblique diameters of the pelvis.

2. *Flexion.* The normal attitude of the entire fœtus is one of flexion, so that the chin lies on or near the sternum before entering the brim; as labour advances the occiput descends below the vertex which constitutes the *mechanism* of flexion. The level at which it begins will vary with the size of the pelvis. The less the resistance, *i. e.* the larger the pelvis, the later it occurs. The object of flexion is to bring the smallest diameter of the head across the pelvic diameter which it occupies, therefore the smaller the pelvis the more marked is the flexion of the head; hence a posterior fontanelle presentation is one of the indications of a small round pelvis.

3. *Internal Rotation.* The object of this movement is to bring the long diameter of the head into that of the outlet. As the pelvic floor slopes downwards and forwards, that part of the head which first meets with its resistance

will by it be directed to the front. If the head is sufficiently flexed to cause the occiput to be the first to meet the resistance of the pelvic floor it will rotate forward. Conversely if flexion be imperfect and the sinciput be the first to strike the sloping floor, then the sinciput will undergo forward rotation—the same applies to face and forehead according to the degree of extension in face presentations.

4. *Extension.* This is the movement by which birth of the head is completed, but it should not be allowed to take place until the occiput is outside the vulva. Flexion of the head should be maintained until the parietal eminences and occipital protuberance is outside the vulva, then the perineum is less likely to be torn.

5. *Restitution and External Rotation.* Directly extension has freed the head, the latter at once swings back to the normal position it occupied before internal rotation had occurred. As soon as internal rotation of the shoulders occurs, the fact is indicated by external rotation of the head; in this movement the head serves as an indication to the position of the shoulders, *i.e.* when the child's face looks towards the mother's thigh the shoulders are lying in the antero-posterior diameter of the outlet, and the long diameter of the thorax and breech will follow in the conjugate of the pelvic outlet.

In the L.O.A. or first vertex presentation the suboccipito-bregmatic diameter of the head lies in the right oblique diameter of the pelvis. Internal rotation takes place through one eighth of a circle from left to right. The shoulders lie in the left oblique with the right shoulder anterior and the left posterior; the right shoulder then rotates through one eighth of a circle from right to left, *i.e.* it comes forward under the pubic arch and at the same time the head rotates externally in the same direction as that in which restitution took place.

Mechanism in Occipito-Posterior Cases.—Owing to the child's spine being apposed to that of the mother the attitude of flexion when the head enters the brim with the occiput behind is imperfect, and the head may even enter the pelvis mid-way between flexion and extension. Generally, however, there is sufficient flexion present in these cases to ensure the occiput reaching the pelvic floor before the sinciput, then it rotates through the transverse and oblique diameters of the cavity and comes to lie under the pubic arch—having thus rotated through three-eighths of a circle (long rotation). In addition, however, to the initial drawback of imperfect attitude, the mechanism of flexion is apt to be interfered with by the fact that the biparietal diameter of the head lies behind the oblique diameter of the pelvis, so that if the head is large or the pelvis small it

may get held sufficiently firmly to prevent the mechanism of flexion occurring, and the occipito-frontal diameter instead of the suboccipito-bregmatic engages. The sinciput on the slightest degree of extension will meet the sloping floor first, and as a consequence will rotate to the front and a face to pubes presentation is the result. Thus a persistent occipito-posterior position is established, and during birth the occipito-frontal diameter of four and a half inches will distend the vulval outlet and endanger the perineum.

In a third vertex position, R.O.P., the internal long rotation takes place from right to left; in the fourth position it occurs from left to right.

Moulding. By pressure the occipital bone is depressed beneath the two parietals, thus deepening the sulcus known as the posterior fontanelle. One or other parietal bone to a slight degree becomes depressed; thus the shape of the head is altered.

The suboccipito- and occipito-frontal diameter suffer compression and shortening of their length, whilst there is compensatory elongation of the mento-vertical diameter. This is most marked in occipito-posterior positions.

In anterior positions the caput succedaneum will be behind, and in posterior positions it will be in front on the parietal bones; and it will lie on the anterior parietal in every case.

Face and Brow Presentations and Mechanisms.—Face presentations are generally met with at the beginning of labour, and are caused by difficulty of the head entering the brim; hence a first face presentation is an extended first vertex. There are four positions possible, the chin being the denominator.

- F. 1 = Right mento-posterior.
- F. 2 = Left mento-posterior.
- F. 3 = Left mento-anterior.
- F. 4 = Right mento-anterior.

As in a vertex presentation the long axis of the head is usually in the *right* oblique diameter; hence the first and third positions are the commonest. On abdominal examination the back is lost to palpation even when it lies anterior, but the occiput is felt on one or other side, and from it an oblique sulcus runs downwards towards the opposite side; when extension is incomplete this groove is horizontal and the brow presents.

When the back is posterior the limbs are palpated with ease, but of course the occiput is not so prominent; the foetal heart is, however, heard more distinctly.

As there is difficulty in entering the brim in a face presentation, the head will lie high up at the beginning of labour, and the foetal heart

will be heard higher up than in a vertex. On vaginal examination in the early stage the presenting part is high; later the membranes protrude abnormally, and may rupture prematurely; later still the facial landmarks can be made out (chin, mouth, orbits); finally in prolonged labour the latter may be obscured by a caput succedaneum, when the diagnosis will depend on feeling the ear, the nasal septum or the alveolar ridges.

Mechanism. Extension of the head which has started at the brim progresses with descent until the cervico-bregmatic diameter lies across the "girdle of contact" with the neck at one extreme and the forehead at the other. In full extension the chin is bound to be the lowest part, and its rotation forwards is certain. The head is born by flexion, which should not occur until the chin has passed the pubic arch. The perineum is then stretched by the cervico-vertical diameter which measures four and a half inches.

Incomplete extension allows the sinciput to reach the sloping pelvic floor before the chin; the result then is that the sinciput instead of the chin rotates forward, the chin rotating into the sacral hollow and rendering natural delivery of a normal fetus impossible.

Management. Preserve the membranes by keeping the patient recumbent during the first stage, and making any vaginal examination with extreme care.

In the second stage locate the chin and get the patient to lie on the opposite side to that on which the chin is situated. If the chin will not rotate forwards rotate the head and trunk under anaesthesia, then pull down the chin, put on forceps and deliver. Failure to deliver by the above method necessitates craniotomy.

Brow Presentation and Mechanism.—A brow presentation may be considered as a subvariety of face presentation, extension being arrested half way, so that the forehead and not the chin becomes the presenting part. The mento-vertical diameter of the head lies across the pelvis. The head lies high in the pelvic brim, the chin and occiput are felt at the same level in making the pelvic grip early in labour. On vaginal examination the orbital ridges are felt at one end of the presenting part and the bregma at the other.

Mechanism. If the head is able to enter the brim in a brow presentation the mento-vertical diameter of five and a quarter inches will lie in the transverse diameter of the pelvis. With a small head or a large pelvis the brow rotates forwards and the occiput backwards, the mento-vertical diameter is compressed, the occipito-frontal diameter is elongated and the brow bulges notably. An extensive caput forms over the frontal bones. The bulging brow presents

at the vulva, the face is squeezed against the pubes and the head is born as follows:—

The brow escapes under the pubes, the cranial vault and occiput escape over the perineum, and lastly the face descends from behind the symphysis. If the brow rotates into the sacral hollow natural delivery cannot occur.

Delivery by Treatment. Never trust to the chance of natural delivery. Do podalic version early in labour, or if unable to do so convert the presentation into a vertex by flexion or into a face by extension.

With fixation of the head later in labour the above is impossible; put on forceps as soon as the cervix is sufficiently dilated. If forceps fail craniotomy must be performed.

Pelvic Presentations and Mechanism.—Pelvic presentations include three varieties: breech, footling and knee. When the normal attitude of flexion is perfect the breech presentation is complete, *i. e.* the feet lie close to the breech but a little higher up. When the normal lie is undone and the legs are extended on the thighs the breech is said to be incomplete. Diagnosis is made by abdominal palpation. The head is recognized at the fundus by the fact that it ballots on the spine. The fetal heart sounds are heard above the umbilical level. Per vaginam the membranes rupture early, and meconium may be recognized. The coccyx and ischial tuberosities can be felt. The finger may enter the anus, which is distinguishable from the mouth by absence of alveolar ridges. Higher up the finger may be made to hook round the groin; whereas in a face the ear would be felt. The foot is recognized by the presence of the heel, and the toes are practically in a straight line. In the male the scrotum is to be recognized.

Danger. Foetal mortality from asphyxia.

Presentations. Four are recognized:—1. Left sacro-anterior. 2. Right sacro-anterior. 3. Right sacro-posterior. 4. Left sacro-posterior.

The first and third are the commonest positions. The sacro-tibial diameter lies in the right oblique diameter of the pelvis.

Mechanism. The anterior hip descends in advance of the posterior by a movement of lateral flexion. It is thus the first object to strike the pelvic floor, and accordingly will rotate forwards; it then escapes under the pubic arch and the posterior buttock sweeps the perineum by a movement of lateral extension. The shoulders lie in the same oblique diameter of the pelvis as that occupied by the bisiliac diameter of the child (hips) and will take on the same internal rotation. Consequently when the left hip is being born under the pubic arch the left shoulder is ready to follow the same course.

The head enters the brim with its long axis

in the transverse diameter; with descent, internal rotation occurs which brings the occiput forwards and the chin points to the sacral hollow. During birth the chin, face and brow, pass in this order over the perineum. In a few cases the after-coming head may turn with the face to the pubes, when delivery is not quite so easy. Of course, there will be no *caput succedaneum*, but the scrotum is often much swollen and ecchymosed.

Delivery in a Breech Case. Keep the membranes intact as long as possible by not allowing the patient to walk about during the first stage. When the trunk is born as far as the navel note the pulsations in the cord; as long as the heart-beat is strong do nothing beyond wrapping up the child's body to protect it from contact with cold air. Free the hands as soon as they can be reached. If pulsations fail use suprapubic pressure and carry the body well forward by seizing the child's pelvis with the right hand and using suprapubic pressure with the left. Some operators prefer to get an assistant to make suprapubic pressure downwards and backwards and employ jaw and shoulder traction themselves. The child is placed astride the right arm and the right index finger enters its mouth and passes far back in that cavity. The left hand is placed on the shoulders and the index finger passes over one shoulder whilst the middle finger passes over the other close to the neck. Traction can then be employed in the changing direction of the pelvic axis.

If jaw and shoulder traction fails forceps must be employed for the after-coming head, for it should always be remembered that the head must be delivered in five minutes to obtain a living child.

When there is delay in the birth of the buttocks give an anæsthetic and bring down a leg. Follow up the anterior thigh as far as the knee, pressure on the inner side of the knee will abduct the thigh and so flex the leg and bring the foot within reach, it can then be brought down into the vagina. If the buttock is impacted because the pelvis is small or the pains weak, the breech hook may be used and traction applied in the fold of the groin; there is danger of fracture or dislocation of the femur, so that where practicable the bringing down of a leg is the better practice.

In extended arms give an anæsthetic and pass the hand along the back of the child until the elbow is reached, then flex the forearm over face and chest, choose the posterior arm first, as there is more room to act in the sacral hollow. If there is delay at the brim from extension of the head, try to flex it by combined jaw traction and fundal pressure; if this fails perforate.

If the head is extended in the pelvic cavity

try to deliver with axis traction forceps; should this fail perforation must be performed.

Transverse Presentation and Mechanism.—Transverse and oblique lies are included under the above heading—neither pole presents, but generally some part of the lateral aspect of the foetus lies in the pelvic axis. Taking the acromion process as the denominator, there are two positions to be considered: Dorso-anterior and dorso-posterior; in the former the normal attitude of flexion is maintained, in the latter with the child's spine towards the mother's, extension occurs and malposition of limbs is common. Generally the head lies in one iliac fossa and the breech lies higher up on the opposite side.

Diagnosis. The long axis of the uterus lies more or less across the abdomen; the head will be felt to one or other side of the pelvic axis. Per vaginam the presenting part lies high up.

A finger-like bag of waters is characteristic, or if the membranes are ruptured, an arm may be felt through the partially dilated os. Later on a prolapsed arm may be found in the vagina and the ribs and axilla may be felt; other points of distinction are the angle of the scapula and the acromion process.

Mechanism. With a full-sized foetus this does not exist; in certain conditions (*i. e.* in cases of very small or macerated infants), natural expulsion may occur by:—1. Spontaneous version. 2. Spontaneous evolution. 3. Spontaneous expulsion (corpore conduplicatio).

1. *Spontaneous Version.* Before the membranes are ruptured, strong pains have been known to push away a shoulder and replace it by head or breech.

2. *Spontaneous Evolution.* The head is extremely flexed, and so is the cervical part of the spine (see drawing, Eden, p. 272); this kills the foetus from thoracic and abdominal pressure. The shoulder and corresponding arm are driven down by strong pains, and the latter prolapses outside the vagina. The back acutely flexed next appears above the perineum, then follow breech and legs, finally the head and remaining arm are born.

3. *Spontaneous Expulsion.* This is a rare occurrence; the foetus must be very premature or in a state of advanced maceration. The foetus is doubled upon itself, and after a shoulder has been driven down the head and chest descend together.

Delivery in Transverse Presentation. When the malposition is detected early, instruct the patient to lie on the side on which the head of the child is situated; this will throw the breech and fundus to that side and cause the head to rise towards the opposite side. In this way a mechanism which has been described as

spontaneous rectification may be brought about, *i. e.* the head may be shifted from the iliac fossa and brought to lie in the axis of the pelvic brim by correcting uterine obliquity. Where the lie is more transverse, such simple treatment is no use, and external cephalic version is required. This is done at the beginning of labour, *i. e.* before rupture of the membranes. The head is brought to lie over the brim, the membranes are ruptured and a tight binder applied. Internal version is to be employed where a transverse lie persists in spite of the above modes of treatment, but it must be remembered that in cases where there are signs of tonic contraction such as a high retraction-ring, or where the uterus is so contracted down on the child that the fetal parts cannot be made out, internal version is contra-indicated for fear of rupturing the uterus; in such cases embryotomy must be performed.

C. L.

ABNORMAL PRESENTATIONS

Abnormal presentations of the child, though frequently an expression of contraction of the pelvis, may, however, occur independently of any demonstrable pelvic abnormality.

A malpresentation causing dystocia is often met with in a multipara where previous obstetric history is normal. There are many pelves, of a minor degree of contraction, fully equal to the task of transmitting a full-time live child, provided other variable factors in labour are favourable, such as normal presentation, good moulding and strong uterine action in the axis of the superior strait; if, however, in a later labour a less favourable presentation occur, the accoucheur may at once find himself face to face with a serious obstacle to delivery. An excess of liquor amnii or a marked deviation of the axis of the uterus from that of the superior strait are comparatively common causes of such variations in presentation.

It is a melancholy reflection that in some of the worst cases of trauma and sepsis (due to manipulations) admitted to lying-in hospitals, the patient is a multipara with a record of many spontaneous full-time labours, and the difficulty in these cases has been found to be due to so simple a cause as an unrecognized occipito-posterior presentation.

Another point impressed upon one is that in the treatment of these abnormal labours there is frequently shown an entire failure to recognize the delicate balance between maternal and foetal interests, a just appreciation of which must be the first qualification of the accoucheur. This may be exemplified by perhaps the commonest observation made at a lying-in hospital in cases admitted in urgent labour, where a

medical practitioner has been endeavouring for several hours without success to extract an impacted occipito-posterior head, the child having died many hours previously. In such cases the routine use of the stethoscope might have saved a maternal tragedy. The stethoscope is still the most neglected instrument in midwifery; in the author's opinion it has an essential place in the accoucheur's bag and helps him better than any other source of information to arrive at those two most important decisions—when to intervene and what form of extraction to adopt.

To arrive at early and accurate diagnosis of presentation abdominal palpation must be carried out. It is not possible in the short space of this article to enter fully into the precise details of the essential method of investigation. Fortunately teaching authorities in the United Kingdom are recognizing the importance of instructing the student in midwifery in lying-in wards where opportunities of obtaining practice in palpation occur daily. The author's experience of abdominal palpation is that it is by no means so uniformly satisfactory in its information as textbooks would lead one to infer. Unfortunately it is just in the case of the primigravida, where we are most anxious to obtain information, that the rigid parietes mask the underlying foetal parts. Still the general principle holds that the presentation should be determined by abdominal palpation and confirmed later by vaginal examination. In a favourable case inspection and palpation should accurately determine the lie, the presentation, and the presence or absence of engagement of the presenting part. Inspection alone of the abdomen in the later weeks or at term may often warn the accoucheur of the presence of abnormalities. Any marked departure from the normal of the contour of the abdomen in a primigravida should be detected at once. This contour in a primigravida with muscular parietes is of remarkably little convexity, a fact which frequently enables her to reach term with the pregnancy unsuspected; any increase in this convexity, where the outline of the abdomen approaches the hemispherical in shape, must be regarded as denoting some abnormal factor present, such as a contracted pelvis, twins or hydramnios, and the cause determined as soon as possible. Early recognition of complications is the key-note of modern midwifery, and frequently such complications may be so judiciously treated as to prevent any serious form of dystocia arising.

Occipito-Posterior Presentations.—This malpresentation easily heads the list. Not in itself an insuperable obstacle to delivery, it is still the most common abnormality that the accoucheur has to deal with. It is not uncommonly

associated, if neglected or undetected, with such grave consequences as foetal death, maternal trauma and a septic puerperium, the direct result of many needless examinations and manipulations. It is certainly, in the author's experience, the most common cause of difficulty in general practice. Its unfortunate reputation is easily explained. A hasty and incomplete vaginal examination, unassisted by abdominal palpation, detects the presence of the head apparently entering the pelvic cavity. No steps are taken to determine accurately the precise spot on the foetal head that is presenting; a false sense of security is engendered that would never have arisen had the practitioner encountered such a marked departure from the normal as a shoulder presentation. In the latter case he will at once recognize the danger; if practised in obstetric manipulations he will carry out appropriate treatment, or if he lacks this experience or confidence he will send for more skilled assistance. He will at least recognize the urgency of the case.

An occipito-posterior presentation may be diagnosed accurately via the abdomen by the association of three cardinal signs:—(1) Irregular nodular foetal protuberances felt occupying the anterior surface of the uterus. (2) The widely abducted thumb and index finger can be made to depress the abdominal wall immediately above the pubes to an extent which is impossible in a first or second vertex. This physical sign owes its presence to the fact that all occipito-posterior presentations exhibit to a more or less degree some extension of the head. Into the resulting space between the foetal chest and chin the abdominal wall may be depressed (Pawlik's sign). (3) The conduction of the heart sounds to one or other flank, well away from the mid line.

By vaginal examination the rhomboid-shaped anterior fontanelle, with its four entering sutures, is encountered by the examining finger. Were the diagnosis always as simple as has been suggested, it would be hard to account for frequent failure of recognition. Unfortunately, if labour has been in progress for some hours with the membranes ruptured, many of the bony landmarks are obscured. In these cases, as soon as dilatation of the cervix permits a fuller examination of the head, an attempt must be made to reach one further landmark which fortunately is never obscured—the *posterior ear*. If the groove between the ear and the mastoid point backwards the occiput must be posterior.

Complications. In what ways may the posterior position of the occiput complicate the various stages of labour?

The early complications noted are premature rupture of the membranes, associated with a long, tedious, painful first stage, not infrequently

lasting more than twenty-four hours. When the expulsive stage has been reached the pains are frequently below the normal strength, often requiring the assistance of forceps. In addition the mechanism of normal labour may be considerably modified.

The large majority of occipito-posterior presentations terminate as occipito-anterior deliveries, as the result of the so-called "long rotation of the occiput forwards." Less commonly (30 cases out of 256 occipito-posterior presentations) the occiput rotates backwards to the sacral hollow, influenced by the action of the pelvic floor on the occiput, since the head is always in these cases slightly extended. This persistent posterior position of the occiput introduces a mechanical difficulty less favourable to delivery than in V1 and V2. Since the occipito-frontal diameter of the foetal skull has to traverse the conjugate at the outlet, *i. e.* a foetal measurement of four and a half inches instead of the suboccipito-bregmatic of three and three-quarter inches or suboccipito-frontal four inches. As a result, delivery of the head with the occiput posterior is often associated with considerable maternal trauma of soft parts (vagina, perineum and anal orifice).

If the head be slightly above the average size, well ossified and therefore relatively less compressible, *impaction of the head in the pelvic cavity* may ensue, with the onset of definite urgent signs and symptoms calling for immediate intervention. The phenomena of impaction call for rapid termination of the labour; whether by forceps or by perforation, being determined very largely by the value of the foetal factor.

Treatment. The difficulties of occipito-posterior labours are mostly produced by defective flexion of the head. Full flexion is difficult to attain in the hinder part of the pelvis, where the biparietal diameter exceeds the sacro-cotyloid; again, the adaptation of the foetal to the maternal spine renders full flexion of the head impossible. It follows, therefore, that ideal flexion cannot be obtained till the occiput is directed anteriorly either by the forces of labour or by *manual rotation of the vertex*. Very little value attaches to other suggested manœuvres for furthering rotation, such as pressing upwards and backwards on the occiput during a pain. It is very frequently unsuccessful, means repeated examinations, and is therefore unsuited for general practice. Direct traction downwards on the occiput by the vectis has passed away with the last generation of accoucheurs. The ideal treatment is to postpone such manœuvres till an advanced stage in labour, when they can be followed by immediate delivery, spontaneous or assisted by forceps.

Let the patient be tidied over the irksome stage of slow cervical dilatation by sedatives

if necessary and ample nutrition till approximately full dilatation is reached. Under the influence of chloroform the *left hand* is introduced into the vagina, while the fingers and thumb grasp the vertex firmly and carry out the rotation in the appropriate direction by a movement of pronation or supination of the hand. The practitioner frequently experiences now a sense of confusion as to which movement of the hand to adopt, a difficulty largely caused by the left lateral position of the patient. There is, however, nothing easier to calculate if he will only recollect clearly whether it be a third or a fourth vertex he is dealing with. In the former (R.O.P.) the occiput must, to reach the front of the pelvis, rotate along the "upper" half of the pelvis (that is, in relation to the patient's posture); conversely in the V4 (L.O.P.) traverse the "lower" half of the pelvis to be converted into a V1.

Therefore the action of the left hand in the former (R.O.P.) manoeuvre must be in the direction of *pronation*, and in the latter (L.O.P.) the hand, in bringing the occiput to the front, will assume the position of supination. The left hand thus assumes the positions which are used for the introduction respectively of the right or upper blade of the forceps and the lower left blade.

One final piece of advice must be added. Manual rotation of the head as carried out in this way frequently fails of its object unless the occiput be held forwards while the forceps is being applied. The rotation has only had the effect of producing cervical torsion (unless the movement has been communicated to the trunk), with the result that the occiput will "twist" back to its original posterior position as soon as the rotating force is removed. The accoucheur will frequently be rewarded by feeling the head descend at once to the perineum when rotation has been effected. One frequently sees cases where the foetal head has descended at once after rotation, and that in cases where delivery with forceps has been attempted for several hours with the occiput unreduced.

Brow and Face Presentations.—Brow presentations seldom occur as a cause of difficulty, but are most frequently met with early in labour where the foetal head is resting at the brim in a position of unstable equilibrium midway between flexion and extension.

This presentation is rarely recognized abdominally, since neither occipital nor sincipital foetal poles form a prominence capable of recognition in the hypogastrium.

By vaginal examination one or other frontal eminence presents, and at the periphery of the presenting area can be felt at opposite poles the orbital ridges and the anterior fontanelle.

Early diagnosis of brow presentation by the vaginal route is difficult, the presenting part being frequently mistaken for the vertex.

The diameter of engagement in this presentation is the "maximum" or mento-vertical diameter, five and a half inches, rendering progress through the pelvic cavity an impossibility if the head be of average size.

Mechanism may be dismissed, since only an undersized head can traverse the pelvis in this position.

Under observation brow presentations are essentially unstable and frequently undergo change either in the direction of flexion or increased extension leading to face presentation, the latter being the more frequent. These two natural terminations suggest the treatment. Early in labour, before the presenting part has entered the pelvis, attempts may be made by abdomino-vaginal manipulations to push up the sinciput, at the same time endeavouring to push the occiput downwards from above. This manoeuvre is seldom successful. Again, if the presenting part is well engaged in the brim, an attempt may be made, if there is no marked pelvic contraction, to induce face presentation by furthering the extension of the head. As a general rule, however, the best treatment will consist in carrying out internal version as soon as the cervix is fully dilated and terminating the labour as a breech. If the labour be too advanced to warrant internal version, an attempt should be made to induce a vertex or face and deliver with forceps. Failing this there is no alternative but to perforate the head. If pelvic contraction coexist, with a record of difficult labours and still-birth, the accoucheur, influenced by the obstetric history, should not forget the advantages of a surgical termination of the labour by Cæsarean section.

Face Presentations result when there is complete extension of the head upon the spinal column, the occiput being in contact with the lower cervical spines and in extreme cases encroaching on the interscapular area. Many causes may contribute to this presentation, both foetal and maternal. The fact, however, that it is so seldom encountered before the onset of labour narrows its causes generally to some abnormality in connection with the maternal passages. Face presentations should always excite suspicion of some pelvic abnormality, the most frequent being flattening of the pelvis. Face presentation in itself (with the sole exception of the persistent mento-posterior position) does not directly add to the maternal risk. The dangers of this presentation are those of the frequently associated pelvic contraction. It is the first duty of the accoucheur to assure himself that this is not present in more than a minor degree, when experience shows he can usually

adopt an expectant attitude and await a spontaneous delivery. Recognition of face presentation by abdominal examination is by no means difficult where the back is directed to the front. The characteristic occipital protuberance at the brim, separated from the back by a distinct interval and on the opposite side to the foetal limbs, is easily recognized.

Vaginal examination frequently gives confusing results early in labour, the cheek may be touched at a high level and mistaken for the breech. Later a "caput," forming primarily over the malar bone, may spread all over the surface of the presenting part and obscure its outlines. Thus the œdematous eyelids have been mistaken for the scrotum. Two landmarks fortunately remain unobscured. The nose, with its absence of loose areolar tissue, remains as a hard cartilaginous nodule in the centre of the presenting part, while the mouth, though largely obscured by the œdematous lips, always reveals its presence to the examining finger by the hard alveolar processes. Labour is frequently modified in the first stage, there being a marked predisposition to premature rupture of the membranes, with attendant risks of cord prolapse and still-birth.

The second stage has one complication only to be feared—failure of the chin to rotate to the front in the first and second (mento-posterior) positions.

Increased extension of the head in face presentation is the natural mechanism of labour accompanying descent, analogous to the increased flexion of vertex labours. With the chin, however, remaining posterior, a degree of hyperextension requisite to force the chin over the perineum becomes incompatible with the advance of the foetus at the brim. Such exaggerated extension causes the brim to be occupied not only by the occiput, but by the upper part of the foetal thorax as well.

Treatment. The greatest care must be taken to avoid facial injury during examinations. Efforts may be made early in the first stage, when the cervix is sufficiently dilated, to alter the attitude of the child by a form of combined abdomino-vaginal manipulation. This combined manoeuvre is necessary, since it is essential in correcting the extension of the head at the same time to combat the extension of the spine, without which force applied solely to flex the head will almost certainly be of no avail. These manipulations are difficult to carry out, better suited for institutional practice, where anæsthesia is always readily obtained; and bearing in mind the frequent spontaneous termination of face presentation, the accoucheur may safely limit his efforts to conserving the bag of membranes and adopting an expectant attitude.

Certain conditions will call for prompt interference—

1. With a minor degree of flat pelvis present, the face not entering the brim readily, the treatment becomes that of flat pelvis. Internal version, as soon as the cervix is fully dilated, and extraction as a breech are indicated.

2. Where the head descends mento-posteriorly into the pelvic cavity and rotation is delayed, an effort may be made to expedite it by hooking down the chin.

3. Failing this, manual rotation of the chin to the front (carried out precisely as with the occipito-posterior vertex) is indicated. Application of forceps to the mento-anterior face in the pelvis is not an unsuitable use of the instrument, though care must be taken in their application to adapt the blades solely to the vault, as there is a tendency for the tips to encroach on and damage the soft structures of the neck.

4. Failing rotation of a persistent mento-posterior in the pelvic cavity with an advanced second stage, perforation of the foetal head (preferably through an orbit) is the only feasible termination of the labour.

Breech Presentation is met with in labour in three to four per cent. of all cases. Its occurrence should suggest to the practitioner the possible existence of certain associated complications. The most important of these associated conditions which act generally in preventing engagement of the head are: (a) pelvic contraction; (b) hydramnios; (c) prematurity of foetus, lessening the tendency to head-downward lie; (d) placenta prævia.

In many cases, however, breech presentation is met with where no such causal factors can be detected.

From the maternal point of view there are no direct risks involved, but indirectly serious maternal trauma may be sustained in treating some of its complications. With the foetus, however, there is always increased liability to still-birth (estimated as high as ten per cent.; forty-six cases Queen Charlotte's Hospital, 1910, 4.35 per cent.) or death shortly after delivery due to obstetric trauma.

Nominally the breech presents in an attitude of complete flexion, and the examining finger will detect both buttocks and both feet. This variety of presentation, known as **Complete Breech**, ensures the maximum safety of the child in labour, since the degree of cervical dilatation necessary to transmit this bulky presenting part will later offer no resistance to the passage of the shoulder girdle and head. Nearly all the risks of breech presentation are summed up under this point, and will generally be found to owe their cause to the fact that an imperfectly dilated cervix has allowed the transmission of the narrow breech of the foetus minus the presence of the flexed legs, with a consequent arrest of arms and head when they

in their turn attempt to pass the imperfectly dilated cervix.

Incomplete Breech.—Frequently the normal attitude is modified by extension of the lower extremities of the foetus at the knee joint. Here the thighs and legs are extended alongside the trunk and cause difficult labour in several ways. Firstly, by permitting the rapid advance of the breech and trunk through a cervix only partially dilated, and later arresting the escape of the foetus at the outlet of the pelvis by checking lateriflexion of the trunk.

Footling or Knee Presentation.—Occasionally the foetus adopts an oblique lie analogous to a transverse presentation, but without its risks of impaction. Here the foetus may be regarded as sitting in one of the iliac fossa with either or both the lower extremities flexed (footling) or extended (knee).

The chief difficulty to be faced here is not one of obstruction, but an extreme liability to premature rupture of membranes and cord prolapse.

Recognition of Breech Presentation. In carrying out abdominal palpation the pelvic grip reveals the presence of a bulkier and often more indefinite foetal pole than the head. Mistakes are sometimes made by gripping the two ends of the bisiliac diameter, which, being hard bony points, are taken for the head. Palpation of the fundus seldom fails to detect the head as a hard globular mass on which "dipping" movements and external ballotement are readily obtained owing to the movement to and fro of the head at the occipital joint. Auscultation generally discovers the area of maximum intensity of heart sounds at the level of or slightly above the umbilicus. In the breech with extended legs they are, however, frequently heard even lower than the normal level in vertex presentations, owing to the easy entrance of this type of breach into the pelvic cavity.

Complications are not infrequent. The chief are—

1. Premature rupture of the membranes, with associated delayed first stage and possibilities of prolapse of the cord.

2. Arrest of advance at the brim, either by large size of the presenting part or some degree of pelvic contraction.

3. Impaction of the breech in the cavity or at the outlet, owing to extension of legs.

4. Displacement of the arms (extension alongside the head, or even with flexion of the forearm behind the occiput).

5. Extension of the head at the pelvic brim or in the pelvic cavity.

General Treatment. Owing to the increased foetal risks of breech presentation in a primigravida an attempt should be made to carry out prophylactic external version in the late weeks of pregnancy.

Where the existence of contracted pelvis is suspected, external version must be carried out as a routine practice, since without gauging the capacity of the pelvis with the skull there can neither be an accurate determination of the degree of the contraction nor precise knowledge of the time at which labour should be induced should this step be decided on. There is no such pressing necessity in a multipara with a normal pelvis. The best time for carrying out external version is in the last week of pregnancy, when there is every probability that the head will remain at the pelvic brim till the onset of the labour. Version practised at a more remote period from full time in no way ensures the permanent occupation of the brim by the head. On the onset of labour the patient should be confined to bed and every effort made to preserve as long as possible the bag of membranes. The possibility of cord complications should be kept in mind, and examination made to exclude this when the membranes have ruptured. Otherwise during the stage of advance of the breech the practitioner should adopt an expectant attitude; interference in the way of expediting the advance of the breech and trunk invites complications later with the arm and head.

When the buttocks have cleared the outlet the legs should be freed by traction on the feet by the finger passed into the vagina and the exposed parts carefully protected from their colder surroundings to avoid the danger of stimulation of the respiratory centre. The umbilical cord is now in sight. Its pulsation should be noted in a loop which is drawn down.

At this stage of the labour a greater or less degree of interference with circulation in the cord must of necessity take place. Approximately, if more than five minutes elapse before the head is delivered, risks of still-birth are very high.

Traction on the lower extremities is quite unnecessary at this stage if the trunk is advancing and vigorous pulsation felt in the cord. Pressure on the fundus is of great service in aiding advance and maintaining flexion of the head. In an uncomplicated case the descent of the arms flexed across the chest will be immediately preceded by the rotation of the trunk as the shoulders rotate into the anteroposterior diameter of the outlet. Delivery of the head, though frequently spontaneous, demands the sole assistance required in a normal case. Pressure from above on the upper aspect of the foetal head is often all that is called for. The routine method, however, of delivery of the head in cases of delay or difficulty at this stage is the combined form of jaw and shoulder traction. Mistakes here are most commonly due to traction in a faulty manner and direction. The index finger inserted in the mouth mainly

plays a passive part and prevents extension : strong traction with this finger is to be depre-
 cated. Frequently the trunk of the child is
 brought forwards over the mother's abdomen too
 soon, producing dangerous hyperextension of the
 head on the spine. The general direction of
 the jaw and shoulder traction is backwards and
 downwards, and must be persisted in till the peri-
 neum is bulged forward by the face. At this stage
 the trunk of the child is brought forwards parallel
 to the mother's abdomen and the face slips out
 over the perineum with the head fully flexed.
 The trunk of the child must always be held in
 such a manner that all force of traction is trans-
 mitted to bony parts, *e. g.* the pelvic or shoulder
 girdle. Still-birth or death in the first twenty-
 four hours often results from grave visceral
 trauma, the result of rough handling of the
 abdomen.

In the author's opinion the final stages of all
 breech labours should be conducted under light
 anaesthesia. The necessity of interference in
 case of complications arises quickly, and the
 manipulations are frequently of such an in-
 tensely painful nature to the mother that their
 correct employment is, in the absence of
 anaesthesia, almost impossible, and even highly
 dangerous, owing to struggling ; and, lastly, there
 is little time to begin to anaesthetize the mother
 if the fœtus is already in jeopardy. Any
 practitioner who has endeavoured to bring down
 the extended arms in the absence of anaesthesia
 must have a very unpleasant recollection of the
 task and an almost certain practical acquaint-
 ance with serious perineal lacerations.

Failing extraction of the after-coming head
 from the pelvic cavity, the use of forceps has
 been recommended ; indeed, some authors go so
 far as to demand that the forceps should always
 be ready at hand in case of difficulty at this
 stage. If the head can be delivered by forceps,
 it can just as readily be delivered by manual
 methods ; cases in which there is delay in extrac-
 tion of the head from the cavity after its
 extension has been corrected are rare. Most
 of the cases in which forceps have been employed
 would have yielded as readily to correctly applied
 manual extraction.

Treatment of Complications. Knee or footling
 presentation may call for prompt interference
 early in labour and constitutes one of the few
 exceptions to the maxim of preserving the
 membranes as long as possible unruptured.
 There is a strong probability of prolapse of the
 cord in these conditions, since the lower uterine
 segment is almost entirely unguarded. The
 cord here may frequently be felt pulsating above
 the unruptured membranes. The safest treat-
 ment is a prophylactic rupture of the membranes,
 followed by traction on one of the lower extremi-
 ties, which is brought down through the partly

dilated cervix, effectually preventing escape of
 the cord.

2. *Arrest of advance of the buttocks at the brim
 after the second stage has lasted several hours.*
 Treatment here is simple : a leg is to be brought
 down, preferably the anterior leg, to ensure
 a sacro-anterior presentation. The reader is
 referred to textbooks where the technique
 of this manipulation is fully described. The
 operation will require an anaesthetic pushed to
 a considerable degree, as indeed is the case in all
 intra-uterine manipulations. Faulty anaesthesia
 lies at the bottom of too many difficult intra-
 uterine manipulations. Following the obstetric
 maxim that no more of the hand or forearm than
 is absolutely necessary is to be introduced into
 the uterus, the lower lying popliteal space is the
 objective, if the legs be extended, and not the
 foot itself. The practised accoucheur should
 be ambidextrous as regards all intra-uterine
 manipulations—a principle not yet emphasized
 in text-books. Before carrying these out, the
 accoucheur must determine whether the foetal
 back is anterior or posterior. It may be enun-
 ciated as a general rule that with dorso-anterior
 positions the use of the left hand is indicated,
 and conversely with dorso-posterior, the right
 hand. A moment's calculation as to the natural
 direction of flexion of the fingers will show that
 naturally the fingers of the right hand will flex
 to the posterior aspect of the uterus, and thus be
 suitably placed to seize limbs directed forwards,
 as in all dorso-posterior positions. If this rule
 be observed, the bringing down of a leg becomes
 relatively an easy matter and not the clumsy
 and tedious manœuvre so often seen.

It is to be emphasized that further traction
 on the leg brought down in these circumstances
 must not be carried out at this stage of labour.

3. *Arrest of advance of the breech in the cavity ;
 or impaction at the outlet due to extended legs.*
 In the former case the difficulty, if due to a
 bulky "complete" breech, is easily ended by
 bringing down the most accessible leg by gentle
 extension at the knee. If occurring with
 extended legs the manœuvre of popliteal
 pressure cannot be effected in the pelvis.
 There is seldom difficulty (except in case of an
 advanced second stage with excessive uterine
 action) in pushing up the breech to the level of
 the brim and then securing the foot, brought
 within the reach by pressure on the hamstrings.

Where the advanced stage of the labour and
 the force of the uterine action make it impossible
 to displace the breech upwards with the inten-
 tion of securing a leg, it becomes necessary to
 deliver the incomplete breech as it presents.
 Digital traction on the groins should first be
 attempted. Owing to the difficulty of securing
 firm digital pressure in this area the manœuvre
 is frequently unsuccessful, the finger slipping

from its hold. It is preferable to apply the pressure to the posterior groin, since the posterior buttock must rotate in the antero-posterior diameter of the outlet, the anterior buttock being more or less fixed. It is practically impossible to secure an effective hold of both groins by traction with two fingers of each hand. Failing to secure advance by this method, recourse must be had to the blunt-pointed breech hook. The greatest care must be taken in its use, since it is not infrequently attended with serious foetal trauma. Under anæsthesia the instrument is introduced in a plane parallel and posterior to the transverse diameter over the posterior aspect of the posterior buttock. It is guided by the fingers of the left hand till it reaches a level above that of the groin; a right-angled turn forwards of the handle will throw the hook into a plane at right angles to the fold of the groin. The protecting fingers are then withdrawn from the posterior aspect of the buttock, and inserted along the cleft of the buttocks over the external genitals to identify the blunt point, which, when it is recognized, is gently drawn down to the knee aspect of the thigh, free of the external genitals. The hook will then lie snugly over the groin with the minimum risk of pressure. Steady traction downwards and forwards on the posterior buttock will cause its advance over the perineum, till a leg can be seized and disengaged, the difficulty then ending.

4. *Displacement of both arms (lateral extension)* is a comparatively frequent complication of the final stage of breech labour. Two factors may contribute to this, either an imperfectly dilated cervix arresting the advance of the shoulder girdle, or a contracted pelvis.

The shoulders most frequently lie obliquely in the pelvis. The disengagement of the posterior shoulder must always be effected first. Where the shoulders occupy the transverse diameter their rotation to the oblique can be effected easily by rotating the trunk of the foetus. The shoulders should be brought as closely within reach as possible, by firm traction on the hip girdle of the foetus in a direction backwards and downwards. Under the influence of rapidly deepened anæsthesia the whole hand (carefully lubricated) is introduced into the vagina along the posterior aspect of the trunk. The first two fingers and the thumb, gliding over the scapula and the point of the shoulder, pass along the whole length of humerus up to the elbow. Flexion of the fingers towards the sacrum carries the humerus across the face and down into the vagina, where it is disengaged. The anterior shoulder may now be rotated towards the sacro-iliac joint and similarly dealt with. There is seldom any difficulty in freeing the second of the two arms, but the efforts to

free the first are often prolonged and frequently appear hopeless. The accoucheur must, nevertheless, persist in his efforts, at the same time using no more force than is absolutely necessary. If to the natural difficulty of the manœuvre are added the struggles of the partially anæsthetized or conscious patient, the result will be still-birth in a large majority of cases. The attempt to free the arms should not be desisted from till the accoucheur is convinced that the child is dead, in which case other means of delivery should suggest themselves, but he is at the same time warned not to desist too soon from what can literally be described as the severest obstetric struggle he is called on to face. Foetuses have survived after an extractive period extending well over five minutes.

5. *Extension of the head* is the only common cause of arrest after the shoulders have been freed. Occurring at the level of the brim, advance is checked owing to the maximum vertico-mental diameter being thrown across the brim of the pelvis, the long axis of the head occupying the transverse diameter of the superior strait.

Pressure should be exerted from above on the upper end of the head, aided by traction on the jaw from below. Should a minor contraction at the brim be the cause of extension, the head will often be felt to slip past the promontory to the pelvic floor with a distinct jerk when this combined manipulation is carried out.

A lesser degree of extension of the head in the cavity (full extension being impossible) is best treated by the classic jaw and shoulder traction, care being taken not to flex the trunk over the pubes until the face causes the perineum to bulge.

Foetal trauma must always be carefully investigated after difficult or instrumental breech extraction and a guarded prognosis given for the first two or three days. Many of these children sustain severe basal lesions of the skull; others suffer grave visceral trauma or injuries to an extremity. It should not be the province of the nurse to point out later that an arm or leg remains immobile and is either paralysed or the seat of a fracture.

Transverse Presentation is brought about when the long axis of the foetus lies obliquely or even directly across the long axis of the uterus. The foetal part presenting early in labour is the shoulder and lateral aspect of the upper part of the thorax; sometimes early in labour the arm and hand may be recognized, though this variety of presentation is more frequently produced after labour has been in progress for some time. Multiparity, with its associated relaxation of the abdominal wall permitting deviations of the uterus from the

normal position, plays an important part in the causation; any other factor preventing the engagement of the head similarly predisposes to transverse presentation.

Diagnosis. Inspection of the abdomen will often reveal the oblique or transverse lie of the fetus. The irregular outline of the uterus, both visible and palpable, together with the recognition of the head in one or other iliac fossa, will confirm the diagnosis.

Vaginal examination before labour starts or early in the first stage may fail to detect the presenting part, which lies higher up above the level of the brim; a presenting part inaccessible by the usual digital examination per vaginam should raise suspicions as to the existence of transverse presentation.

There are certain spontaneous terminations to such labours, but the accoucheur's duty is not to await them in an expectant attitude, but promptly to correct a position which if it persists must be regarded as an insuperable obstacle to labour.

Treatment. 1. *At full time or early in the first stage (the cervix not admitting of manipulations per vaginam).* If there is reason to believe that obliquity of the uterus is the most prominent cause, this may be corrected by the *posture of the patient*. Let her be placed on the left side (as will be most frequently the case). The fundus of the uterus previously deviated to the right side will advance to or beyond the middle line to the left. This alteration of uterine obliquity frequently disengages the head from the left iliac fossa and determines a vertex presentation. The head may now be secured in the superior strait by means of a tight binder and two small hand-towels folded up and placed parallel with Poupart's ligament on either side, thus endeavouring to "splint" the foetal head. This manœuvre will fail if the hand is prolapsed alongside the head.

At the same early stage, if correction of the position of the uterus fails to alter the nature of the presenting part, attempts should be made to carry out external version and secure a breech presentation. These two forms of treatment are obviously only applicable where the membranes are unruptured.

2. *Early in the first stage (the cervix admitting two fingers, membranes unruptured).* *Bipolar version* is to be carried out, with due care not to rupture the membranes before the knee or foot can be seized and brought down through the partially dilated cervix. It is important that the accoucheur in carrying out this form of version should not neglect the full assistance that can be gained by the use of the left (or abdominal) hand. Most of the force transmitted to the fetus should be transmitted by this hand if the membranes are to be pre-

served intact. On recognizing the knee or foot in the lower uterine segment, the membranes are ruptured and the lower extremity hooked down by one or two fingers through the cervix.

3. *Later in labour (the cervix only partially dilated, and the membranes ruptured).* Here a long tedious stage of dilatation must be anticipated. The liquor amnii is slowly draining away; the uterus is steadily adapting its outlines to the foetal parts, rendering subsequent change of position difficult; the fetus may suffer from injurious pressure; the cord may prolapse, while more and more of the upper extremity is wedged down into the lower genital tract.

The ideal treatment here is the introduction of Champetier de Ribes' bag. By its use a good deal of the liquor amnii may be preserved, the dilatation stage is quickened, and on expulsion of the bag the presentation can be rectified by internal version followed by immediate extraction.

4. *Second stage (the cervix fully dilated, an arm prolapsed into the vagina).* Here the choice of manœuvre involves the most delicate sense of judgment. Two factors have to be weighed carefully, the *maternal and foetal lives*. It will thus be seen that if the foetal life is already seriously embarrassed (and still more so if the fetus is dead), the safety of the mother is the sole consideration. In these circumstances the accoucheur must carry out that method of extraction which is devoid of maternal risk.

The only two forms of treatment at this stage that have to be considered and weighed one against the other are internal version and decapitation. Points in favour of internal version will be: (a) a live fetus, (b) a comparatively recent rupture of the membranes (not more than one or two hours), (c) a comparatively long interval between uterine pains and uterine relaxation between the contractions.

Points contra-indicating internal version and conversely indicating decapitation will be: (a) a dead fetus, (b) membranes ruptured for many hours, (c) strong uterine action, with fixation of the presenting part and moulding of uterine wall to the foetal outlines, (d) the presence of a contraction ring round the fetus, demonstrable on introducing the hand above the level of the brim. Tonic contractions of the uterus offer no such difficulty of choice of manœuvre. The sole treatment here is decapitation.

Should the general and local indications favour internal version, the anæsthetic should be pushed to a degree approximating to surgical anæsthesia. Relaxation both of the abdominal and uterine muscle is favoured and there should be an entire absence of struggling. The right or left hand will be gently introduced through the fully dilated cervix, according as to whether the presentation is dorso-posterior or dorso-

anterior respectively. It is important in this manœuvre to take full advantage of the assistance rendered by the extended hand. By abdominal pressure not only is counter-pressure employed to resist the excessive upward thrust of the internal hand, but the leg or knee is frequently brought into reach from above, with the introduction of the minimum volume of the hand and forearm into the genital tract.

Several well-known difficulties may occur during internal version—

1. The opposite hand may be seized and brought down: the bony heel, unlike any surface marking of the hand, should identify the foot.

2. There is frequently a trying moment when the accoucheur, having grasped and made traction on the leg, discovers that the head has not risen to the fundus. If the leg can be secured by a piece of sterilized tape, further vaginal manipulations may be devoted to pushing up the head, or its elevation may be assisted by abdominal manipulation. No further difficulty need be anticipated when the leg is brought down.

3. A strong contraction of the uterus may supervene during the attempt to produce version. During the contraction let all manipulations be suspended and the hand remain motionless till the "pain" has passed off. If the accoucheur during a prolonged attempt experience a painful cramp in the interosseous muscles of the hand, let him relax his grip and rest his hand till the spasm passes off. He should not have to withdraw his hand when a long and futile attempt to grasp the leg convinces him he has introduced the less adaptable of the two hands.

4. Delivery of the trunk and shoulders following the version as a rule not being spontaneous, extension of the shoulders is a frequent complication. It is therefore advised that a carefully sterilized tape be tied on the arm (should it have been prolapsed and accessible at the vulva) before replacing it and carrying out the internal version. By this manœuvre much delay is saved in the delivery of a foetus frequently already jeopardized by the length of the labour and accompanying shock of internal version. A hot bath (T 105°) and means of resuscitation should be ready at hand for the infant.

Decapitation is indicated, as stated above, where internal version would involve the slightest risk of uterine trauma. Cases of uterine rupture admitted to hospitals usually owe their cause to faulty manipulations, the most common of which is internal version or attempts at this manœuvre in the presence of the contra-indications already mentioned. The immediate cause of the rupture is the attempt

to draw the long axis of the child across the short axis of the uterus, coupled with the relative tenuity of the lower uterine segment in advanced labour.

To facilitate decapitation two conditions must be present: the neck must be reasonably accessible, and the parts to be severed under a considerable degree of tension to offer resistance to the cutting edge of the sharp hook. Cases where the neck is not easily accessible or out of reach may require special treatment. Tension of the structures of the neck is easily produced by traction on the prolapsed arm, and for this purpose a loop of tape tied round the wrist may be given to an assistant, who maintains steady traction thereon.

Deep anaesthesia is essential. The sharp hook, either with a cutting or a deviated edge, is introduced in the hollow of the left fingers (as with the breech hook), with the plane of curve directed across the pelvis parallel with but anterior to the transverse diameter of the pelvis. Whether the presentation be dorso-anterior or dorso-posterior the hook is invariably introduced between the anterior part of the pelvis and the foetus. The neck is identified, the hook passed several inches above the neck and then rotated at right angles till its plane lies in the antero-posterior plane of the pelvis. It is then drawn down a few inches while the fingers of the left hand are passed round to the posterior aspect of the neck and feel for the blunt tip to determine that the hook is encircling neck and neck alone. The finger tips of the left hand are now kept in contact with the tissues of the neck, while the right hand, grasping the handle, carries out a series of backward and forward sweeps in the antero-posterior plane of the pelvis, at the same time pulling downwards steadily. As long as the finger tips of the left hand give accurate information of the progress of the cutting edge of the hook a very considerable amount of force may be used, but as the soft structures on the proximal side of the neck are approached care must be taken to prevent the sudden slipping of the hook on completing the severance of the head; in an uncomplicated decapitation these structures (skin and muscles) are often dragged down to the vulva and the final separation completed outside the body.

Steady traction on the prolapsed arm or tape fastened to it will be followed at once by the delivery of the trunk in all cases where no other pelvic or foetal complication is present.

It is to be emphasized that the direction of the cutting edge is always backwards and downwards and directed away from the bladder. In case the accoucheur has no decapitating hook with him, he can equally well be served with a long pair of stout scissors curved on the flat. For this reason the latter instrument

ould always be found in the accoucheur's bag. The author has experience of the use of both these instruments in decapitation, and while the hook is always preferable if the neck is at a high level, large stout scissors well guarded by the left hand are little (if at all) inferior to the hook.

The greatest difficulty in impacted transverse presentation is encountered in those cases where the neck is high up and inaccessible and the pinning of the lower uterine segment renders the introduction of a necessarily greater volume of the hand extremely dangerous. Here attempts to reach the neck should be abandoned and reduction of volume of the fetus proceeded with at its most accessible part. This will be the lateral aspect of the abdomen.

Stout scissors must be employed first to remove high up the prolapsed arm and shoulder. The abdomen and thorax of the fetus are then opened. The spine is divided next with the scissors, and by means of sharp hooks fixed into the lower half of the fetus its delivery is effected, the upper half being delivered later after a vertex presentation has been produced.

Delivery of the loose head seldom offers difficulty except in the presence of marked pelvic contraction or a cervix which tends to close before the head is delivered. Let a face presentation be produced by combined abdominal and vaginal manipulations. The finger inserted into the mouth draws the head down easily and delivers it as a mento-anterior presentation. If resistance to advance be experienced, insert a sharp hook into the mouth behind the hard palate and pull: this is nearly always effective; but if, on the other hand, a major degree of pelvic contraction exist, perforation of the vault and extraction by craniotomy, cranioclast or cephalotripsy is demanded. After internal version or decapitation for transverse presentation, the hand should always be introduced into the genital tract and a careful search made to eliminate uterine or vaginal lacerations. If discovered they call for prompt treatment.

Twins.—From the practical point of view the interest of multiple pregnancy is limited to diagnosis, routine treatment and treatment of complications.

Diagnosis. This still remains more frequently conjectural than certain. At any rate this is so in lying-in hospitals, where not infrequently twins escape certain recognition till the first child is born. More frequently the diagnosis is conjectural and lacks certain proof. Suspensions of multiple pregnancy should be raised by (1) an unusual girth of abdomen at the umbilicus (*e.g.* over forty inches); (2) with a vertex engaged at the brim of the pelvis, the recognition of a hard rounded globular body

at the fundus in which dipping movements and external ballottement can be carried out. (3) Maternal family history of twins in the presence of the suggestive signs noted above is additional but not certain confirmation. (4) The only absolute diagnosis is based on hearing two foetal hearts beating at different rates, heard with maximum intensity in widely separated areas of the abdominal wall. The accoucheur who suspects twins but cannot prove their existence is placed in a trying situation. He is reluctant to admit his suspicions to the prospective mother, and on the other hand fears a loss of his reputation in failing to diagnose their existence. No great harm can be done in mentioning the possibility of multiple pregnancy to the father or other close relative.

Routine treatment of twin labour embraces two important points:—(1) Ascertaining the lie of the second child when the first is born; (2) prophylaxis against the tendency to post-partum hæmorrhage with which such labours are not infrequently associated.

The presentations most frequently encountered are vertices, though there is a distinct tendency for the second child to depart from the flexed attitude and longitudinal lie. Hydramnios of the sac of the larger twin in the uniovular variety frequently gives rise to inertia, malpresentation, premature rupture of membranes and a long tedious first stage. On the birth of the first child an internal examination should be made to determine the prominence of the second bag of membranes and the lie of the second foetus. Should this be transverse a bipolar version should be carried out and a leg brought down. In all other cases where the vertex or uncomplicated breech is detected, the patient should be given nourishment and allowed to rest without further disturbance for a half to one hour, since not infrequently there is during this time an entire cessation of uterine contractions. If after half to one hour the placenta of the first child is not expelled and pains begin to return, the membranes of the second child should be ruptured and the mother allowed to deliver herself spontaneously. Forceps delivery in these cases (except where alarming hæmorrhage may demand the rapid evacuation of the uterus) is to be deprecated.

The only second stage complication of note to be recorded is *interlocking*. This event must be of excessive rarity. Records of Queen Charlotte's Hospital, with an average of twenty twin births per annum, show no mention of it in the last ten years.

It appears to be most predisposed to by a position in utero, where the lower lying fetus advances as a breech while the second presents

as a vertex. Here the two chins may interlock and bring advance of the first child to a standstill. If the heads cannot rapidly be disengaged and freed, the first child will almost inevitably perish. Its neck should be severed as high as possible and the head pushed up; the head of the second child should then be grasped with forceps and delivered, leaving the loose after-coming head of the first child to be dealt with as in decapitation for *Impacted Transverse*.

Rarely the accoucheur may have to face a situation wherein the birth of the first child is followed shortly after by its placenta, the uterine activity now coming to an end. Here there is reason to believe that the foetuses are of different intra-uterine ages, a possible difference of several weeks to three months existing between them. He will get very little assistance as to the final conduct of such a labour in these circumstances on consulting authorities in text-books. The author has always felt that in a case outside a hospital he would at once rupture the second bag of membranes and precipitate the expulsion of the second foetus.

Hydrocephalus is met with in labour either as a vertex but more commonly as a breech presentation. As the former it is much more readily recognized and treated, but as a breech the diagnosis is frequently not made till after prolonged efforts at extraction have failed and further examination throws light on the nature of the obstruction.

Diagnosis (Vertex Presentation). *Abdominal palpation* reveals a large tense globular mass unengaged above the pelvic brim and reaching from pubes to the umbilicus in a well-marked case.

Vaginal examination discovers high up a tense cystic rounded mass, scattered over the surface of which the flat bones of the vault can be felt separated by wide intervals.

Treatment. As soon as the second stage is reached the cystic swelling is perforated or cut into with scissors and an amount of clear watery fluid, up to several pints, escapes. Frequently, if the uterus is acting fairly strongly, the head will descend into the pelvis and delivery be spontaneous. The collapsed head may, however, be thrown into many folds and fail to descend. In this circumstance, if there be no contra-indication, internal version followed by extraction is the simplest means of delivery. Should, however, the uterine condition render internal version dangerous, extraction by means of the craniotomy forceps will be necessary.

Hydrocephalus. Presenting by the Breech. In these circumstances diagnosis of the cause of arrest of the head is frequently not made till after vigorous traction on the trunk has failed

to deliver it. It should be a rule without exception, where the head alone is detained in or above the pelvic cavity, that palpation of the hypogastrium should be carried out to determine the size of the head before effecting strong traction on the trunk. There are two methods of reducing the volume of the after-coming head. The first, devoid of risk and involving no internal manipulations, aims at tapping the dilated cerebral vesicles via the spinal column and foramen magnum. The spine is exposed high up in the vicinity of the second to the fourth cervical spines, the laminae cut through and a gum-elastic catheter with stylet pushed along the canal till the foramen magnum is traversed and the ventricles tapped, the head being slowly delivered as the vault collapses. The second involves the use of the perforator directed through one of the lateral inferior angles of the parietal bone, with the attendant risks of vaginal infection and trauma during attempts at perforation. For this reason the former method is to be recommended.

By **Anencephaly** is understood a condition in which there is a primary failure of development of the neopallium or cortex of the brain, with a corresponding absence of the squamous bones of the vault, the medulla lying exposed on the base of the skull. The condition is frequently associated with excessive development of the foetus and with hydramnios. It is not incompatible with live birth, the child frequently surviving for a short time unless means are taken to destroy it at birth.

The *diagnosis* when presenting by the base of the skull is seldom difficult. The irregular bony protuberances of the sella turcica unprotected by soft parts make its recognition easy. More frequently the face presents, in which case the fingers passed beyond and above the characteristic bulging eyes detect the absence of the vault and the presence of bone uncovered by soft parts. The mechanism of the face presentation proceeds normally. If the shoulders be arrested owing to excessive foetal development, recourse should be had at once to division of the clavicles with scissors (cleidotomy), but in the majority of cases labour is spontaneous and devoid of complications.

Abnormal Size of the Foetus.—Excessive development of the foetus usually owes its cause to one of several factors—

1. *Post-maturity* of the foetus, that is undue prolongation of a pregnancy, in some cases reaching the forty-fourth week, calculated from the last menstrual date.

2. *Advanced age of the mother.*

3. *Multiparity*, often associated with a progressive increase in the size of successive infants.

4. *One or both parents of unusual size.* Of these *post-maturity* and *excessive parental development* are the more commonly met with. Records of cases of *post-maturity* are accumulating in recent years, and extraordinary cases of difficulty in labour arising therefrom can be found in the literature. The subject is of exceptional interest as providing the accoucheur with one of the very few serious mechanical difficulties which can in no way be foreshadowed before all time. Not infrequently the child may die in utero before labour begins, and superadded infection of uterine contents complicates a case already offering serious mechanical difficulties in extraction.

Owing to the difficulty of making a certain diagnosis in these cases treatment must always be unsatisfactory, but there is one rule, the observance of which should lessen the possibilities of marked *post-maturity*. On carrying out the routine examination of the abdomen at the thirtieth week the size of the uterus (as calculated from height of fundus above the pubes) should be carefully estimated and compared with the normal standard for the corresponding period of amenorrhœa. If the standards coincide the patient's dates are probably correct, and from them may be calculated the date of onset of labour. If in such a case a week elapses uneventfully after the approximate date of labour, an examination of the abdomen should be demanded. Excessive size of the abdomen and a large, well-ossified head unengaged at the normal pelvic brim should suggest the possibility of this complication and call for induction of labour forthwith, especially if the previous obstetric history records the birth of large infants. Such a case, if met with in labour uncomplicated by previous attempts at extraction and with the foetus alive, calls for Cæsarean section; otherwise, if the foetus is dead, embryotomy should be carried out early in the second stage. Some of the serious cases recorded have been associated with dead fetuses and a degree of abnormal uterine action almost defying extraction from below, even aided by embryotomy. Risks of encountering difficulty due to *post-maturity* will always be run if practitioners do not as a routine practice compare at the seventh month the duration of pregnancy (as calculated by menstrual dates) with its duration as calculated from height of fundus above the pubes. Not infrequently the practitioner accepts the patient's dates without verification and finds that labour does not supervene till a month later. This well-recognized form of domestic embarrassment is accepted at once as evidence that the patient has given faulty information, since a normal full-time labour sets in four weeks later, but a small proportion of these cases will be due to

true *post-maturity*; hence the importance, as insisted above, of verification of the duration of pregnancy at or about the thirtieth week, and prompt examination within seven days after the estimated date has been passed. This subject has been perhaps touched on with greater fullness than its frequency warrants, but the writer is familiar with several cases where most disastrous results in labour have been met with by practitioners of exceptional care and experience.

Impacted Shoulders may be met with in all cases where the foetus is above the average size.

The difficulty is encountered after complete birth of the head and the movement of external rotation has taken place.

The cause of failure of the trunk to advance is the hitching of the anterior shoulder at the upper margin of the symphysis pubis.

The complication may be met with in three conditions—

1. A large child, alive but not of excessive development (seven to ten pounds).

2. Excessive development of the child (over ten pounds) and alive.

3. Pathological increase in size of the foetus (fœtal anasarca); foetus dead.

In group 1 is met one of the common terminal difficulties of delivery with vertex presentation. Treatment, though simple, frequently is mismanaged. The two serious mistakes made at this stage are: (a) faulty direction of traction, (b) rough treatment of the foetus, predisposing to serious cervical injuries.

The correct procedure to free the shoulders consists in first artificially completing the external rotation. Next the head is grasped by its two lateral aspects in the palms of the hands, the right palm covering the anterior parietal, the left palm the posterior. Both hands are now carried towards the perineum, gently lateriflexing the neck, whose anterior aspect will be under slight tension. This movement is sufficient to disengage and draw backwards and downwards the anterior shoulder, which will appear at the subpubic angle. The neck is now gently lateriflected in the reverse direction—i.e. towards the symphysis pubis, and the trunk advances as the posterior shoulder escapes over the perineum. This movement of lateriflexion must be steady and gradual, since excessive tension on the neck has been associated with grave trauma of cervical nerve trunks and resulting palsy of the upper extremity.

In group 2, where disengagement of the anterior shoulder fails, recourse must be had to digital traction on the axilla, preferably the posterior, assisted by pressure on the fundus from above. Traction on the posterior axilla

with the blunt hook (introduced as in impacted breech) is to be deprecated till digital methods have failed, but should be attempted with care, if the child is alive. Such children will, however, very speedily perish if delivery of the trunk is delayed for a few minutes, and the accoucheur is warned not to persist in traction on the head and neck, when there is no further evidence of foetal life, without a preliminary reduction of the measurement of the bisacromial diameter.

Group 3, where the foetus attains an excessive and pathological increase in size, arrest of the shoulder girdle at the brim is relatively common. The clavicles must be severed in their middle by a large pair of blunt-pointed curved scissors whose tip is guarded by the fingers of the left hand. On severing the clavicles the acromion processes become capable of much closer approximation to the middle line of the foetus. Large shoulder girth is not uncommonly associated with other pathological conditions, *e. g.* foetal ascites and anasarca. Here the scissors must be plunged into the front of the thorax of the child and pushed in until the diaphragm is punctured, enabling the trunk of the child to be delivered after several pints of fluid have escaped.

Prolapse of a Limb with the head.—This variety of compound presentation must be regarded in its early stage as little different from transverse presentation, to which it will inevitably give rise if neglected.

If met with in labour early in the first stage, displacing the head after the membranes have ruptured, attempts may be made to displace the arm upwards and press the head into the brim by applying a tight binder. This manœuvre generally fails, however. If seen later in labour, with full dilatation of the cervix, the arm should be pushed up as high as possible above the greatest diameter of the head and forceps applied at once for extraction if other conditions do not contra-indicate a rapid delivery.

If the attempt to seize the head with the forceps fail owing to the hand still encroaching over the presenting head, internal version, if not contra-indicated, should be carried out and be followed by extraction. This compound presentation should always excite suspicions of the existence of pelvic contraction, though the two are not necessarily associated.

Prolapse of the Cord is associated chiefly with two factors, malpresentation and some degree of pelvic contraction, though other complications, such as hydramnios or unusual length of the cord, may alone predispose to it.

Treatment will vary as to whether the child is alive or not, as evidenced by the pulsations of the cord felt on examination. In the latter case the condition has ceased to be urgent and

the labour should be allowed to take its due course, though it is advisable in all cases to warn the nearest relative as to the foetal condition.

If the child be alive prognosis will depend directly on the degree of dilatation of the cervix, and on the nature of the presenting part (vertex, breech or transverse).

If the condition be detected early in the second stage with a vertex presentation (and almost invariably associated with a premature rupture of membranes), an attempt must be made to carry the loop of the presenting cord as high up as possible with the finger tips above the presenting part. Raising the hips of the patient with pillows may assist both in the reduction of the cord and its maintenance above the presenting part. A tight binder may now be used to force the vertex well down into the lower uterine segment. Unfortunately, the associated conditions of either an occipito-posterior presentation or a flattened pelvis negative the success of this simple treatment. It must, however, be attempted in the absence of other means of treatment. Efforts to maintain the cord elevated during a pain, hoping the presenting part will descend below its level and thus end the difficulty, are similarly almost always devoid of success.

With a vertex presentation and an imperfectly dilated cervix the use of Champetier de Ribes' bag is ideal treatment. The cord should be digitally pushed up as high as possible, with the patient in the raised pelvis position, and the bag inserted. There need be no great fear that a loop of cord will be nipped between the bag and the lower uterine segment. As soon as the bag is distended, if the foetal heart be heard vigorously pulsating, there is no further direct foetal risk, since as soon as the bag be expelled the child can be extracted with forceps or delivered following internal version.

If the cord prolapse with a breech presentation and the cervix be imperfectly dilated, the cord is to be pushed up and a leg brought down to block up the lower uterine segment.

Most favourable of all cases to treat will be those where with a fully dilated cervix and a vertex presentation a loop of cord is felt pulsating alongside of, or in advance of, the presenting part. Here a rapid delivery is essential, and preferably with forceps. There need be no necessity to await an actual contraction of the uterus, provided the uterus be not in a state of "temporary passivity" or secondary inertia. One or two vigorous pulls should be given and not too much regard paid to the perineum if the foetal circulation is embarrassed, since perineal repair is possible, but the restoration of a dead foetus beyond the powers of the accoucheur. Forceps delivery in these circumstances is

always preferable to internal version and extraction, which invite complications with the after-coming arms and head, further jeopardizing a fetus with an already embarrassed circulation.

A more insidious cord complication still exists—**Expression of the Cord.** Here a loop of cord advances into the pelvis with the vertex, but does not project in front of its greatest diameter. It thus entirely escapes detection on digital examination, though severely pressed on. The possible existence of this complication should always be suggested by an unexplained flagging of the foetal heart-rate, calling for immediate delivery if all local conditions are favourable for the application of forceps. For this reason it should be laid down that auscultation of the foetal heart should always be carried out as a routine on several occasions in the second stage. R. D. M.

ABNORMALITIES CONNECTED WITH THE UTERUS

The abnormalities in labour, due directly to the uterus, may be grouped under five headings—

- I. Abnormalities of the uterine contractions.
- II. Abnormalities in the dilatation of the cervix.
- III. Misdirection of the uterine axis.
- IV. Malformation of the uterus.
- V. Tumours of the uterus.

I.—Abnormalities of the Uterine Contractions

- 1. The contractions may be abnormally powerful.
- 2. The contractions may be too weak.
- 3. The contraction may be continual or *tonic*.

1. Abnormally Powerful Contractions. Precipitate Labour.—By a rapid succession of contractions labour is completed with extraordinary speed, the cervix being dilated, the child born and the placenta expelled in the space of a few minutes. This is true precipitate labour and is accompanied by serious risks and disadvantages. The patient may not be able to get assistance from doctor or nurse; labour may occur in inconvenient situations; the child may be expelled on to the floor and may die of hæmorrhage from rupture of the cord; the patient may suffer from shock; there are usually extensive lacerations of the cervix, vagina and perineum, and there is a risk of acute inversion of the uterus and post-partum hæmorrhage.

There are also other cases where labour, beginning normally, terminates with unexpected rapidity. This is often seen in women who have borne many children; progress has been slow

until the moment of rupture of the membranes; then there is one strong pain and the child is in the bed in a few seconds. In other cases the os uteri having attained a certain degree of dilatation in a regular manner may, after a period of hesitation, attain full dilatation within a few minutes and the child be expelled with corresponding speed. Such surprises, though most often met with in multiparæ, may also occur in primiparæ.

Treatment. It is a safe rule never to leave the house after the os uteri has attained the size of a five-shilling piece in primiparæ and a florin in multiparæ. When uterine contractions become unduly powerful and frequent, and the progress of labour is too rapid, the only thing to do is to give chloroform, which usually diminishes the force and frequency of the pains.

2. Abnormally Weak Contractions.—Of this there are two varieties, between which it is of the utmost importance to distinguish.

(a) **Primary Inertia.**—The uterine contractions are weak and ineffectual from the commencement. Consequently labour is prolonged, although the resistances are normal. The uterus, however, *loses in no degree its power to retract*.

(b) **Uterine Exhaustion or Atony.**—This is sometimes called *secondary inertia*. *Uterine exhaustion* and *primary inertia* are two utterly different conditions. In *uterine exhaustion* the uterus has become exhausted from preceding efforts; not only do contractions cease, but *the uterus totally loses its power to retract*.

Primary Inertia.—Primary weakness of the uterine contractions is commoner in primiparæ, occurs often in nervous and sensitive women, in cases of hydramnios and twins, where there is over-distension, and is occasionally encountered in women who have borne many children at short intervals.

From the commencement of labour the uterine contractions are weak and occur at irregular and long intervals. Consequently the cervix dilates slowly and the expulsion of the child is delayed. In other cases, after a prolonged first stage, the contractions increase in strength and frequency as soon as the membranes rupture and the head begins to press upon the pelvic floor. Such cases are frequently encountered in primiparæ, especially in occipito-posterior presentations.

The effects of prolonged labour may be seen either in the mother or in the child. Generally speaking, there are no ill-effects so long as the membranes remain intact, if the contractions are not painful, and the patient can get occasional snatches of sleep. If the liquor amnii drains away prematurely the contractions become painful and cramp-like, although no more effectual; the patient then soon becomes

worn out, as indicated by a rise in the pulse-rate, and the foetus may suffer from pressure.

Treatment. In the first stage of labour patience is essential; reassure the patient that all is well and that a little delay at this stage does no harm. The rectum must be cleared and the bladder emptied. The patient must walk, stand or sit as much as possible. When pains begin to die down, procure sleep by giving syrup of chloral hydrate, two drachms, or by injecting one-third of a grain of morphia; after sleep, progress may be more rapid. A prolonged hot bath is usually beneficial, and better still are hot vaginal douches.

Drugs are of no service. Ergot is positively dangerous, for it may cause tonic contraction. Quinine is harmless, but often without much effect.

If the patient begins to show signs of exhaustion more strenuous measures must be adopted. First anaesthetize the patient, and stretch the os with the fingers: this often has a wonderfully stimulative effect. If this is without result the os must be dilated to full size by mechanical means and the patient delivered. If the os is small, *i. e.* the size of a crown-piece or less, insert a Champetier de Ribes' bag and apply traction by attaching to it a weight of not more than four pounds, which is hung over the footrail of the bed. If the os exceeds the size of a crown-piece, complete dilatation with the hand and deliver by forceps.

In the second stage, do not allow labour to drag on indefinitely. Assuming that the pelvis and presentation are normal, it is a useful rule never to allow the second stage to last more than two hours. If at the end of two hours there is no prospect of immediate termination of labour, deliver by forceps in a head presentation, or by traction in a breech. By this means (i) the mother is saved needless pain, (ii) uterine exhaustion and post-partum hæmorrhage are prevented, and (iii) there is less chance of the foetus suffering from pressure.

It is most important to auscultate the foetal heart at regular intervals during prolonged labour, so as to discover signs of foetal distress before it is too late to save the life of the child.

Uterine Exhaustion.—After uterine contractions have been strong and regular they gradually diminish in force and frequency, and finally cease. Although, as a rule, the uterus becomes exhausted only after long and vigorous action to overcome obstruction, exhaustion occasionally occurs in the first or second stage of a normal labour. In such cases we must presume that the muscles of the uterus are inherently weak or its nerves or nerve centres are at fault.

The *diagnosis* is easy. There is complete absence of uterine contractions and the uterus feels uniformly soft.

The *effect* is that the labour comes to a standstill. Neither mother nor child suffer in the least. After a varying interval of time the uterus recovers and labour recommences.

Treatment. Let the patient rest; procure sleep by administering a suitable sedative, such as chloral hydrate, chloralamide or morphia; wait until uterine action recommences, as it is bound to do. *On no account deliver the patient so long as contractions are absent*, or the worst form of post-partum hæmorrhage is bound to occur.

3. Tonic Contraction of the Uterus.—There are two varieties, *complete* and *partial*. In *complete tonic contraction* the uterus does not relax between the pains. In the *partial* variety there is a localised ring of tonic contraction (contraction-ring) forming a stricture in the neighbourhood of the internal os uteri.

Causation. Tonic contraction may follow (i) prolonged unsuccessful efforts to overcome obstruction; (ii) premature rupture of the membranes and rigid cervix; (iii) administration of ergot; (iv) the worst cases follow repeated unsuccessful attempts at delivery by forceps or version in obstructed labour.

(a) **General Tonic Contraction.**—*Diagnosis.* This presents no difficulty. Its onset is gradual; the intervals between the contractions become progressively shorter, and the contractions themselves longer and, finally, continuous. The patient is in constant pain and rapidly becomes exhausted. The uterus feels hard, tense and tender. Foetal parts cannot be felt nor the foetal heart heard. The presenting part is fixed and covered with a large caput succedaneum.

Effects. Labour comes to a standstill; for so long as the uterus ceases alternately to contract and relax there can be no advance of the foetus, but merely a rise in intra-uterine pressure. The liquor amnii drains away completely and the foetus perishes, because (i) the placenta is compressed against the foetus and the utero-placental circulation impeded; (ii) the foetus is subjected to dangerous pressure. The mother becomes exhausted. There is danger of rupture of the uterus from excessive retraction of the upper segment and over-distension of the lower.

Finally, tonic contraction occasionally gives rise to a peculiar form of dystocia which I have elsewhere termed "active retention of the foetus by the uterus." In this condition the uterus grips the foetus as in a vice. An extremely fine example of this has been published by Russel Andrews and Maxwell, in which tonic contraction of the uterus gripped the foetus so tightly that powerful traction, subsequent to removal of the head, cleidotomy, and removal of the thoracic and abdominal viscera, failed to budge the foetus, and in which hysterectomy

had eventually to be performed. In two remarkable cases described by myself of tonic contraction associated with transverse presentation, Cæsarean section was performed after ineffectual attempts at delivery by the natural passages; even after the uterus had been opened, so tightly was the foetus gripped by the uterus, that evisceration had to be performed through the uterine incision before the foetus could be removed.

Treatment. Inject one-third of a grain of morphia hypodermically and anæsthetize the patient with chloroform. By these means the uterus may become relaxed and delivery be effected. It is important not to attempt delivery until complete relaxation has occurred, otherwise the additional stimulation will only increase the intensity of the contraction. Deliver the patient by the safest method; if forceps fail in a head presentation, do not hesitate to perform craniotomy, for the child may be already considered dead. Carry out all manipulations with the greatest caution, otherwise the uterus may be ruptured.

If in spite of prolonged chloroform anæsthesia the contraction does not pass off, delivery must be effected in spite of it, and the means of delivery must suit the circumstances of the case. It may be necessary to perform Cæsarean section or hysterectomy, as in the cases already quoted.

(b) **Partial Tonic Contraction.**—The importance of contraction rings in the neighbourhood of the internal os uteri as a cause of obstruction to labour has only recently been realized. Such rings form as the result of tonic contraction of the circular muscular fibres, which are well developed in this part of the uterus. Premature rupture of the membranes and intra-uterine manipulations seem to be important factors in their causation. A *contraction ring* is very different in origin and nature from the *retraction ring*, which may also form in the same neighbourhood in cases of obstructed labour with excessive retraction of the upper segment of the uterus. The retraction ring is more the result than the cause of obstructed labour. However, for practical purposes, the end-result is the same; both varieties of ring may produce a stricture in the neighbourhood of the internal os uteri and impede the progress of the child.

In some cases the ring forms in front of the presenting part, in others behind it; in the latter case the ring interlocks with a groove on the surface of the child—between the head and the trunk, for example.

Diagnosis. In spite of good contractions, labour is delayed; there is no apparent cause of obstruction, such as contracted pelvis or mal-presentation. On vaginal examination the os uteri will be found dilated, but on passing

the finger upwards a well-defined ring will be met, lying immediately below the presenting point; during a uterine contraction the ring contracts and effectually impedes the advance of the child.

If the ring is situated behind the presenting part the diagnosis is not so apparent; but if the hand be passed into the uterus above the presenting part, the ring will be discovered.

Treatment. When the ring has formed in front of the presenting part, give the patient half a grain of morphia hypodermically, anæsthetize her deeply with chloroform, dilate the ring manually, and deliver with forceps. If it is found impossible to dilate the ring, and the child is alive, Cæsarean section must be performed. If the child is dead, perform craniotomy, and deliver by the method of continuous traction applied to a cranioclast screwed firmly home by means of a weight attached to the handle.

When the ring has formed behind the presenting part, first attempt delivery by forceps; if these fail, try continuous weight traction; if all efforts to deliver by the natural passages are unsuccessful, Cæsarean section must be performed. In cases where grave uterine sepsis is feared, it is best to remove the uterus.

Rupture of the Uterus.—Rupture of the uterus during labour may be *spontaneous* or *traumatic*. Spontaneous rupture is accomplished by the unaided force of the uterine contractions; traumatic rupture by intra-uterine manipulations performed under unfavourable conditions.

Etiological Factors. In the vast majority of cases rupture of the uterus is a sequel of over-distension of the lower segment consequent on obstructed labour; there are, however, cases, though few, which depend on other conditions. For this reason the etiological factors may be at once divided into—

1. Obstructed labour.
2. Other factors.

1. **Obstructed Labour: Mechanism of Rupture.**—During labour the uterus becomes differentiated into two portions, an upper segment which contracts and retracts to expel the foetus, and a lower segment which is stretched and dilated to allow it to pass. As the upper segment retracts it becomes progressively thicker, and as the lower segment stretches it becomes progressively thinner. At the junction between the two segments the lower margin of the upper forms a muscular ridge on the inner wall of the uterus; this is the retraction ring (Ring of Bandl). In physiological labours retraction of the upper segment and stretching of the lower can seldom be appreciated clinically, though occasionally the retraction ring can be felt above the symphysis as a transverse

ridge. Excessive retraction of the upper and thinning of the lower segment are (with the rarest exceptions) only consequent on the exaggerated uterine action which accompanies obstructed labour, when the differentiation of the uterus into upper and lower segments becomes very evident. The upper segment forms a relatively small proportion of the uterus and covers the upper part of the fœtus like a thick cap. The lower segment forms a relatively large proportion of the uterus and is over-distended by having to accommodate the major portion of the fœtus; the thinning is greatest on the side which is most distended, as, for example, on the side which accommodates the head in transverse presentation.

The retraction ring rises to a higher level and forms a prominent ridge running transversely or obliquely around the uterus.

With further retraction of the upper segment over-distension of the lower segment progresses until ultimately its thinned walls can no longer withstand the pressure of the fœtus, and it ruptures spontaneously during a uterine contraction.

Traumatic rupture is easily caused by intra-uterine manipulations when the lower uterine segment has become over-distended. The accident has most commonly followed internal version for impacted shoulder presentation, though sometimes the mere introduction of the hand into the uterus may cause the already overstrained lower segment to give way.

2. Factors other than Obstructed Labour—

(a) If the uterine wall be weakened from any cause, the rise in intra-uterine pressure during labour may be sufficient to bring about rupture. Weakening may be caused by: (i) the cicatrix of a former Cæsarean section; (ii) the cicatrix left by a former rupture; (iii) degeneration of the uterine muscle or interstitial fibrosis; (iv) new growths; fibromyoma, carcinoma or sarcoma.

(b) *Misdirection of the Uterine Axis.* In cases of pendulous abdomen, the uterus is in a position of excessive antelexion and the presenting part is continuously driven by the uterine contractions against the posterior wall of the lower segment, which may ultimately yield.

(c) *After Operations for Fixation of the Uterus.* A few cases of rupture have occurred after fixation operations for prolapse and retroflexion.

Varieties. Rupture of the uterus may be complete or incomplete. In the former the muscular and peritoneal coats are both torn and the opening communicates directly with the peritoneal cavity. The fœtus may escape and lie amongst the intestines, or it may remain, wholly or in part, within the uterus. Coils of intestine often prolapse through the rent. In

incomplete tears the peritoneal coat remains intact. This variety is most common in the lateral wall of the uterus and opens into the cellular tissue between the layers of the broad ligament.

The extent of the tear varies in different cases. Spontaneous tears are usually more extensive than traumatic. In rupture associated with obstructed labour the tear always commences in the lower segment and is oblique and longitudinal in direction, thence it may spread upwards into the uterus and downwards into the cervix and vagina; sometimes the tear spreads widely into extra-uterine structures, and the broad ligament may be torn or the bladder opened.

The amount of hæmorrhage varies considerably; it comes partly from the placental site, before the uterus retracts, and partly from the torn edges of the uterus. Extra-uterine vessels, such as the vaginal, vesical or ovarian, may be torn across and bleed freely.

With incomplete rupture a subperitoneal hæmatoma may form, and in tears of the lateral wall, blood may accumulate between the layers of the broad ligament. Such collections, if large, may rupture secondarily into the peritoneal cavity.

Clinical Aspects. These may be divided into—

1. The events preceding rupture.
2. The signs and symptoms of rupture.

1. *The Events preceding Rupture.* Rupture may occur without any warning, as from the yielding of a cicatrix or from weakness of the uterine wall. In the majority of cases rupture is preceded by a definite series of events. These consist in the signs of obstructed labour and of over-distension of the lower segment.

Signs of Over-Distension of the Lower Segment. These indicate (i) that spontaneous rupture is imminent if delivery be further delayed; (ii) that operative manipulations must be carried out with the utmost precaution if traumatic rupture is to be avoided. They are—

(a) The general condition of the patient. She is restless and exhausted; the uterine contractions cause intense pain and, if there is tonic uterine contraction, the pain is continuous; the pulse is rapid and weak and the temperature is raised.

(b) The nature of the uterine contractions. The contractions follow one another at short intervals and are powerful, prolonged and exceedingly painful, or there may be tonic uterine contraction.

(c) The condition of the uterus. The upper part, corresponding to the retracted upper segment, is hard and prominent; it does not become completely relaxed between the pains

and does not allow the outlines of the foetus to be easily felt; the lower segment feels soft, elastic and almost fluctuating between the pains, and allows the foetus to be felt with extraordinary distinctness; it is tender on pressure. During a contraction it becomes tense, but never so hard as the upper segment. The retraction ring can be felt, and is usually visible, as a ridge or groove, running obliquely or transversely across the uterus about the level of the umbilicus; the higher it lies, the greater is the distension of the lower segment. The round ligaments can be felt as tense, thick bands running obliquely from the sides of the uterus, downwards and outwards towards Poupert's ligaments; owing to the usual rotation of the uterus to the right, the left round ligament is more prominent than the right.

(d) The presenting part of the foetus. On vaginal examination the presenting part is immovably fixed over the brim of the pelvis; if it fits the brim, there is a large caput succedaneum.

2. *The Signs and Symptoms of Rupture.* These vary considerably, according to the extent and situation of the tear, the escape or otherwise of the foetus into the abdominal cavity and the degree of hæmorrhage.

At the moment of complete spontaneous rupture the patient experiences sudden and severe pain in the lower part of the abdomen, and passes into a condition of profound shock. The uterine contractions naturally cease forthwith. Usually there is more or less external bleeding from the vagina. The symptoms immediately secondary to the rupture depend entirely upon whether or not there is much hæmorrhage. When this is severe the patient quickly becomes collapsed, with all the symptoms associated with internal hæmorrhage. If the abdomen be examined the first thing that strikes one is the extraordinary ease with which the foetus is felt, lying as it does directly beneath the abdominal wall. The uterus retracts and may be felt as a hard tumour with the fundus lying at the level of the umbilicus. If there be much internal hæmorrhage the abdomen becomes distended and there are signs of free fluid. The vaginal examination yields unmistakable evidence. The presenting part of the foetus, which formerly had been fixed above the pelvic brim, having retired in the abdominal cavity, can no longer be felt. If the examining hand be passed into the uterus, the tear can be felt and the hand can be passed through it amongst the intestines. If the rupture has occurred through the lateral wall of the uterus the foetus may come to lie wholly or in part between the layers of the broad ligament.

If the foetus remains in the uterus the physical signs differ somewhat from the above, but

whether the rupture be complete or incomplete, the presenting part, instead of remaining firmly fixed, recedes and becomes freely movable. This is perhaps the most important sign. Confirmation may always be obtained by passing the hand into the uterus and feeling the rent. The time at which collapse appears varies considerably. If the hæmorrhage is gradual it may be delayed for a considerable time.

When the rupture occurs as the result of operative manipulation the signs and symptoms of rupture are not always manifest, especially if the patient be under an anæsthetic. Collapse may be the only symptom which draws attention to the accident, and if collapse follows a difficult instrumental extraction in a case of obstructed labour, rupture should be suspected. Many cases of slight rupture escape notice altogether and unsuspected ruptures have often been discovered only on passing the hand into the uterus after delivery.

Prognosis. In complete spontaneous rupture, where the tear is extensive, and especially if the foetus has escaped into the abdominal cavity, the maternal mortality is from fifty to sixty per cent. Of the total mortality, sixty per cent. is due to sepsis, for in the class of case in which rupture occurs the interior of the uterus is almost certainly infected, from prolonged labour and repeated examinations and intra-uterine manipulations. The usual form of sepsis arising in these cases is general peritonitis. Dangerous hæmorrhage occurs in about forty per cent. of cases. Death from hæmorrhage seldom occurs immediately, but after a few hours from continuous oozing or recurrent hæmorrhage. There is no doubt that the initial shock, by lowering the blood pressure, plays an important part in checking hæmorrhage; recurrent hæmorrhage is apt to occur when shock is recovered from. If the course of labour has been aseptic and hæmorrhage has ceased the prognosis becomes fairly good. In traumatic rupture, and in incomplete rupture where the tear is a small one, the prognosis is good.

Treatment. Prophylactic. Though rupture of the uterus is usually the consequence of bad midwifery, yet it must be admitted that there are cases in which the uterus ruptures with extraordinary ease, and that excessive excitability of the uterus or weakening of its wall, or both, may bring this to pass comparatively early in labour. Such cases are, however, rarely encountered and rupture may usually be avoided by the proper management of labour. All pregnant women should be systematically examined for the presence of pelvic contraction or pelvic tumours. The importance of a thorough abdominal and vaginal examination early in labour cannot be too strongly empha-

sized, for at this stage not only is examination easier and better tolerated by the patient, but, if an abnormality is detected, difficulties can be anticipated and a definite plan of campaign decided on. Failure of the presenting part to enter the pelvis after one hour of expulsive pains should always arouse suspicion. One of the most important rules in midwifery is to *anæsthetize the patient and to examine her thoroughly as soon as it is evident that labour is not progressing properly*. If this were more often done there would be fewer disasters. Signs of over-distension of the lower segment should be watched for, and when they appear labour should be terminated. Operative manipulations in such cases should be performed with the greatest care and under full anæsthesia. Version should only be attempted in the intervals between the uterine contractions and should be performed slowly, gently and with the uterus supported by the outside hand.

Treatment of the Rupture. This differs according to the necessities of the case. Every case of rupture of the uterus will be treated by one of four methods—

(a) Nothing is done, and recovery left to nature.

(b) The tear will be lightly packed with gauze and drained by the vaginal route.

(c) The abdomen will be opened and the tear sutured.

(d) The abdomen will be opened and the uterus removed.

The chief factors which determine the proper method of treatment are (i) the position of the foetus, (ii) the degree of hæmorrhage and (iii) the extent of the tear. It is not easy to lay down definite rules, but the most convenient way to attempt this is to divide all cases into two classes.

1. Those that require abdominal section.
2. Those that do not.

1. *Cases that require Abdominal Section.* If the foetus cannot be extracted by the natural passages it must be removed by the abdominal route. This will be so if the foetus has escaped entirely into the peritoneal cavity, or if so much of it has escaped that extraction by the natural passages is impossible, difficult or dangerous: injudicious attempts at extraction may lead to extension of the tear, renewal of hæmorrhage or injury to the intestines.

If, after the foetus has been extracted, examination or the condition of the patient reveals the fact that hæmorrhage is still continuing, the abdomen must be opened and hæmorrhage controlled. It must be borne in mind that even when the uterus is hard and contracted severe hæmorrhage may still continue.

In very extensive tears, even if the foetus has been extracted and hæmorrhage has ceased, recovery is more likely to take place if they are dealt with by abdominal section. Opinions differ on this point, and it cannot be denied that many such cases recover completely if dealt with by the vaginal route.

The Operation. Since patients are usually in a state of profound shock and collapse the utmost precaution must be taken to combat these both before and during operation. Intravenous injections of saline solution should commence before the operation and should continue throughout it.

The abdomen should be opened by a six-inch incision starting two inches above the umbilicus. After the foetus and placenta have been removed, and blood and clots cleared away, the uterus should be drawn up through the wound and the rent sought for and its extent defined. Now is the time when the operator must make his decision as to (i) whether he can deal efficiently with the tear by suturing it, or (ii) whether he should remove the uterus.

Treatment by Suture. Suture of the rent is only suitable if the edges can be accurately coapted and if hæmorrhage can be efficiently controlled. This method of treatment is only suitable if the tear is confined to the uterus, if its course is fairly regular, if it be in an accessible position and if its edges can be accurately coapted. The sutures should include the peritoneal and muscular coats of the uterus.

Removal of the Uterus. This must take the form of supravaginal hysterectomy, and usually is indicated if the tear is extensive and irregular. Its advantages are that it controls bleeding, removes a source of sepsis and precludes rupture in subsequent pregnancies or labours.

2. *Tears that do not require Abdominal Section.* Treatment without abdominal section is only suitable for small tears unaccompanied by hæmorrhage. If it be decided to treat the case by vaginal drainage the external genitalia and vagina should be carefully made as aseptic as possible and the hand should then be introduced into the uterus and the tear explored. Any clots should be removed and a douche nozzle should be introduced through the tear and the peritoneum douched with normal saline solution. The objects of this method of treatment are (a) to provide drainage, (b) to stop the intestines from prolapsing. Drainage is carried out by passing a moderate-sized rubber tube into the peritoneal cavity through the lower angle of the tear; its lower end should not reach more than half-way down the vagina. The rest of the tear should be covered lightly with gauze, not plugged tightly.

The sole object of the gauze is to prevent prolapse of intestine. The drainage tube, unless

here be signs of sepsis, may be removed at the end of forty-eight hours.

In cases treated by this method the patient should be maintained afterwards in the sitting position by means of a bed-rest; the head of the bed should be raised on eight-inch blocks. Better drainage is thus ensured.

Tears which open into the broad ligament are best treated by first douching the cavity with an antiseptic solution and then plugging with gauze—hæmorrhage is controlled, and after twenty-four hours the plugging may be removed.

It must be remembered that where a tear has been treated by the vaginal method, abdominal section for recurrent hæmorrhage may ultimately be necessary. For this reason patients should be kept under close observation for twenty-four hours.

Cases of severe rupture of the uterus may occur where, though the practitioner knows that abdominal section is the correct treatment, the surroundings are so unfavourable or help is so distant that it is out of the question. In such a case collapse and shock must be treated by saline infusions. An effort must be made to check hæmorrhage by plugging the uterus, cervix and vagina tightly with gauze and by applying counter-pressure from the abdomen by applying a pad and a tight binder over the uterus. In this way, enough counter-pressure may be obtained to press the edges of the tear more tightly together and so to control the bleeding.

II.—Abnormalities in the Dilatation of the Cervix

The cervix dilates slowly for two reasons:—(1) Uterine contractions are weak. (2) The cervix is rigid. The first has already been dealt with under *Uterine Inertia*.

Rigidity of the Cervix may be (1) *functional* or (2) *organic*. Functional rigidity is common; organic rigidity is rare and is caused by scar tissue from former operations or lacerations and by carcinoma or fibromyoma of the cervix.

Functional Rigidity may arise through premature rupture of the membranes, whereby the natural dilator is lost; from morbid adhesions of the membranes to the lower uterine segment, whereby advance of the membranes and formation of a bag of waters is prevented, or from a spasm of the circular muscular fibres of the cervix.

Functional rigidity is most common in primiparæ who are obstetrically "elderly," *i. e.* over thirty-five. It is common in occipito-posterior presentation where the head is extended. The preliminary part of dilatation occurs normally and the rigidity affects the os externum; the edge of the os, instead of being thin and elastic, feels thick, resistant and rigid.

Effects. These are maternal and foetal, and are worse after the membranes have ruptured. The first stage of labour is prolonged and the mother becomes exhausted. Another danger is sepsis. The child may die from pressure, but is safe before the membranes rupture.

Treatment. Patience and unaided nature suffice for slight cases, but help must be given as soon as ill-effects are noticed. A hot bath and hot vaginal douches are often beneficial. If sleep can be procured the rigidity often passes off, but it is difficult to procure by drugs so long as pains are constantly occurring. A good plan is to anaesthetize the patient for a short time lightly with chloroform after having given a full dose of chloral hydrate. If the os still remains rigid, the patient must be anaesthetized and mechanical dilatation carried out either manually or with a Champetier de Ribes' bag. When the os is already half dilated, full dilatation can be accomplished by the hand and the child delivered by forceps in a head presentation. When the os is less than half dilated a bag must be used.

A peculiar form of non-dilating os sometimes occurs, in which the internal os uteri and cervical canal dilate normally, but the external os remains completely or almost completely closed. The dilated cervix becomes stretched over the presenting part like a thin membrane and descends with it to the pelvic floor. The bulging swelling may be mistaken for the bag of waters, but on careful examination the external os is discovered in its centre as a tiny opening with thin wire-like edges.

The *treatment* of this condition is extremely simple. If the finger be pushed through the opening and its edge pulled on, dilatation will occur with surprising ease and rapidity.

Organic Rigidity.—If the rigidity be due to cicatricial tissue, mechanical means of dilation (manual or by a bag) must first be tried. If these fail the cervix must be incised. For this purpose expose the cervix by introducing a large Sims' speculum. Then with scissors or a blunt-pointed bistoury make about six equidistant shallow incisions through the edge of the os externum. If there be a definite band of cicatricial tissue it will be sufficient to incise this. The completion of labour must then be left to nature; if the child be delivered too rapidly the incisions may spread upwards into the lower uterine segment.

Organic rigidity due to carcinoma and fibromyomatous tumours of the cervix has been dealt with before.

III.—Deviation of the Uterine Axis from the Normal

Anteversión of the uterus in the latter months of pregnancy is common in multiparæ with lax

abdominal walls and separated recti. It also accompanies pelvic contraction, since the presenting part cannot enter the pelvis and the uterus must gain room by stretching the abdominal wall. Extreme cases of "pendulous abdomen" are met with in lumbar kyphosis, where the shortened abdominal cavity cannot contain the enlarging uterus.

The effect of anteversion is that, since the uterine axis is directed backwards, dilatation of the cervix is interfered with and the presenting part finds difficulty in entering the pelvis. There is also a risk of rupture of the lower uterine segment.

Treatment consists in keeping the uterus in proper position by the application of a firm abdominal binder.

Lateral Deviation of the uterus is apt to occur in multiparæ with lax abdominal walls and in cases of contracted pelvis where the presenting part remains above the brim of the pelvis. Much the same effects are caused, though in less degree, as in anteversion, and the treatment is the same.

IV.—Malformations of the Uterus

Pregnancy and labour may occur in all varieties of "double uterus," for a description of which the reader is referred to the article on malformations. Malformations are rarely diagnosed during labour, until attention is drawn to them by some difficulty. Bicornute uterus is recognizable on abdominal palpation, though it cannot be decided for certain whether the physical signs are those of bicornute uterus or of a fibromyoma of the fundus. The foetus may occupy one horn and the placenta the other. In extreme forms of bicornute uterus and in double uterus the non-pregnant horn undergoes sympathetic enlargement during pregnancy and may occupy the pelvis, forming a tumour obstructing labour and necessitating delivery by Cæsarean section. In such a case it would be felt on vaginal examination; but, until the abdomen had been opened, differentiation between a non-pregnant horn and fibromyoma of the uterus or an ovarian tumour would not be possible. Both divisions of a double uterus may contain a foetus, but this is exceedingly rare. In a septate uterus the placenta may be implanted in the septum. Valuable indications of a double uterus are given if, on vaginal examination, a septum is found in the vagina or cervix.

The effects on labour produced by the above malformations may be summarized as follow—

1. Weakness of the uterine contractions. In all forms of double uterus the muscular power of the uterus is impaired.

2. Because of the weakness of the uterine wall rupture may occur.

3. Post-partum hæmorrhage. This may occur if the placenta is implanted in the feebly-retracting septum of a septate uterus. I know of a fatal case, where the foetus and placenta occupied separate horns, and where the contractile and retractile power of the uterus was feeble.

4. Malpresentations are common.

5. Labour may be obstructed. Reference has already been made to obstruction caused by the non-pregnant horn. I know of a case of labour in a uterus with a septate cervix, with a presentation; the child was arrested by the legs passing through either side of the septum, and delivery had to be effected by division of the septum.

Treatment. Obviously, treatment must be expectant and depend on the effects produced. The practitioner, when he has diagnosed malformation, must be on the look-out for one or other of the troubles mentioned above, and must take precautions to anticipate or to remedy them.

V.—Tumours of the Uterus

Fibromyoma.—The effects of these on labour depend mainly on their position. When in the body of the uterus they seldom cause trouble; when in the cervix or lower uterine segment they may obstruct labour. The possible complications are: (i) malpresentation of the foetus (ii) inefficient uterine contractions, (iii) post-partum hæmorrhage, (iv) obstructed labour; but complications are uncommon.

Malpresentations.—Breech and transverse presentations occur relatively often.

Inefficient Uterine Contraction.—This depends on the situation, size and number of the tumours. It will not occur if the tumours are subserous and situated mainly in the upper part of the fundus. It is common if the tumours are large and interstitial; labour is prolonged and often has to be terminated by forceps.

Post-partum Hæmorrhage.—Interstitial tumours may lead to this by interfering with the proper retraction of the uterus during the third stage of labour, especially if the placenta be implanted on or near the site of a large tumour. Tumours of the cervix or lower segment may lead to retention of the placenta.

Obstructed Labour.—Tumours of the cervix or lower uterine segment which occupy the pelvis and lie in front of the presenting part will obstruct labour; so also will subserous pedunculated tumours which have fallen into the pouch of Douglas and have become impacted in the pelvis. Tumours of the cervix or lower part of the uterus which, early in labour, would seem certain to cause obstruction are frequently drawn up out of the pelvis during the dilatation of the cervix. This important point must be

remembered in the management of labour in such cases.

Diagnosis. Even moderate-sized tumours may escape detection during abdominal palpation, because they are soft and not unlike the wall of the normal uterus; during a contraction, however, they may be felt to harden and become more distinct. Fibromyomata are frequently mistaken for foetal parts; the important difference is that foetal parts can be momentarily displaced by pressure, fibromyomata never. A single large tumour may in shape and size simulate a foetus, and has been frequently mistaken for a twin. Tumours which occupy the pelvis may escape observation until attention is drawn to them by interference with the normal course of labour; it is often impossible to distinguish them from ovarian tumours.

Treatment. This must be adapted to the peculiarities of the case. When the tumours are situated in the body of the uterus and the child is presenting normally, nothing need be done; inefficient uterine contractions may delay labour and necessitate its termination by forceps. Extra precautions must be taken to guard against post-partum hæmorrhage.

Tumours situated in the lower segment of the uterus which seem likely to interfere with the descent of the presenting part are often drawn up out of the way during the first stage of labour. This event should be awaited and may be assisted by pushing the tumour upwards during uterine contractions.

If the tumour is lying impacted in the pelvis, efforts must be made early in labour to displace it upwards out of the pelvis; in the case of a subserous pedunculated tumour these efforts are likely to succeed; if it be interstitial in position, and especially if it lie beneath the peritoneum of the pelvic floor or between the layers of the broad ligament, it remains immovable. Attempts may first be made without an anæsthetic; if the tumour cannot be pushed up from the vagina, try and push it up from the rectum; the genupectoral position may be helpful. If unsuccessful, anæsthetize the patient and make further attempts. If the tumour remains immovably fixed the practitioner must without delay make up his mind how the patient is to be delivered. If it fills the greater part of the pelvic cavity there is no alternative but to perform Cæsarean section.

There remains a class of case where the tumour only fills a small part of the pelvic cavity and where it is not easy to make up one's mind whether delivery by the natural passages is possible or not. It is an important rule, in connection with this class of case, never to drag a foetus by main force past an obstructing tumour. The disadvantages of such a procedure are manifest; the foetus usually is killed and

the mother runs grave risks from bruising and laceration of the soft parts; the tumour itself may undergo necrosis in the puerperium and produce a grave sepsis.

In these cases it is safer for the mother, and obviously more advantageous for the foetus, to perform Cæsarean section. The questions of ways and means, and circumstances and surroundings of the patient, will often force the hand of the practitioner, and make it necessary to perform craniotomy or evisceration and drag the mutilated child past the obstructing tumour.

Cæsarean section should be combined with an operation for removal of the tumour—either by hysterectomy or, if possible (and, of course, always preferably), by myomectomy.

Carcinoma of the Cervix.—When the practitioner finds that a woman in labour is suffering also from carcinoma of the cervix, he must consider the complication from two points of view—

1. The management of labour.
2. The treatment of the carcinoma.

Both depend on the stage which the growth has reached. Unfortunately, the increased vascularity of the cervix consequent on pregnancy promotes an unusually rapid rate of growth of the carcinoma, so that by the end of pregnancy cases are rarely seen otherwise than in an advanced state, when the cervix and surrounding tissues are extensively involved and the cervix cannot properly dilate; consequently natural delivery is either impossible or only attained by extensive tearing of the carcinomatous tissues, with consequent hæmorrhage or sepsis. In early cases the unaffected portion of the cervix dilates sufficiently to permit delivery. Where the disease is so advanced as absolutely to obstruct delivery by the natural passages, Cæsarean section is the only alternative.

Septic infection is a frequent event after such delivery, whether effected through the natural passages or by Cæsarean section. It is apparent, therefore, that advanced carcinoma of the cervix is a grave complication of labour; where, on the other hand, the growth is still in an early stage the danger is much lessened.

1. *Management of Labour.* The first point to decide is whether delivery through the natural passages is possible or not. Cases fall into three groups: (i) where the disease is confined to the cervix or nearly so, so that the natural dilatation of the cervix is little interfered with; (ii) where the disease is so advanced and widespread that delivery by the natural passages is out of the question; (iii) an intermediate group where, though delivery through the natural passages is possible, it will only be attained by

extensive lacerations and by the sacrifice of the child.

The practitioner will have little difficulty in deciding upon the management of cases in groups (i) and (ii). Where the disease shows no tendency to interfere with the natural dilatation of the cervix, nothing need usually be done but await the termination of labour. It is important to avoid lacerations and to keep the membranes intact as long as possible; if the cervix prove refractory, assist dilatation gently with the hand, or snip through the carcinomatous edges of the cervix with scissors; do not apply forceps until the dilatation of the cervix is complete. Where the disease is so advanced that delivery by the natural passages is out of the question, Cæsarean section is the only alternative.

It is the third group that presents difficulty. The alternative methods of delivery are by the natural passages or by Cæsarean section. In both the patient runs grave risks, and the interests of the child must be balanced against those of the mother. The mother runs risks in either case, for the risk of delivery by the natural passages is not much less than by Cæsarean section, and the carcinoma will almost certainly prove fatal in a few months. The correct treatment, then, is Cæsarean section, in the interests of the child. The position must be frankly explained to the patient and her relatives and the decision must lie with them.

If Cæsarean section is decided upon, proper precautions must be taken to protect the patient against septic infection. After the abdomen has been opened the uterus must be everted and carefully packed off from the abdominal cavity with gauze, to prevent contamination of the peritoneum with infected liquor amnii. After the child has been extracted the uterus should be removed by supravaginal hysterectomy, by which means a focus of sepsis and a channel of infection are removed. If after Cæsarean section the advantages of direct inspection of the pelvic contents lead the operator to believe that the disease is still in the removable stage, he should proceed at once to perform the extended abdominal operation (Wertheim's). If it is decided to deliver by the natural passages, manual or instrumental dilatation of the cervix will have to be performed, combined with incisions through the diseased tissues; perforation of the head or other means of lessening the bulk of the child will probably be necessary in order to allow it to pass through the narrow and imperfectly dilated passages. After delivery the vagina and interior of the uterus should be copiously doused with an antiseptic solution and lacerations plugged with iodoform gauze.

In all cases, whatever be the extent of the growth or the method of delivery adopted, preliminary curetting and cauterization of the growth must be carried out in order to lessen, as far as possible, the risks of sepsis.

2. *Treatment of the Disease.* After the patient has been delivered there still remains to be considered, in operable cases, the treatment of the carcinoma. Upon this, authorities are not in agreement; some counsel removal of the uterus by the abdominal or vaginal route immediately after delivery; others advise a wait of a fortnight before resorting to operation.

Since it is important to remove the disease as quickly as possible and as completely as possible, it is obvious that the wisest course is to perform the extended abdominal (Wertheim's) operation two or three days after delivery, by which time the patient will have recovered sufficiently from the effects of labour to enable her to stand a severe operation.

E. H.

CONTRACTED PELVIS

An intimate knowledge of both the theoretical and practical aspects of pelvic contraction is essential to the specialist, but the requirements of the general practitioner are fulfilled by a careful study of the practical part of the subject.

Many practitioners fall into a routine which has neither science nor efficiency to recommend it, being based on the simple principle that forceps should be applied in all cases of delay, whether in the first or second stage; failure to deliver with forceps is an indication for craniotomy, which is performed regardless of the child's condition, whether it is alive or dead.

Classification. No matter what particular form of contracted pelvis is encountered, as regards its effect on labour it falls into one of two general classes—

1. Flattened pelvis.
2. Generally contracted pelvis.

The mechanism of labour in every case follows or attempts to follow that of one or the other of these two types.

Diagnosis.—Before Labour.—Skeletal abnormalities, such as deformities of the spine, hip-joint disease, absence or deformity of a lower limb, evidences of rickets, very small stature, etc., indicate the advisability of a careful examination. The abdominal signs of contracted pelvis depend on the fact that the head does not pass through the pelvic brim and occupy the lower uterine segment during the latter weeks of pregnancy. In addition there are the signs elicited by vaginal examination and external and internal pelvic measurements.

In a primigravida the head, normally, is fixed in the pelvic inlet at least three weeks before delivery. If this does not occur, the resulting physical signs are readily detected by abdominal palpation. The head being free above the brim, the child moves freely in the uterus. Abnormal presentations are relatively frequent, and suggest the probable presence of contracted pelvis. In a multigravida the head does not fix until shortly before labour, but the history of previous labours gives reliable information.

Inspection. In a primigravida a pendulous abdomen is always suggestive. The child is entirely above the brim and the abdomen may have a smaller capacity than normal, therefore the uterus falls forward. If the abdominal walls are relaxed by previous labours, this sign is of much less value. The absence of a pendulous abdomen does not exclude the possibility of a contracted pelvis.

Palpation. Palpation reveals non-fixation of the presenting part and possibly an abnormal presentation. If these signs occur within the last three weeks of pregnancy in a primigravida they are strong presumptive evidence of contracted pelvis. If the anterior superior iliac spines can be spanned the pelvis is contracted to some extent. The converse is not true.

When labour has begun, if the vertex presents, the form of contraction can often be diagnosed by the position of the head at the brim. In general contraction the head tries to enter the brim in the normal position. The resistance it meets causes exaggerated flexion. This makes the obliquity detected by Pawlik's grip much more marked. In flattened pelvis the transverse diameter is the largest, the head enters the brim with the sagittal suture lying transversely. The head is incompletely flexed, as by this means the bitemporal diameter (three and a quarter inches) passes through the true conjugate instead of the biparietal diameter (three and three-quarter inches), which would engage if the head were completely flexed. Therefore insufficient flexion and transverse position of the head indicate a flattened pelvis, and exaggerated flexion with the head engaging in the oblique diameter, a generally contracted pelvis.

Vaginal Examination. After the onset of labour, vaginal examination reveals the conditions resulting from inability of the presenting part to enter the brim. The empty cervix and lower uterine segment hang down into the pelvic cavity. The membranes protrude markedly through the os. The presenting part may be felt moving freely above the brim. Care should be taken to avoid rupturing the membranes while examining. After the condition of the os, cervix and membranes are determined, the

position of the promontory of the sacrum, the length of the diagonal conjugate, the iliopectineal lines and the general pelvic outline should all be observed.

External Pelvic Measurements. Every patient should be measured externally at the end of the seventh month. While these measurements do not establish the presence or absence or degree of contraction they are valuable aids in drawing attention to the probability of a contracted pelvis in a woman apparently normal. The diameters to be measured are the interspinous, intercrystal and external conjugate.

Interspinous Diameter. The patient lies in the dorsal position. Each end of the pelvimeter is held between the thumb and middle finger while the index fingers palpate the anterior superior iliac spines. The ends of the pelvimeter are then placed on the outer sides of the iliac spines and the measurement read on the scale. Normally the interspinous diameter is about ten and three-quarter inches.

Intercrystal Diameter. The ends of the pelvimeter are moved back and forth along the outer edges of the iliac crests until the point of greatest separation is determined. Normally the intercrystal diameter is about twelve inches.

Very little significance is to be placed on the actual length of these two diameters, as they may be considerably reduced in normal pelves. The importance of the measurements lies in their relation to one another. Normally the intercrystal diameter exceeds the interspinous by about one and a quarter inches, and should this excess be less than three-quarters of an inch it indicates some degree of rachitic contraction.

External Conjugate. This measurement is taken with the patient lying in the left lateral position. One end of the pelvimeter is placed in the dimple below the spine of the last lumbar vertebra, the other on the soft parts over the pubes at the level of the crest. The external conjugate is normally about eight and a quarter inches. It varies considerably either way, but if it falls below seven inches it indicates some flattening, although not the degree.

Internal Measurements. If possible these measurements should be made before the onset of labour, because the manipulations necessary are very likely to cause rupture of the membranes if the os is open. Internal pelvimetry is indicated whenever there is any reason to suspect the presence of a contracted pelvis. If routine examination of patients is carried out at the seventh or eighth month, measurements can be made and suitable treatment determined upon without undue haste.

The various methods for internal pelvimetry fall into two classes, instrumental and digital.

Of the digital methods the estimation of the true conjugate from the length of the diagonal conjugate is the one in most common use, and when combined with manual exploration of the pelvis and the application of Müller's method, an approximate idea of the pelvic size is obtained; but these means are only to be relied upon when instrumental measurement is impossible.

Diagonal Conjugate. The diagonal conjugate is measured from the nearest part of the promontory of the sacrum to the under surface of the symphysis pubis. The patient lies in the dorsal position across the bed. An anæsthetic is not necessary. The examiner's index and middle fingers are passed into the posterior vaginal fornix and pushed up until the sacral promontory is reached. It is recognized by its wedge-shaped cartilage and by the fact that the vertebræ slope away above and below it. The end of the middle finger is pressed against the most prominent part of the promontory. The radial surface of the index finger is brought up to the under surface of the symphysis. This point of contact is marked with a blue pencil and the fingers withdrawn. The measurement is made with a stiff rule from the end of the middle finger to the pencil mark.

The size of the true conjugate is estimated by subtracting half to three-quarters of an inch from the diagonal conjugate. This is the first of many errors to which the method is liable. There is no definite rule by which one can know when to subtract a half and when three-quarters of an inch. The relation between the diagonal and true conjugates will vary with the height of the pubes, its inclination and the relative elevation of the promontory of the sacrum. The mark of the symphysis is made on stretched-out skin or glove surface, and when the fingers are withdrawn the skin or glove retracts. The amount of error in this factor is about a quarter of an inch. Taking these various sources of error into consideration it is evident that the estimation of the true conjugate from the diagonal conjugate is at the best approximate.

If the pelvis is normal in size it is often very difficult to reach the promontory with only two fingers in the vagina. Under these circumstances it is safe to conclude that the pelvis is not contracted.

False Promontory. A source of error in measuring the diagonal conjugate and one likely to be present in flattened pelvis is a false promontory. If the possibility of its presence is known, its recognition presents no difficulties. A false promontory is formed by undue projection of the joint between the first and second sacral vertebræ. It lacks the wedge-shaped cartilage, and in feeling above for the recession

of the vertebræ the finger recognizes the true promontory.

Manual Exploration. This means the careful palpation of the whole of the true pelvis, from the ilio-pectineal lines down to the pelvic outlet. It can be done satisfactorily only when the patient is anæsthetized and by examining with the whole hand in the vagina. This method taken in conjunction with the estimation of the true conjugate already described, is often said to be more satisfactory than any form of instrumental mensuration. It is no doubt true that considerable accuracy can be acquired by experience, but if the same time and trouble were spent in developing the skill to use a Skutsch's pelvimeter, the results obtained would be much more satisfactory. The ability to explore the pelvis manually would be learned in mastering the technique of pelvimetry.

Skutsch's Pelvimeter. The objections to the use of this instrument are first, the number of assistants necessary, and second, the practice required to make the results trustworthy; but the results of treatment based on these amply repay the time expended.

Skutsch's pelvimeter consists of two limbs meeting in a reversible lock and joined above the lock by a curved rod bearing a shoulder where it fits into the rigid bar. When the limbs are separated the soft bar moves on this connecting arc and screw-locks in each limb serve to fix them at varying distances from each other. The rigid bar is curved at the end and by means of the reversible joint this convexity can be made to look towards or away from the soft bar, which is several inches longer than the rigid one and can be twisted into any position.

There is no satisfactory instrument for measuring the pelvic diameters directly. Skutsch's pelvimeter measures them indirectly in the manner to be described.

Technique of Internal Pelvimetry. Preparation of Patient. The patient is placed in the cross-bed position with the legs in patent crutches or held by assistants. Anæsthesia is nearly always necessary and ether is the anæsthetic of choice. The pubis is shaved, washed and disinfected and the vagina douched. A catheter is passed.

The intersection of the symphysis with the crests of the pubic bones is marked by a cross in blue pencil. A similar cross is made over the top of one of the great trochanters. These are the landmarks for the adjustment of the soft bar.

The first measurement is made from the promontory of the sacrum to the cross over the pubes. This gives the length of the true conjugate plus the thickness of the pubes and soft parts over it.

The operator should wear rubber gloves. The ends of the pelvimeter are adjusted approximately to the separation needed, with the ends

opposite to one another and in the same plane. The operator passes his half hand with the rigid limb up to the promontory and places it firmly against the most prominent part. Then by moving the rigid limb laterally and back and forth, the end of the soft limb is brought opposite the cross on the pubes, on to which it is pressed by an assistant just firmly enough to dimple the skin. The ends are now properly placed to measure the over-all antero-posterior diameter. The hand holding the pelvimeter at the joint separates the limbs slightly, thus lifting the soft bar so that it will not be bent as the instrument is withdrawn. After withdrawal the shoulder on the connecting arc ensures accurate readjustment. The screw-lock is kept loose to permit of these movements. The distance between the ends of the pelvimeter is measured with a stiff rule. This measurement is repeated three times and the greatest difference between them in this and all subsequent measurements should not exceed one-fifth of an inch ($\frac{1}{5}$ cm.). On account of the tone of the tissues, the first measurement is the least trustworthy. The average of the three is taken.

It is usual to take the over-all transverse diameter next, as by so doing the rigid bar need be readjusted only once. In taking the transverse measurements it is easier to use different hands in the vagina for the two parts, that is, in measuring from the right ilio-pectineal line to the left trochanter the right hand is used in the vagina for the over-all measurement, and the left for the measurements of the thickness of the pelvic wall, from the ilio-pectineal line to the left trochanter. This obviates working with crossed hands. The transverse diameter is measured on the same principles as the antero-posterior. The limbs of the pelvimeter are more widely separated and the points adjusted to lie in the same vertical and horizontal planes. The patient's thighs are held at right angles to the pelvis and slightly separated. The end of the rigid bar is placed on the ilio-pectineal line at its point of deepest curvature, and by manipulating this limb the end of the soft bar is brought over the mark on the great trochanter of the opposite side. Then the assistant pushes the end of the soft bar down to the skin. Before withdrawing the pelvimeter the limbs are slightly separated, and after withdrawal readjusted to the same position by means of the shoulder on the connective bar. The distance between the ends is measured, the measurement repeated three times and the average taken. There should not be more than one-fifth of an inch ($\frac{1}{5}$ cm.) difference between any of the three measurements. The result represents the transverse diameter of the pelvis plus the thickness of one pelvic wall and the soft parts over it.

The third measurement is that of the thickness of the pelvic wall and soft parts over it. It is taken from the opposite ilio-pectineal line to the same mark over the trochanter. The rigid bar is turned around so that the end points towards the soft bar and the ends are adjusted approximately to the proper separation, care being taken to keep them in the same horizontal and vertical planes. The end of the rigid bar is placed on the ilio-pectineal line opposite the point from which the previous measurement was taken; the adjustable bar is fixed as before on the cross over the great trochanter. The average of three measurements is taken. On subtracting this measurement from the over-all transverse the result gives the true transverse diameter of the pelvic brim. Normally it is about five inches.

The last measurement to be taken is the thickness of the pubes and soft parts over it. The end of the rigid bar is placed on the most prominent part of the inside of the pubes and the end of the soft bar brought opposite to and then down on the cross over the top of the pubes exactly as in the first measurement. The average of these three measurements is subtracted from the over-all antero-posterior diameter, and the result is the true conjugate. Normally it should be about four and a quarter inches.

The transverse diameter of the outlet can readily be measured with a Skutsch's or some other form of external pelvimeter. The measurements are taken from the inside of one ischial tuberosity to the inside of the other.

Treatment Based on these Measurements.—The normal pelvic measurements on which these rules are based are—

True conjugate four and a quarter inches.

Transverse five inches.

The following rules of treatment apply to simple flat pelvis. The treatment of a generally contracted pelvis is that of a simple flat pelvis with a true conjugate half an inch shorter, in other words a generally contracted pelvis of three and a quarter inches comes into the same class as a simple flat pelvis of two and three-quarter inches.

During his mastership of the Rotunda Hospital, Dr. Hastings Tweedy instituted and taught the division of pelvic contractions into five degrees, separated from each other by half an inch. The first degree is from four and a quarter to three and three-quarter inches; the second, three and three-quarters to three and a quarter inches; the third, three and three-quarters to two and three-quarter inches; the fourth two and three-quarters to two and a quarter inches; and the fifth below two and a quarter inches.

First Degree of Contraction: four and a quarter to three and three-quarter inches.—Normal de-

livery may confidently be expected when the vertex presents. Contractions of this degree are easily overlooked, unless attention is directed to them either by routine pelvic examination and measurement, or by the occurrence of some abnormality of labour, such as premature rupture of the membranes, prolapse of the cord and abnormal presentations.

Treatment. The degree of contraction is so slight that it causes comparatively little trouble in actual delivery, therefore abnormalities are treated regardless of the contraction. A prolapsed cord is replaced, and if this fails the child is turned.

Brow and transverse presentations are turned, and occasionally turning is indicated in face presentations.

Management of Natural Labour in Contracted Pelvis. A very large child can be delivered through a normal pelvis, which means that there is considerable range of adaptability between the head and pelvis. This fact should be remembered and counted upon in the treatment of contracted pelvis. If a large head will go through a normal pelvis then a normal head will go through a moderately contracted pelvis.

As the head is not fixed in the lower uterine segment when labour begins, the membranes are subjected to the full force of the uterine contractions and are apt to rupture early. This is attended with more serious consequences than premature rupture in an otherwise normal labour. The liquor amnii escapes rapidly past the presenting part and the uterus shuts down on the child, interfering with the placental circulation and causing localised acute metritis from irregularly distributed pressure.

To avoid this complication the patient is kept in bed from the onset of labour and discouraged from bearing down. Even if the membranes do rupture there is less rapid loss of liquor amnii when the patient is kept in bed.

If the pelvis has not been measured this should be done as soon as possible, remembering the risk of rupturing the membranes if they are still intact. It is often advisable to wait until the membranes rupture before measuring. At the same time the pelvis is explored manually and Müller's method of determining the relative size of the head to the inlet is applied.

Uterine inertia is apt to manifest itself because of the lack of stimulation of the presenting part on the cervix. Delay due to inertia must not be confounded with that due to pelvic contraction. The foetal heart, the condition and action of the uterus and the maternal pulse and temperature are safe guides.

A mistake frequently made in a case of flattened pelvis is to confound the normal presentation in this condition (*i. e.* the long axis

of the head in the transverse diameter of the brim, only partially flexed, to bring the bitemporal diameter ($3\frac{1}{4}$ in.) instead of the biparietal ($3\frac{3}{4}$ in.) into the true conjugate) with a brow presentation. Examination of the head at delivery shows the caput over or near the anterior fontanelle and not on the brow.

Labour is allowed to progress normally as long as there is no sign of foetal or maternal distress. Advance of the head is noted by abdominal palpation and not by vaginal examination as the formation of a large caput causes spurious descent of the head.

Nægele's Obliquity or Asynclitism. In flattened pelvis the posterior parietal bone is frequently arrested at the promontory and the anterior is forced down into the pelvis, causing the head to lie in a position of exaggerated lateral inclination. This is known as Nægele's obliquity. It accounts for the fact that the caput is formed mostly over the anterior parietal bone in flattened pelvis. As labour progresses and the head is pushed further, the posterior parietal bone passes the promontory and the head resumes its normal inclination. Sometimes Nægele's obliquity is so marked that the sagittal suture is felt by vaginal examination to be only a short distance in front of the promontory. Obliquity in the opposite direction, with the posterior parietal bone low in the pelvis and the sagittal suture near the pubes, is said to be a very unfavourable sign in regard to normal delivery.

After the membranes are ruptured the force of the uterine contractions in moulding the head is aided by the application of a tight binder pinned from above downwards, the pins being placed about one inch apart. This keeps the head driven against the inlet.

Scopolamine and morphine should always be remembered as useful aids to carry the patient over a prolonged first stage and should certainly be administered if the patient is put in Walcher's position.

Walcher's Position. The length of the true conjugate can be appreciably increased by putting the patient in Walcher's position. The objection to it as usually employed is that it is painful and tiring. Forty-five minutes at a time is as long as it can be maintained. The following modification enables a woman to remain indefinitely in this position without a great degree of discomfort, which is still less if sedatives are given.

After the membranes have ruptured, the patient is placed in the cross-bed position with the sacrum supported by the edge. Small blocks are put under the legs of the bed on this side, one at the foot and one at the head. Books serve the purpose if blocks are not obtainable. Two chairs are placed at the side of the bed with

space enough between them for the patient's legs to hang down. The patient is covered with blankets and each leg wrapped separately. Between the pains the feet are rested on the chairs, but when the pain comes on the legs are allowed to hang down straight, the bed being raised on the blocks so that the feet are free of the floor, and the tilting prevents the patient being pulled too far over the edge by the weight of her feet.

Under these conditions Walcher's position may be maintained for hours, and a head that would otherwise remain unfixed moulds through the brim.

Even after the os is fully dilated, plenty of time is necessary to allow the head to be well moulded through the brim before forceps are applied, as otherwise insurmountable difficulty may be encountered. Ten to twelve hours are often necessary in the second stage before the head has been properly moulded, but the better the chance given for normal delivery, the better are the foetal and maternal results.

Throughout labour, and particularly after the membranes are ruptured, a very careful watch should be kept on the child's condition as evidenced by the rate and rhythm of the foetal heart. The condition of the uterus and the pulse and temperature show how the mother is standing the strain of labour.

Whenever foetal or maternal distress is manifested immediate delivery is indicated. Forceps should be tried tentatively, and if they fail, pubiotomy or symphysiotomy should be performed.

Perforation of a living child is never justifiable, and to allow a child to die during labour as result of delay in adopting means to expedite delivery is an error in technique that should not be allowed to occur. Waiting for a child to die and then doing a craniotomy is as bad practice as perforating a living child.

Distended bladder and rectum should always be remembered as causes of delay in delivery.

Second Degree of Contraction: three and three-quarters to three and a quarter inches.—The abnormalities of labour mentioned as occurring in the first degree of contraction occur with greater frequency and are of more serious import, as the contraction makes subsequent delivery more difficult and dangerous.

If the child is of normal size and presents by the vertex natural delivery frequently occurs with the aid of scopolamine and morphine, a tight binder and Walcher's position after the membranes are ruptured, and plenty of time to allow moulding of the head. The management of labour in these cases has already been described (see p. 909). The nearer the length of the true conjugate is to the lower limit the less likely is normal delivery.

The after-coming head can be delivered with comparatively little difficulty, although the foetal mortality is considerably greater than in vertex presentations. The nearer the contraction is to the lower limit the greater is the difficulty with the after-coming head and the higher the mortality. Therefore prophylactic version as a treatment for contracted pelvis is not attended with as good results as when delivery is uninterfered with, but in this degree of contraction version may still be justifiably recommended for complications of labour such as non-replaceable prolapse of the cord, transverse, brow and face presentation. For the last two conditions pubiotomy, symphysiotomy and hysterotomy are justly now being substituted for the older treatment of version.

If the head becomes impacted at the brim or in the pelvis and symptoms of maternal or foetal distress are manifested, forceps should be tried tentatively and if this fails delivery should be completed by pubiotomy or symphysiotomy. *Forceps should never be applied to a head not fixed by its largest diameter unless preparations are complete for enlarging the pelvis.* There is now no place in the treatment of contracted pelvis for dragging a head through by main force. If the child is dead delivery should be completed in the manner giving the least amount of traumatism to the mother: forceps, version, perforation, or in a transverse presentation decapitation.

For the practitioner induction of premature labour under the guidance of Müller's method (see p. 911) is a very useful treatment in this degree of contraction, although the induction of premature labour for contracted pelvis is rapidly falling into disrepute.

If during labour there is considerable over-riding of the head and the os is less than three-quarters open when distress is manifested, Cæsarean section, preferably extra-peritoneal, is the operation best suited for delivery. This is more likely to occur when the true conjugate is near the lower limit of three and a quarter inches.

Third Degree of Contraction: three and a quarter to two and three-quarter inches.—Normal delivery of a full-term full-size child is practically impossible in this degree of contraction. Delivery by the breech requires the exhibition of considerable force, and the child (if of normal size) is usually dead, and very often delivery is impossible until the head is perforated.

If the woman is seen early in labour (uninfected by vaginal examinations) the classical Cæsarean section is as a rule the operation of choice. If seen after labour has advanced the choice lies between extra-peritoneal Cæsarean section and pubiotomy and symphysiotomy. If the os is fully, or almost fully open, pubiotomy

is better than hysterotomy, because, if fibrous union results, normal delivery is possible in subsequent labours.

If the os is less than three-quarters open when delivery becomes necessary extra-peritoneal Cæsarean section is preferable, because delivery by the vagina necessitates considerable laceration of the cervix. The lower limit of this degree of contraction ($2\frac{3}{4}$ in.) is the lowest limit of safety for performing pubiotomy or symphysiotomy.

Induction of premature labour is still justifiable in practice, but it has to be done so early in pregnancy that the foetal mortality is high.

If the child is dead it can always be delivered by perforation.

Fourth Degree of Contraction: two and three-quarters to two and a quarter inches.—Delivery of a normal-sized child through the vagina is out of the question. The contraction is too great to ensure safety in the performance of pubiotomy or symphysiotomy. Before labour, or early in the first stage when the membranes are unruptured and the patient uninfected, the classical Cæsarean section is the operation indicated.

If late in labour, with a well-formed lower uterine segment, or after repeated vaginal examinations, or attempts to deliver, the condition of the child determines the operation to be selected. If it is alive extra-peritoneal Cæsarean section should be performed, if dead, perforation, cephalotripsy and cleidotomy. As the lower limit of this degree of contraction is reached these latter operations become very difficult and are attended with a definite maternal mortality. Bearing this in mind it is often preferable to do an extra-peritoneal Cæsarean section even if the child is dead.

Fifth Degree of Contraction: below two and a quarter inches.—Cæsarean section is the only possible form of treatment in these cases. As the woman is a dwarf, she is always sent to the hospital in time for operation.

Müller's Method.—This method is used to determine the proper time to induce premature labour, as indicated by the size of the head in relation to the pelvic inlet. The patient should be anaesthetized. If the head is not over the brim it is brought there by external version. The half hand is placed in the vagina with the thumb extended up the front of the pubes. The foetal head is pushed down into the brim by the other hand. The fingers in the vagina feel the head if it passes through the brim, and if it does not the thumb measures the amount of over-riding, *i. e.* the projection of the head over the crest of the pubes.

This manœuvre is repeated each week, and the day the head refuses to enter the brim, or

is pushed in with difficulty, is the time to induce premature labour.

Müller's method fails in very stout women, in posterior positions of the occiput and abnormal presentations of the head that cannot be changed. To be properly done an anæsthetic is essential and it is undesirable to anæsthetize the patient every week.

Müller's method is useful in conjunction with the other examinations in contracted pelvis and is the only method practicable for determining the relative size of the head and pelvic inlet.

Induction of Premature Labour. This is a treatment rapidly and deservedly being relegated to a subordinate position in the treatment of contracted pelvis. For work in institutions it has no place, because of the better permanent results following full-term labour, terminated spontaneously when possible, and failing this, the methods of pubiotomy or symphysiotomy. In general practice, induction of premature labour still holds a place of some importance, but the indications can be decided only upon the careful application of Müller's method, supplemented by internal pelvimetry. The man who is able to do this properly can easily learn the technique of the operations for widening the pelvis.

A large number of cases on which premature labour is induced would deliver themselves naturally at full term, and thus the child is unnecessarily exposed to the risks of prematurity. If labour is induced before the thirty-fifth week the foetal mortality is very high, fifty to seventy per cent. Reports published to refute this statement are so indefinite in regard to pelvic size and the period of pregnancy as to be almost worthless from a statistical standpoint.

The statement is often made that induction after the thirty-sixth week is useless as the child does not increase in size after that. This is doubtful, and if labour is to be induced it should be done under the guidance of Müller's method, regardless of the period of pregnancy.

If induction is indicated before the thirty-fifth week the results will be better if the woman is allowed to go to full term and some other means of delivery adopted.

Women with contracted pelves are prone to overcarry. If they do, it needlessly increases the difficulty of delivery. On this account labour should be induced at term if delivery by the vagina is to be expected. J. R. F.

POST-PARTUM HÆMORRHAGE

The term "post-partum" hæmorrhage means hæmorrhage occurring after the birth of the child; it may occur before or after the expulsion of the placenta.

Classification. Cases of post-partum hæmorrhage may be grouped into three divisions—

1. Bleeding due to failure of retraction of the uterine muscle.

2. Bleeding due to lacerations and injuries of the birth-canal.

3. Bleeding due to disease.

The prevention of post-partum hæmorrhage depends upon the proper management of labour, particularly of the third stage. This subject is dealt with elsewhere, and in this article we shall confine ourselves to a description of the methods of treatment to be employed after the hæmorrhage is established.

1. **Failure of Retraction.**—When the placenta is detached from the uterine wall in the third stage of labour the vessels which open into the sub-placental sinuses pour their blood into the uterine cavity. In a normal labour the uterus retracts immediately the placenta is expelled, the mouths of the vessels are thus closed and the bleeding is arrested; if for any reason the uterus fails to retract the mouths of the vessels are not closed and post-partum hæmorrhage results. Failure of retraction of the uterine muscle is due to two main causes:—

(a) Retraction is prevented if the uterine cavity is not completely emptied.

(b) Retraction fails if the uterine muscle is exhausted, or its contractile power temporarily or permanently impaired. The bleeding in this case is spoken of as atonic hæmorrhage.

(a) Lack of retraction because the uterus is not empty may occur under the following conditions:—

(i) The placenta may be completely detached, but the uterine contractions may not be sufficiently strong to expel it into the vagina (retained placenta).

(ii) The placenta may be in part detached but in part so firmly adherent to the uterine wall that even strong contractions are unable to complete its separation (morbidly adherent placenta).

(iii) During the expulsion of the placenta one or more cotyledons may remain attached to the uterine wall and be left behind.

(iv) A small secondary placenta (placenta succenturiata) may be retained.

(v) A considerable portion of the membranes may be left behind.

(vi) Blood clots may accumulate in the uterine cavity.

(vii) In twin labours hæmorrhage may occur after the separation of the placenta of the first child, because the presence of the second child prevents retraction.

(viii) A submucous fibroid in the wall of the uterus may act as a foreign body.

(b) Atonic hæmorrhage may be caused by a variety of conditions:—

(i) Multiparity. If a woman has borne many children, and particularly when succeeding pregnancies have followed one another very rapidly, the quality of the uterine muscle may be impaired to such an extent that retraction in the third stage of labour is incomplete. Atonic hæmorrhage is much commoner in multiparæ than in primiparæ.

(ii) Uterine exhaustion. In a long and lingering labour the uterus sometimes becomes tired out and contractions cease (secondary uterine inertia). If during the total absence of pains the child be extracted artificially, retraction is often imperfect and hæmorrhage results.

(iii) Ante-partum hæmorrhage. If blood has been lost before delivery post-partum hæmorrhage is also likely to occur, partly from the anæmic condition of the uterine muscle, and partly from the lowered vitality of the patient.

(iv) Over-distension of the uterus such as occurs in hydramnios and twin labours interferes with retraction and predisposes to post-partum hæmorrhage.

(v) Prolonged administration of chloroform, deep anæsthesia and the use of morphia are attended with the danger of post-partum hæmorrhage.

Non-retraction may be partial or complete. Complete non-retraction means that the whole uterine muscle is in a state of relaxation. Incomplete non-retraction means that part of the uterine muscle is in a state of contraction and part in a state of relaxation; the latter condition is met with in hour-glass contraction and in some cases of inversion of the uterus.

2. **Hæmorrhage from Lacerations.**—During the delivery of the child lacerations of the soft parts of the birth-canal are almost inevitable. In most cases the tears are of slight extent and give rise to little or no hæmorrhage, in exceptional cases they are deep, large vessels are torn across and serious hæmorrhage results. The blood may come from—

(a) *The Vulva.* The part of the vulva most often lacerated is the perineum, but this seldom gives rise to profuse hæmorrhage; next in frequency come the labia, but tears in this region very rarely cause severe bleeding. When the anterior parts of the vulva are torn the hæmorrhage is apt to be profuse and difficult to control, for the structures in this situation, particularly in the neighbourhood of the clitoris, are very vascular.

(b) *The Vagina.* Lacerations may be found in any portion of the vagina, but the resulting hæmorrhage is slight, except when they are situated on the anterior wall.

(c) *The Cervix.* Deep tears of the cervix often give rise to very profuse bleeding. The branches of the uterine artery in the region of the internal os attain a large size during

pregnancy, and if these are torn across the loss of blood may be both rapid and severe. Tears of the cervix are usually lateral.

(d) *The Corpus Uteri.* A tear commencing in the cervix may extend upwards and involve the portion of the uterine wall situated between the two layers of the broad ligament. Such a tear constitutes a rupture of the uterus. If the peritoneum is not involved in the tear the rupture is said to be "incomplete," if the peritoneum is involved, "complete." In incomplete rupture part of the blood escapes per vaginam and part forms a collection between the layers of the broad ligament, and passing backwards strips up the peritoneum from the posterior abdominal wall forming a retro-peritoneal hæmatoma. In complete rupture most of the blood escapes into the peritoneal cavity. In some cases of rupture the tear is transverse and situated entirely in the corpus uteri, not involving the cervix.

3. Hæmorrhage due to Disease.—Certain morbid conditions of the blood and vascular system may give rise to hæmorrhage after delivery. Hæmophilia, scurvy and pernicious anæmia are very rare in parturient women, and will not be discussed in this article.

Late Post-partum Hæmorrhage.—There may be no unusual hæmorrhage at the time of delivery, but subsequently at some time during the lying-in period bleeding may occur. The cause of late post-partum hæmorrhage is, in the great majority of cases, the retention of portions of the placenta or membranes; amongst rarer causes may be mentioned the separation of a slough, the extrusion of a uterine fibroid and carcinoma of the cervix complicating the puerperium.

Concealed Post-partum Hæmorrhage.—Under exceptional circumstances in post-partum hæmorrhage the blood collects in the uterus, distending its cavity so that a considerable amount of bleeding takes place before any blood escapes externally. In such cases the escape of blood is usually prevented by the placenta, which has become detached and plugs the lower uterine segment.

The Diagnosis and Symptoms of Post-Partum Hæmorrhage. When the blood escapes externally the diagnosis is self-evident. When the blood is concealed the symptoms are those of collapse and internal hæmorrhage. The skin and mucous membranes become pale, and the body is bathed in a cold clammy perspiration. The pulse-frequency increases and its volume diminishes; the temperature falls. The patient suffers from breathlessness and tosses about on the bed, moving her arms and legs in an aimless fashion. As more blood is lost the phenomena of "air hunger" become apparent, the patient sighs deeply, then takes

hurried shallow respirations, and finally exhibits marked dyspnoea, struggling and fighting for breath. The sight becomes dim and complaints are made that the room has become very dark, finally after a few convulsive movements she passes into a state of coma.

As soon as the diagnosis of post-partum hæmorrhage is made, the first step is to determine its cause. Is it traumatic or due to failure of retraction? This question is answered by ascertaining by abdominal palpation the condition of the uterus. If the uterine walls are firm and well-retracted, the blood is almost certainly coming from a laceration in some part of the birth-canal; if the uterus is flaccid and bulky the blood is in all probability coming from the placental site. The treatment adopted is determined by the decision arrived at. We shall consider first the treatment of hæmorrhage due to failure of retraction.

Treatment of Hæmorrhage due to Failure of Retraction. In dealing with any case of atonic hæmorrhage our efforts are directed towards exciting firm retraction of the uterine muscle. By this means and by this means only, effectual closure of the uterine sinus is secured. As a preliminary to such retraction in any case of severe bleeding the uterine contents must be evacuated. When the hæmorrhage commences immediately after the birth of the child the hand should be placed upon the fundus uteri, and by movements of massage attempts be made to excite contractions. If, in spite of this treatment, the hæmorrhage still continues, the cord should be ligatured and divided as rapidly as possible, and the patient turned on to her back.

The next step will depend upon the condition of the uterus; if the muscle responds to the massage and becomes firm to the touch so that the outline of the uterus can be clearly defined, attempts should be made to express the placenta by Credé's method. If the muscle remains soft and flabby so that the outline of the uterus cannot be clearly defined, such attempts are dangerous and should not be made, for they may cause inversion of the uterus.

If the placenta cannot be expressed by Credé's method it is probably in part morbidly adherent to the uterine wall, and must be removed manually. This procedure is attended by grave risks of infection, particularly as from the severity of the hæmorrhage it is not always possible to devote time to thorough disinfection of the vulval orifice and of the operator's hands. Careful disinfection should have taken place earlier in labour, and a careful obstetrician will always take care that the patient's vulva and his own hands have been rendered as sterile as possible before the patient passed into the third stage. In most cases,

however, it is possible to wash the hand and forearm again with a solution of one in a thousand perchloride of mercury before manually removing the placenta.

Manual Removal of the Placenta. The details of the procedure are as follows:—The fingers of the right hand are bent into the form of a cone, the labia separated with the fingers of the left hand and the right hand introduced into the vagina; the left hand is then placed on the fundus of the uterus. The cord is felt for with the right hand, and is followed up through the cervix and lower segment into the body of the uterus; it thus forms a guide which leads directly to the placenta. The portion still attached to the uterine wall is felt for, and using only the pulps of the fingers is detached by a sawing movement; the detachment should be commenced at the upper part and proceed from above downwards, for as soon as the uterine wall is freed from the adherent placenta it retracts.

When the placenta has been completely detached it is removed from the uterus, and at the same time any clots which may have accumulated in the cavity are cleaned out. The uterus is now empty, and our further efforts are directed towards securing retraction. The uterus is massaged and then grasped as firmly as possible by the hand placed upon the abdomen, and a hot intra-uterine douche is administered if it has been prepared. If the douche is not ready and bleeding still persists, bimanual compression should be practised.

Bimanual Compression. The fingers of the right hand are bent into a cone and the hand introduced into the vagina; as soon as the whole hand is within the vaginal canal the fist is clenched and pushed up in front of the cervix into the anterior fornix. The broad surface formed by the first phalanges of the fingers is now in contact with the anterior surface of the uterus, separated only by the bladder and the vaginal wall. The left hand is placed on the abdomen, pushed down behind the uterus and the uterus sharply ante-flexed. The uterus is compressed between the two hands in such a way that the inner surfaces of the anterior and posterior walls are pressed firmly together, and the hæmorrhage is thus arrested by the direct pressure. It is always possible to arrest temporarily the bleeding in this way, but the cramped position in which the hands are held makes it impossible to continue very long, and as soon as the douche is ready it is administered.

The Intra-Uterine Douche. For the administration of an intra-uterine douche it is best to employ an apparatus consisting of a douche can, to which an intra-uterine douche tube is connected by four feet of rubber tubing. The can should be capable of holding at least two pints, and the intra-uterine tube should have

a double curve and preferably be made of pewter. The whole apparatus is sterilized by boiling. The fluid employed should be sterilized salt solution, sterilized water or a weak solution of a non-poisonous antiseptic such as lysol or iodine, and should be injected into the uterus at a temperature of 120° F. When the douche has been prepared the nozzle is held between the fingers of the right hand, introduced through the vulva and vagina into the uterine cavity and passed on until the end of the tube is in contact with the fundus; the left hand is placed on the abdomen over the uterus, and the nozzle is clearly felt through the walls of the uterus and abdomen. At least two pints of fluid should be injected. When the hot fluid comes into contact with the uterine wall contractions are excited and the uterus is felt to harden and become smaller. If this procedure fails to arrest the hæmorrhage the uterine cavity should be plugged.

Plugging the Uterine Cavity. The object of the uterine plug is not simply to distend the cavity and arrest the hæmorrhage by direct pressure upon the bleeding points, but to excite uterine contractions. As the plugging is introduced into the cavity the uterus contracts down, and the mouths of the bleeding vessels are closed. The material used is a matter of no great importance provided it is absolutely sterile. Rolls of sterilized gauze, if they be at hand, answer the purpose well, but broad strips of linen sterilized by boiling are equally efficient; the strips should be about four inches wide and should be knotted together to facilitate their removal. The operation may be performed with the patient in either the lithotomy or left lateral position. An assistant keeps gentle pressure upon the fundus uteri through the abdominal wall so as to press the uterus down and bring it more easily within reach. The end of the roll of plugging is then taken in the fingers of the right hand and pressed well up into the cavity of the uterus. As the gauze is passed in, the uterine muscle contracts down upon it, and the plugging is continued until no more material can be introduced. The plugging should be removed at the end of twenty-four hours and an intra-uterine douche administered.

The Administration of Drugs. The drugs which possess the greatest value in the arrest of post-partum hæmorrhage are ergot and pituitary extract.

Ergot. The ergot used in midwifery practice should have been physiologically tested and preferably standardized. A specimen of ergot may appear perfectly good as regards colour, taste and smell, and yet be quite inert physiologically. Since rapidity of action is essential in dealing with cases of post-partum hæmorrhage

the drug should be administered hypodermically in the form of ergotin or ergotinine.

Pituitary Extract. Pituitary extract exerts a powerful influence upon the uterine muscle, and acts more quickly than ergot. It can be obtained sterilized and standardized in ampules of 1 c.c. ready for immediate injection. By raising the general blood pressure it is of great value in combating the shock which is always associated with the hæmorrhage.

Compression of the Abdominal Aorta. Hæmorrhage can sometimes be temporarily arrested by compressing the abdominal aorta against the lumbar spine. This method is in many cases difficult to practice, and is unreliable in its results; it is therefore not to be recommended as a routine practice in the treatment of post-partum hæmorrhage.

Hour-Glass Contraction of the Uterus.—In hour-glass contraction the uterine walls are in part contracted and in part relaxed. A ring of firm contraction in the situation of Bandl's ring separates the relaxed upper and lower uterine segments. The condition is rare; it occurs sometimes before the birth of the child and may obstruct delivery, but more often it develops post-partum.

The shape of the uterus is roughly hour-glass, the upper part is relaxed and contains the placenta which is often morbidly adherent to the wall, the junction of the two segments is tightly contracted and forms a ring of constriction easily felt on the surface of the uterus and below this is a second relaxed portion consisting of the lower segment.

In hour-glass contraction the loss of blood is not so rapid as when the uterus is completely relaxed, but bleeding continues until the uterus is emptied and the total loss may be great.

Diagnosis. On abdominal palpation the uterus is large, its upper portion, though retracted, feels unusually soft and flabby, and below this flabby portion is felt a ring of constriction. When the hand is introduced into the vagina and the cord is traced upwards, it is found to pass through an opening narrow but usually large enough to admit a finger, and above the opening can be felt a soft mass consisting of blood clot and placenta.

Treatment. The contracted ring forms an obstacle which prevents the introduction of the hand into the uterus, and the spasm may be so great that it is difficult to dilate the ring; it is therefore advisable that the patient should be deeply anæsthetized. The left hand is placed on the fundus and the uterus pressed down, the right hand is introduced into the vagina and the tips of the fingers passed into the retraction ring. By means of these fingers the ring is gradually dilated until the hand can be passed into the upper segment and the

placenta separated and removed. Should hæmorrhage continue after the removal of the placenta, it must be treated by the methods previously described.

Treatment of Traumatic Hæmorrhage. Traumatic hæmorrhage usually commences immediately after the birth of the child, and the diagnosis is made by finding the uterus in a condition of firm retraction. When the bleeding is severe the cord should be tied immediately and the child removed. The patient is placed, preferably in the lithotomy position, in a good light, and an attempt is made to find the bleeding point. We commence with the *vulva*. A swab is wrung out in lotion and pressed firmly against any part of the vulva from which the blood appears to be coming; if the bleeding point is in the vulva the pressure will arrest the hæmorrhage; if the bleeding point is higher up, the hæmorrhage will continue. In hæmorrhage from the vulva the bleeding vessels are in sight, and pressure forceps and ligatures can be applied, but in lacerations of the anterior part it is often necessary to underpin the torn tissues.

The *vagina* is next examined, a hot douche is given to wash away blood clots and lacerations are sought for. If they are found the bleeding is temporarily arrested by plugging, and eventually the tear is sewn up.

In most cases of severe traumatic hæmorrhage the blood comes from the *cervix*. Cervical lacerations are usually lateral, and may extend up into the broad ligament, not uncommonly they are bi-lateral. As soon as the tear is found the two edges are pressed together with the fingers, and a vulsellum forceps introduced into the vagina is made to grasp the cervix as near the top of the tear as possible, so that when the fingers are withdrawn the edges of the tear are still kept in apposition. The vulsellum effectually controls the bleeding, and may be left in position until an anæsthetic can be administered and the tear sewn up with catgut sutures.

This is the best method of arresting hæmorrhage from a torn cervix, and it is advisable to carry a vulsellum forceps in the midwifery bag for the purpose. The alternative is to plug the laceration; this is, however, more difficult to accomplish and less reliable in its action.

The treatment of ruptured uterus is considered elsewhere.

Acute Inversion.—In inversion of the uterus the mucous surface of the organ protrudes through the cervical canal and forms a tumour which projects to a greater or less extent into the vagina, whilst the peritoneal surface forms a depression with its concavity towards the abdomen.

For the production of acute inversion the uterus must contain a cavity, and its wall must

ther in part or throughout its whole extent be in a relaxed condition. Both these essentials may be present during the third stage of labour.

Inversion may be brought about either by pressure from above or by traction from below, and in each case may be produced either spontaneously or artificially. Inversion may be produced *spontaneously* from above by violent straining efforts on the part of the woman whilst the uterine walls are relaxed, *artificially* by attempts to express the placenta by Credé's method when the uterus is neither contracted nor retracted. Inversion may be produced spontaneously from below by the sudden fall of the child if a woman is delivered in the upright position, or artificially by traction on the cord in attempts to deliver the placenta.

Inversion may be passive or active. In passive inversion the whole uterus is relaxed and the force which produces the inversion turns the uterus inside out like the sleeve of a coat. In active inversion part of the uterus is relaxed and part contracted, the relaxed portion indented and inverted into the cavity, the contracting portion then forces it on further and produces a greater degree of inversion.

Signs and Symptoms. There are two main symptoms of acute inversion of the uterus—*hæmorrhage* and *collapse*. In most cases the woman experiences a sensation "of something giving way inside," and this sensation may be accompanied by stranguary and tenesmus from dislocation of the bladder and rectum. Abdominal pain is often a marked symptom, but in exceptional cases is entirely absent. Simultaneously with the onset of these symptoms a tumour appears in the vagina or at the vulva, hæmorrhage commences, the patient becomes faint and the pulse feeble and frequent.

Diagnosis. The vaginal tumour may be mistaken for a uterine fibroid. The diagnosis between the two conditions is made by abdominal palpation; if the uterus cannot be felt in its normal condition, but a ring can be felt above the pubes into which the fingers can be passed, the diagnosis is certain. If the placenta is still attached to the inverted fundus the diagnosis can be made at a glance.

Prognosis. Inversion is a very grave accident; the latest collected statistics show that at the present time its mortality is about thirty per cent.

Treatment. An attempt should be made to reduce the inversion as rapidly as possible. When the whole uterus is flaccid this usually presents no great difficulty, but when there is a firm retraction ring at the junction of the upper and lower uterine segments this ring may offer an almost insuperable obstacle to reduction. When the placenta is still attached to the uterine wall an attempt should be made

to replace the uterus before separating it, as the placenta affords a protection to the wall against infection, but if the attempt fails, the placenta should be detached. The left hand is placed on the abdomen and the fingers pressed down into the depression formed by the inverted fundus; this hand steadies the uterus and prevents it from being pushed upwards and torn away from its attachments during attempts at reduction. The inverted uterus is grasped with the right hand and pressed steadily upwards in the axis of the pelvic inlet, whilst with the fingers efforts are made to push up first that part which came down last. In difficult cases it is best to attempt to reduce first the anterior wall.

When attempts at reduction have failed and the patient survives the accident, the inverted uterus should be carefully washed over daily with antiseptic lotions, protected by sterile dressings, and at a later stage of the puerperium reduction should be attempted with a modified form of Aveling's repositor.

Collapse following Post-Partum Hæmorrhage.—The dangers of post-partum hæmorrhage are not over when the bleeding is arrested. The patient suffers from severe collapse, and it is not uncommon for further bleeding to occur three or four hours later. In addition to these immediate dangers there is increased liability to thrombosis and a lowered resistance to septic infection. The treatment of collapse should be upon the same lines as after any other form of severe hæmorrhage. The windows should be open, the foot of the bed raised, the patient surrounded by hot blankets, and towels wrung out of hot water applied to the head. It is important to raise the blood pressure as rapidly as possible; for this purpose pituitary extract should be administered subcutaneously and infusion of normal saline solution administered. The saline may be injected per rectum, subcutaneously or intravenously. Of these methods the first is the simplest and most easily accomplished. H. W.

OBSTETRICAL OPERATIONS

In this article I propose to discuss the subject of Obstetrical Operations under the following subdivisions:—

I.—Operations to secure the Delivery of the Live Child

[Apart from manual manœuvres which are dealt with elsewhere.]

- (a) FORCEPS DELIVERY.
- (b) ENLARGEMENT OF THE PELVIC GIRDLE.
 1. *Symphysiotomy.*
 2. *Pubiotomy.*
- (c) CÆSAREAN SECTION.
- (d) HYSTEROTOMY.

II.—Operations involving the Destruction of the Live Fœtus, and the Delivery of the Dead Child

- (a) CRANIOTOMY.
- (b) CLEIDOTOMY.
- (c) EVISCERATION.
- (d) SPONDYLOTOMY.
- (e) DECAPITATION.
- (f) COMPLETE EMBRYOTOMY.

III.—Operations for the Repair of Parts Lacerated during Parturition

[Apart from rupture of the uterus, which is dealt with elsewhere.]

- (a) REPAIR OF THE CERVIX.
- (b) REPAIR OF THE VAGINA AND PERINEUM.

I.—Operations to Secure the Delivery of the Live Child

Forceps Delivery.—The obstetrical forceps are mechanical instruments used to assist delivery, and it is said that they may be utilized in

posterior presentations as a rotator. One may safely say, however, that less damage will be done, especially by the unskilled, if no more be attempted in an active sense than can be accomplished by careful application of traction applied in the right direction.

There have been so many forms of instrument devised that a practitioner may have an individual preference, and this is often associated with the teaching obtaining in the school at which he was educated. And there is no doubt that one becomes as attached to one's own special pair of forceps, as one may to a gun or a cricket bat. The two types of instrument of most general service are those known as the Simpson-Barnes long forceps (Fig. 1), and the Milne-Murray axis-traction forceps (Fig. 2).

The former instrument is most convenient for use when the head is not high in the pelvis—in cases, in fact, of only moderate difficulty. It is possible to extend the range of applicability of this instrument by utilizing the Le Page grip-

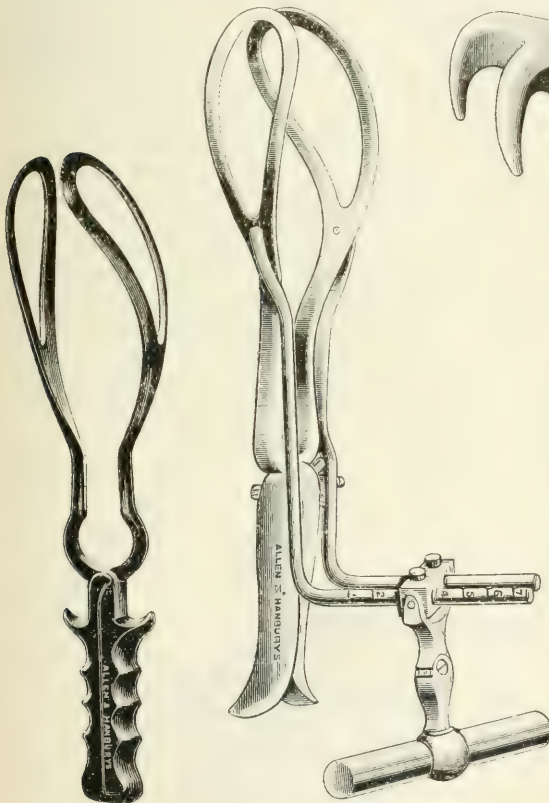


FIG. 1.—Simpson-Barnes' Forceps.

FIG. 2.—Milne-Murray's Axis-traction Forceps.

various ways to effect certain results. Since such an action as leverage is rarely justifiable or expedient, we may, for all practical purposes, look upon the forceps only as an instrument for traction, and occasionally in occipito-

FIG. 3.—Le Page's Grip-tractor.

tractor (Fig. 3), which fits on to the forceps and affords an axis-traction advantage, or by the Pajot and other forms of grip to be alluded to later.

For all difficult cases with the application of forceps to the head high in the pelvis the axis-traction forceps should be used.

Indications for the Application of Forceps

It must be remembered that forceps are used solely to *assist* delivery in cases which for some reason are not terminating to the best possible advantage of the mother or the child. The use of forceps merely to save time cannot be too strongly deprecated; and no practitioner is fulfilling his duty to his patient if he indulge in what has been described as 'meddlesome midwifery.' However expert he may be, some of his patients must suffer sooner or later. At the same time he must not let his conscience carry him to the opposite extreme.

The indications for the application of forceps may be divided into two groups:—

Maternal Indications—

1. Inefficiency of the uterine contractions, or of the accessory expulsive processes.
2. Heart disease, when the strain of labour must often be mitigated as far as possible, the case being otherwise straightforward.
3. Eclampsia, when rapid delivery is usually

manded. The second stage of labour should have commenced.

4. If there be undue delay, and the second stage of labour have lasted over four hours and progress seem delayed, forceps should be applied, for it is of no use to wait until exhaustion has set in. It is better practice to assist labour in good time.

5. Maternal exhaustion with a rapid pulse.

6. Some cases of slight pelvic contraction (over three and a half inches), when the head is well moulded in the pelvic brim, but the labour is becoming unduly prolonged. (Refer to *Maternal and Fœtal Exhaustion*.)

7. Rigidity of the pelvic outlet in elderly primiparæ. The application of forceps in these circumstances should be delayed as long as possible, for the employment of them almost inevitably leads to laceration.

Fœtal Indications—

1. Danger to the life of the fœtus owing to the prolongation of labour. In these circumstances a fœtal pulse above 160 beats per minute, below 110, gives warning that the labour must be terminated within a reasonable time if the life of the child is to be saved. So also does the passage of meconium with vertex presentations.

2. Premature separation of the placenta with bleeding.

3. Prolapse of the cord. After replacement of the cord with the head presenting, forceps could be applied.

4. Uncommon positions of the fœtus, such as cephalo-posterior presentations, face (mento-anterior) presentations or delay in the delivery of the after-coming head in breech presentations; so in a few cases of the impacted breech, forceps may be used to assist delivery.

Conditions necessary for the Application of Forceps

Most writers insist that certain conditions shall obtain before it can be considered proper, with the above indications, to apply forceps. These are—

1. *The os uteri must be fully dilated.* Some authorities do not consider full dilatation a *nequa non*; but there is no doubt that if it were so considered much damage to the cervix could be avoided. And after all it is usually, when the head is engaged, merely a matter of waiting a sufficient length of time. Sometimes the cervix when almost fully dilated can be slipped over the head by manual manœuvres.

2. *The presentation must be a suitable one.* That is to say, an occipito-anterior or posterior, mento-anterior face or an after-coming head in a breech presentation; and more rarely a breech presentation.

3. *The head must be engaged in the pelvic*

brim. Forceps ought in no circumstances to be applied to the "floating" head. The reasons are clear. If the head and pelvis be normal there should be no need for forceps at this stage. If, on the other hand, the pelvis be contracted they can be of no use.

4. *The relative size of the fœtal head to the pelvic diameters must be normal or nearly normal.* For example an hydrocephalic fœtus and a normal pelvis, or a normal fœtus and a definitely contracted pelvis contra-indicate the use of forceps.

5. *The membranes should be ruptured.* This condition is to ensure that the placenta shall not be prematurely detached; and, also, in order that the uterus may be able to contract on the fœtus after the amniotic fluid has escaped.

Preparations for the Application of Forceps

Before forceps are applied the accoucheur must see that the bladder is emptied by catheter. If the delay occur with the fœtal head well down in the pelvis the urine may have been accumulating in the bladder for some time, and catheterization may then be difficult. It is advisable also to empty the rectum should this not have been done within the previous six hours.

The pubic hairs should be cut short or shaved, and the parts well washed with soap and water and scrubbed with biniodide of mercury aqueous solution (1-500). As a rule the use of tincture of iodine for the purification of the vulva is inadvisable owing to the moist condition of the parts. The forceps are boiled, and the hands of the accoucheur are recleansed and covered with freshly sterilized rubber gloves.

The patient is then anaesthetized, and placed either in the left lateral or in the dorsal position.

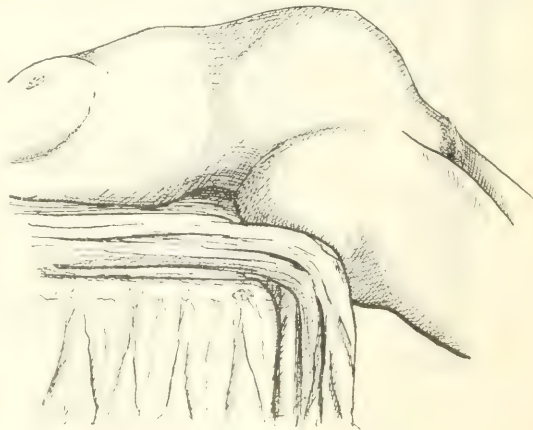


FIG. 4.—The Walcher Position.

Sometimes what is known as the *Walcher position* is adopted when there is some flattening of the pelvis. In this position the pelvis of the patient overhangs the edge of the table or

bed with the legs extended (Fig. 4), with the result that an increase of .5 to 1.0 centimetre in the conjugate diameter may be obtained, and delivery be thus facilitated in some difficult cases.

Application of the Forceps

Position of the Forceps. The adjustment of the forceps is difficult or easy according to the presentation of the foetus, and according to whether the head be high, midway or low in the pelvis.

In the vast majority of cases the forceps are applied to the sides of the head; and probably they should always be so applied when possible. Some authorities have advised that the forceps be directed along the lateral walls of the pelvis, more or less regardless of the position of the foetal head. The general opinion at the present time is against this latter procedure as a routine practice. If the head be lying low in the pelvis its long diameter will be in the antero-posterior plane, and forceps applied to the lateral pelvic walls will grasp the sides of the head. But when the head is high in the pelvis there is no such correspondence, and the ideal of these two positions in regard to the forceps cannot be obtained. In such circumstances it is usually best to grasp the head in an oblique manner—one blade being placed over the mastoid region and the other over the opposite frontoparietal area. This method of application usually ensures a good grip, and is a compromise between the ideal position in regard to the pelvic walls and the best grip of the head, without being likely to cause injury either to the mother or the child.

In some cases of high operation in flat pelvis in which forceps are called for, Munro Kerr advocates an antero-posterior application of the forceps to the foetal head; that is to say, one blade is placed over the face and the other over the occiput. In such circumstances of course the head would be lying transversely. Most authorities object to this as being liable to damage the child, and also because it is very difficult to get satisfactory locking of the instrument unless the head be very small.

In cases of impacted breech when one cannot get a finger into the groin, before using a blunt hook it is advisable to apply the forceps over the trochanters with the tips lying between the thighs and the abdomen of the foetus. Contrary to the usually expressed opinion I have found this method for delivery of the impacted breech easy and effective.

Introduction and Adjustment of the Forceps. To adjust the forceps, whether the ordinary or the axis-traction, the blades are unlocked (the varieties of locks will not be considered, the English double slot lock being most generally

in use in the United Kingdom), and the position of the head having been accurately ascertained, the accoucheur proceeds to adjust the blades in the intervals between the "pains." When the head is low in the pelvis the operation is much simpler than when it lies high.

Taking first the lower blade—that is, the one which will lie on the left side of the pelvis—the

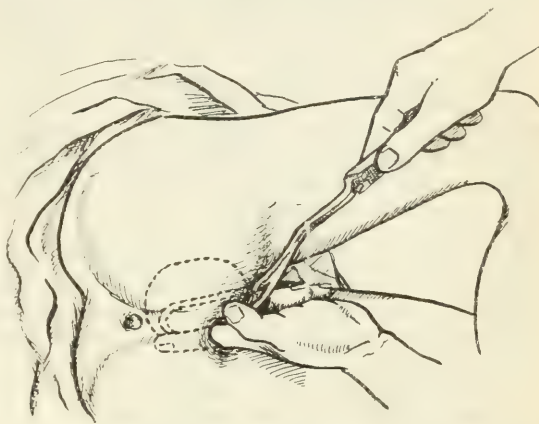


FIG. 5.—Insertion of the Lower Blade of the Forceps.

operator grasps the handle of the instrument in the right hand (Fig. 5), and inserting the first two fingers of the left hand into the vagina—half guarding, as it were, the perineum—and reaching up to the foetal head he passes the blade along the palmar surface of his fingers, and in this way guides the blade on to the convexity of the head. As a rule it is easier

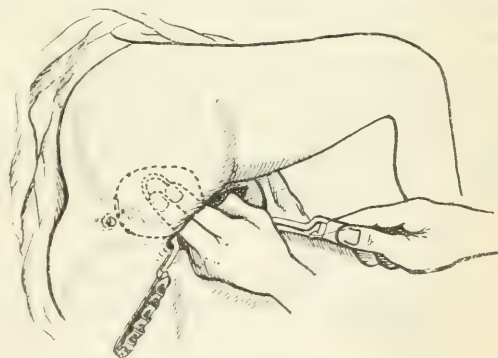


FIG. 6.—Insertion of the Upper Blade of the Forceps. The handle of the lower blade projects backwards.

and better first to pass the blade into the curve of the sacrum, and subsequently under the guidance of the fingers to rotate it to the side of the head, care being taken that the instrument lies in contact with the head and that the dilated cervix is not nipped. This last manoeuvre causes the handle to become directed more or less backwards according to the height the head is lying in the pelvis (Fig. 6).

Next the upper blade—that is, the one which will lie on the right side of the pelvis—is adjusted. The two fingers of the left hand are inserted into the vagina, guarding the perineum but in the opposite posterior quadrant to that occupied when the first blade was being inserted (Fig. 6). The adjustment of the upper blade is carried out in a similar manner to that adopted for the lower blade except that the upper blade is carried round to the other side of the head. As this blade slips into position the handle becomes directed backwards alongside of the handle of the first blade and the two are then locked. If not properly adjusted they may fail to lock, consequently no violence should be used to effect the junction: they should be readjusted.

The application of forceps to the after-coming head in breech presentations is not difficult, and should be carried out if there be delay after traction by Mauriceau's or the Prague methods with suprapubic pressure, or if the child be making spasmodic efforts to breathe. The body of the child is carried forward between the thighs of the mother and the blades of the forceps are applied to the sides of the head, which is delivered in the ordinary way (Fig. 7).

Traction and Rotation. Traction is made in a downward direction and should not be too violent. It is difficult to define the amount of force that is legitimate; experience teaches this, and teaches it by results. Slipping of the forceps from the head may cause serious laceration, but the careful practitioner will observe the commencement of such an occurrence and desist from exerting traction until he has readjusted his instruments. In high forceps deliveries the traction is applied by means of the axis-traction forceps in the normal direction of descent. The effort is thus made with the maximum mechanical advantage.

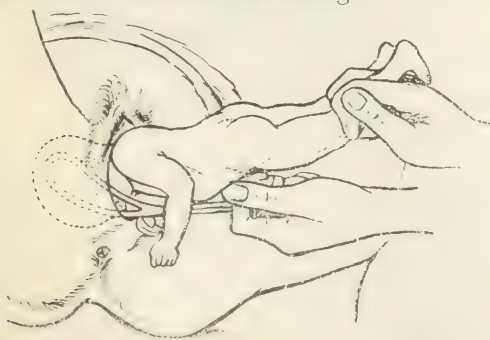


Fig. 7.—Forceps Delivery of the After-coming Head. (After Munro Kerr.)

With the Simpson-Barnes forceps a certain degree of axis-traction can be imparted by

means of the Le Page grip-tractor already mentioned, or of Pajot's manœuvre, or a modification of it, by which traction backwards is made with the left hand, while downward traction is carried out with the right (Fig. 8).

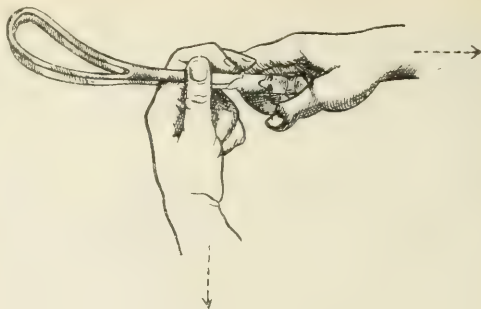


Fig. 8.—Modified Pajot's Manœuvre.

As the head descends to the vaginal orifice the forceps are carried forwards between the thighs (Fig. 9).

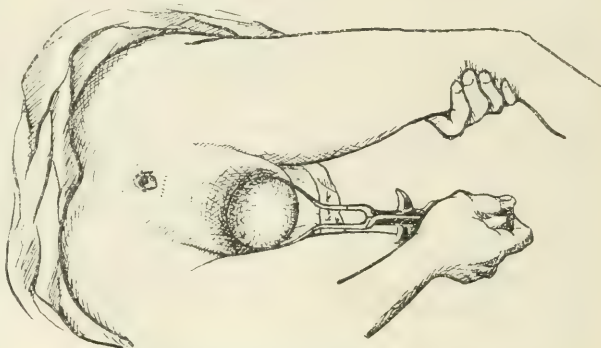


Fig. 9.—Bringing the Head down on to the Perineum with Forceps.

In cases of occipito-posterior presentations Whitridge Williams states that he can invariably rotate the head and deliver it in an occipito-anterior position by means of Scanzoni's manœuvre.

Most authorities, however, do not consider this so easy of accomplishment, and think that the forceps are more or less passive, being carried forward with the long rotation that usually occurs when the head reaches the pelvic floor. By Scanzoni's method the forceps, which have rotated backwards, are taken off and readjusted with the curve forwards, so that the pelvic curve of the forceps is turned to suit the forward rotation of the occiput.

It is most important to remember that in all cases of forceps delivery continuous compression of the foetal head must be avoided; hence permanent fixing by tying the handles of the forceps together is bad practice, for between the "pains" and traction the blades

should always be partially released and separated.

Removal of the Forceps. When the head is well down at the vaginal orifice and the perineum is stretching with each "pain" it is advisable to remove the forceps (except perhaps in difficult cases of persistent occipito-posterior presentation, and in some cases of face presentation in which it is necessary to deliver the chin past the symphysis in mento-anterior positions) in order as far as possible to avoid lacerations of the perineum. The removal of the blades of the forceps is accomplished by unlocking the handles and rotating first one blade and then the other backwards under the stretched perineum. Care is taken to keep the cephalic curve of the blade close against the convexity of the head; in this way no strain is put on the stretched perineum and the instrument can be removed by passing the handle between the thighs of the patient and up towards her abdomen. This manoeuvre ensures continued apposition of the cephalic curve of the blade to the vault of the foetal skull (Fig. 10).

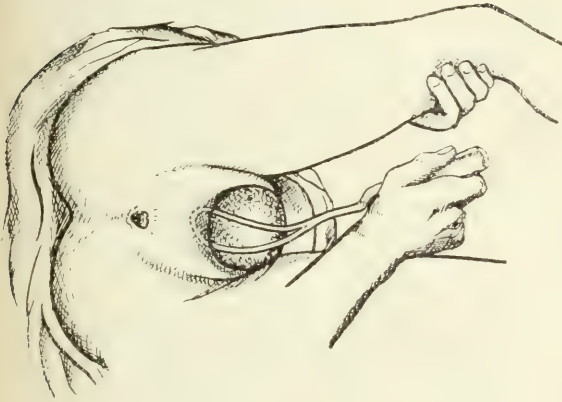


FIG. 10.—Removal of the blade of the Forceps.

Enlargement of the Pelvic Girdle.—There are two operations, symphysiotomy and pubiotomy, by which an enlargement of the pelvic ring may be obtained; and section of the pelvic girdle is carried out in both. These operations are rarely performed, and should never be attempted by any one who is not a skilled surgeon, and then only in favourable surroundings and in carefully considered circumstances.

Conditions which must obtain in connection with the performance of Symphysiotomy and Pubiotomy

Munro Kerr states that the essential conditions are—

1. The child must be alive.
2. The pelvis must be of sufficient size and there must not be too great disproportion between it and the foetal head.

3. The passage must be well dilated.

4. The parturient canal must not be infected.

Later he adds, that these operations should never be performed upon a primigravida.

Most authorities agree with these conditions, although in regard to the fourth it is impossible to say that the condition of the parturient canal would not be considered "suspect" in the majority of cases if it were Cæsarean section that was contemplated.

Indications for Symphysiotomy and Pubiotomy

These operations have, as already stated, a limited, but, within correct limitations, a distinct place among the methods of the expert obstetrician for the delivery of a live child.

In those cases in which there is no great disproportion between the foetal head and the conjugate diameter—that is to say, in the border-line cases in which ordinarily the question of Cæsarean section might be in the balance with the induction of premature labour if the case were to be considered during pregnancy—in such cases when the conjugate diameter is not under three inches, the labour is well in progress and the other conditions alluded to are fulfilled, one of these operations may be the very best method of terminating the labour in the interests both of the mother and the child. So, also, in persistent brow and face presentations these operations have on occasions afforded a solution of the difficulty.

Symphysiotomy and Pubiotomy are, then, operations rather of the moment than of anticipation.

Symphysiotomy

This consists in the division of the symphysis pubis in order to allow of outward and downward rotation of each half of the pelvic girdle. The average gain in the true conjugate is about one centimetre for a pubic separation of six centimetres between the divided ends of the bone.

It is interesting to recall the fact that in rodents the pelvic girdle separates widely at the symphysis pubis during parturition; and it is probable that in most of the lower animals some degree of symphyseal stretching or separation occurs.

Symphysiotomy is carried out either by the open or subcutaneous method. The former is probably the safer. It is performed by exposing the anterior surface of the symphysis, during which process the suspensory ligament of the clitoris is cut through. A director is then passed behind the joint, which is divided with a blunt-pointed bistoury. During the delivery of the child the pelvis is supported by assistants, and pressure is likewise maintained afterwards while the wound is being closed. This is accomplished by suturing first

the periosteum, and then the fascia with chromic catgut, and finally the skin.

Owing to the greater liability of injury to the urethra and the venous plexus at the neck of the bladder and round the orifice of the vagina, and the greater difficulty of after-treatment subsequent to symphysiotomy most surgeons prefer pubiotomy, which gives rise to rather less trouble in these respects.

Pubiotomy

This operation has the same object as symphysiotomy, and the enlargement produced in the pelvic diameter is practically the same. Pubiotomy may be performed subcutaneously as recommended by Döderlein and others, or by the open method. In either case a Gigli's flexible saw is used to divide the pubic bone a little external to the symphysis. The section of the bone may be made by dividing it vertically downwards or slantwise from above downwards and outwards. The latter direction is said to reduce the chances of damage to branches of the internal pudic artery.

With either method there is some risk of bleeding if the corpus cavernosum be damaged at all. If the subcutaneous method be used a saw-carrier is passed from below, between the labium minus and majus of that side close round the back of the pubic bone and out above and inside the pubic spine, which can previously be located with the finger. The degree of angle required in regard to the section of the bone is gauged beforehand. In the open method an incision is made transversely over the pubic spine, and the forefinger is pushed close behind the pubes to displace the bladder and its plexus of veins. A saw-carrier is then passed between the finger and the pubic bone and brought out below through another small incision. Finally, in either case, the bone is divided with the saw.

During the delivery of the child the pelvis is supported on either side, and at the termination of labour the wounds, which have been carefully protected, are freed from blood and closed with sutures. A bony union not infrequently follows if the pelvis be well supported, and the patient submitted to sufficient rest in bed.

Cæsarean Section.—This operation, which is of great antiquity, has of recent years become an operation of predetermination and election in a large variety of cases.

Indications

1. Pelvic deformities. In the vast majority of cases of contracted or funnel-shaped pelvis, which have been recognized before frequent examinations or attempts at delivery have been made, Cæsarean section should be performed in order to secure a living child.

Reference to infected or "suspect" cases will be made later on.

Further it may be laid down that when the true conjugate diameter measures under two and a quarter inches craniotomy is extremely difficult or impossible, and is accompanied by such a high mortality that Cæsarean section should always be preferred, alone or together with hysterectomy according to circumstances.

2. New growths of the genital organs or pelvic structures obstructing the passage of the fetus.

(a) Fibromyomata of the uterus, when these growths obstruct the pelvic channel. As a rule such tumours grow from the supravaginal cervix or the posterior wall of the uterus, and they may fill the pelvis. If the tumour be subserous and have a long pedicle it can sometimes be pushed out of the pelvis and the child extracted, but most frequently Cæsarean section followed by hysterectomy is demanded when the pelvis is blocked by fibromyomata.

(b) Cancer of the Cervix. If it be decided that complete removal of the uterus together with the growth is not likely to be of much avail to the mother, then the pregnancy should be allowed to go to term and the child delivered by Cæsarean section.

(c) Cancer of the vagina. The same remarks apply to cancer of the vagina as to cancer of the cervix uteri.

(d) Cancer of the rectum or bladder. Occasionally, especially with cancer of the rectum, there may be a tumour sufficiently large to prevent delivery, in which case Cæsarean section should be performed at full term.

(e) Tumours of the ovary. These may be innocent or malignant. Most frequently labour has been obstructed by dermoid cysts and by fibromata. If the case be seen during labour, it is generally possible to displace the tumour upwards and to deliver the child; but if this be impossible Cæsarean section should be performed with removal of the tumour, in preference to removal of the tumour by the abdominal route and allowing the labour to pursue its own course. If the tumour were discovered some time before labour, it should, of course, be removed and the pregnancy be allowed to continue.

(f) Tumours of the pelvic parietes. Exostoses and sarcomata may obstruct delivery, in which case Cæsarean section may be called for.

3. Narrowing of the vagina by cicatrization or in elderly primigravidae may form an indication for delivery of the child by this operation.

4. Placental conditions. Cæsarean section has not infrequently been performed for—

(a) Central placenta prævia. Such treatment is undoubtedly sound when the patient is a primigravida; but the general opinion is

that in multiparæ, version is the better treatment, unless the hæmorrhage be unusually profuse, with but slight dilatation of the cervix.

(b) In accidental hæmorrhage, especially when partially concealed, some operators have removed the uterus after performing Cæsarean section.

5. Rupture of the uterus. In rupture of the uterus without the delivery of the child or its escape into the peritoneal cavity, Cæsarean section with or without removal of the uterus may be called for. If the rupture be at the fundus—as it may be when caused by a fall or after ventral fixation—then the laceration may be closed by suture after the child has been removed. When the rupture occurs during delivery, after removing the child the operator should always perform hysterectomy.

6. Deformities of the uterus. Pregnancy in a bicornute uterus is not uncommon. When the horn is badly developed the condition usually resembles in its clinical course a tubal pregnancy; but when the horn is fully developed the pregnancy may go on to full term. In these circumstances delivery of a live child may be impossible owing to pelvic contraction—for the conjugate diameter is often small when the uterus is bicornute—or (and) owing to obstruction by the non-pregnant horn, which enlarges considerably with pregnancy in the other cornu. I have performed Cæsarean section in such a case.

7. After ventral and vaginal fixation of the uterus, dystocia has frequently been met with, and in some cases Cæsarean section has been necessary owing to rupture of the uterus (*vide supra*), or because its fixation in a malposition has interfered with the course of labour. Consequently I do not think that ventral and vaginal fixation—that is, absolute fixation of the corpus uteri to the abdominal or anterior vaginal walls—are justifiable operations during the child-bearing period.

8. Maternal disease. In serious cases of heart disease in which it is advisable to avoid the strain of labour, and in eclampsia, especially when the cervix is rigid, and immediate delivery is imperative, Cæsarean section is not infrequently a procedure of great value.

9. Post-mortem Cæsarean section should be performed if the mother die with a live and viable child in her womb. In such circumstances it is obvious that section must be immediately and rapidly performed if the child is to be saved.

From the foregoing indications it will be evident that Cæsarean section is an operation with a very extensive sphere of usefulness.

Contra-indications to the Operation

1. When the conjugate diameter is over two and a quarter inches, and the child is dead, and

attempts at delivery have been made. In these circumstances craniotomy should be performed.

2. When, with a conjugate diameter over two and a quarter inches, repeated examinations and attempts at delivery have been made. In these circumstances the child should be destroyed, owing to the danger of infection if Cæsarean section be performed.

The Technique of the Operation

The operation may be carried out during or immediately preceding the onset of labour. The latter is probably the better time to select if there be a choice in the matter. It has been found that contraction and retraction of the uterus occur as well before as after parturition.

There are two forms of operation: the intra-peritoneal and the extraperitoneal.

Intraperitoneal Cæsarean Section. After purification of the skin of the abdomen an incision about eight inches in length is made, either entirely above the umbilicus, as practised chiefly in America, or two-thirds above the umbilicus and one-third below.

These high incisions give better access to the fundus and upper portion of the uterus than those below the umbilicus. If an intramuscular (somatic) injection of infundibulin were not given at the commencement of the operation, 1 c.c. of a twenty per cent. solution should now be injected directly into the wall of the uterus.

The uterus is next incised as it lies within the abdomen, or after delivery through the abdominal wall. Many modern operators do not deliver the uterus, and one at least (Wallace) deliberately sews the uterus to the parietes after Cæsarean section in order that subsequent operations may be performed extraperitoneally.

Delivery of the uterus through the abdominal incision has the advantage that the peritoneal cavity can be more efficiently packed off and kept unsoiled by blood and amniotic fluid. This is especially important in "suspect" or infected cases. Extraction of the placenta and child is also facilitated. Some authorities with the largest experience favour delivery of the uterus before incision. With a somewhat limited experience of the operation, it appears to me the simplest method of performing it, and it has only the small disadvantage of a rather larger incision in the abdominal wall than is necessary if the uterus be not delivered.

The incision through the uterine wall is made longitudinally in the mid-line from just below the summit of the fundus down through the upper portion of the anterior wall. It should not extend into the lower uterine segment.

Transverse incisions have been practised, but on the whole the longitudinal is the better. When the muscle wall of the uterus has been incised the membranes or placenta present;

these are torn through and the fœtus is extracted by the feet. The cord is clamped in two places and divided, and the child handed over to an assistant for resuscitation, should that be necessary. The placenta and membranes are then stripped off and removed, and two fingers are passed through the cervix to ensure dilatation of the canal with drainage of the uterine cavity. In "suspect" or infected cases the placenta and membranes may be pushed through the cervix and be removed per vaginam.

If the cervix be rigid, a strip of gauze should be passed through the cervical canal to drain the uterus for twenty-four hours.

After the uterine contents have been delivered, gentle massage of the uterus is carried out by the assistant in order to encourage contraction.

The incision in the uterine wall is now closed in the following manner.

Interrupted sutures of chromic catgut are inserted one-quarter to one-third of an inch apart, and they are so placed that they embrace the whole thickness of the muscular wall down to but not through the mucosa. These sutures are carefully tied, for there appears to be some danger of their becoming loosened by the subsequent movements of the uterus. A superficial finer chromic catgut continuous suture is next inserted to close the peritoneum over the uterine incision. This is best accomplished by using the Lembert method of suture. As a rule there is but moderate bleeding if the operation be carried out expeditiously, consequently neither the tourniquet nor any of the many other methods devised for checking hæmorrhage need be adopted.

The abdomen is closed in the usual manner.

The after-treatment is carried out on ordinary lines, but care must be taken to see that the lochia escape in the normal manner. There is sometimes a danger of the discharge becoming pent up, hence the advisability of ensuring free drainage in the manner described above. The baby may be put to the breast at the usual time.

The mortality of the operation (about ten per cent. for all cases) has been somewhat high owing to the fact that many septic cases have been operated upon; and also because many operations have been carried out for more or less desperate conditions, and not always in the best surroundings.

Extraperitoneal Cæsarean Section has been advocated by several German authorities. Access is gained by an incision parallel to Poupart's ligament and the bladder is pushed aside. The incision into the antero-lateral wall of the uterus is made in the lower uterine segment. This operation has been recommended for infected cases, but it is difficult to see what advantage could be gained in such circumstances, for infection of the cellular tissue would be a most serious matter.

Extraperitoneal Cæsarean section has been performed in the United Kingdom on very few occasions.

Hysterotomy.—This operation, often misnamed "vaginal Cæsarean section," is a most useful procedure in selected cases.

I believe, however, that it should not be chosen in preference to abdominal Cæsarean section for the delivery of the full-term fœtus. But it is an expeditious method of emptying the uterus during the early months of pregnancy. All operators know how difficult may be the delivery of a twenty-week old fœtus through the cervical canal. This procedure is made easy by hysterotomy. The operation also is of great service in certain other gynæcological conditions, such as the removal of growths from the interior of the uterine cavity.

Technique of the Operation

The perineum is retracted with a speculum, and the cervix, seized in two pairs of volsellum forceps placed laterally, is drawn down. An incision is then made through the vaginal mucosa around the anterior lip at the point of reflexion. This enables the operator to separate the bladder from the anterior wall of the cervix and uterus with the finger, alone or with the assistance of a gauze dab. Next the cervix is divided with scissors in the anterior median line through the internal os. The length of the section of the anterior wall of the lower uterine segment will depend on the size and age of the fœtus to be extracted. The membranes are ruptured, a leg is seized and the child delivered. There may be some difficulty with the after-coming head, and this must be met according to the circumstances.

If the operation be performed when the child is at full term (in my opinion this should not be done), and the woman be a primigravida, then it will usually be necessary to make a para-vaginal incision, as first devised for other gynæcological procedures by Schuchardt, in order to deliver the child.

After the uterine contents have been evacuated the cavity of the uterus is douched out with hot sterile water and an intramuscular injection of infundibulin given to cause contraction of the uterus.

The incision in the cervix is then sutured with chromic catgut and the vaginal fornix closed.

If the cervix were not dilated at the commencement of the operation it is usually advisable to drain the uterine cavity with gauze for twenty-four hours.

II.—Operations involving the Destruction of the Live Fœtus and the Delivery of the Dead Child

These operations, which often involve the destruction of the live child, may be classed under the general heading of "Embryotomy."

Fortunately they are rarely called for, but in certain circumstances they are not only justifiable but are demanded.

Craniotomy.—This procedure consists of the various means adopted to reduce the size of the foetal head; but the description will also include the extraction of the head after it has been crushed.

Indications

1. Large size of the foetal head, such as hydrocephalus. Also the large size and aplasticity of the foetal head, which are seen in cases of prolonged gestation, but not discovered until parturition is in progress, or possibly until the trunk has been born.

2. Contracted pelvis, when the true conjugate measures at least two and a quarter inches (it is a very serious thing to attempt craniotomy with a less diameter), and the child is dead or dying, or repeated efforts have been made to deliver, or the parturient canal is most probably infected.

3. Obstruction by growths. The same remarks apply as in the case of a contracted pelvis. But it is very rarely that a foetal head should be crushed and dragged past a growth.

4. When the child is dead and simplification and rapidity of delivery are required.

5. In malpresentations in which delivery is impossible and labour is advanced. These may be persistent mento-posterior face, occipito-posterior vertex and brow presentations.

6. Difficulties in delivery with multiple pregnancy. Such may be caused by "locked twins" or by monsters.

7. In serious disease in the mother, such as eclampsia and heart disease, when the labour is difficult and advanced, and immediate delivery is necessary, craniotomy is sometimes the best procedure to adopt. (Refer also to *Cæsarean Section*.)

8. With tetanic contraction of the uterus, when it is impossible to deliver the child rapidly by other means.

Although this is a long list of possible indications for the performance of craniotomy it must be remembered that it is the *possibility* only which should be considered in most cases, for the child is usually alive. With more careful investigations and observations concerning the pregnant patient before parturition, and with the great improvements in the technique of Cæsarean section, and also with the possibilities attaching to symphysiotomy and pubiotomy, craniotomy should be a very exceptional method when the child is alive. With hydrocephalus, with a

dead child and moderate grade of pelvic contraction, with impacted malpresentations of the vertex and with certain monsters craniotomy will always be the method of election. Possibly also, until we discover an efficient method of preventing the high mortality following Cæsarean section in infected cases, craniotomy must have its place in such circumstances; for we must always consider the mother's life first, not only on sentimental grounds but also for state reasons, since it is probable she will have more children in the future.

Craniotomy has been entirely displaced by Cæsarean section in all cases in which the obstetrician has known before labour of pelvic contraction.

Perforation

Perforation of the foetal head is carried out with an instrument specially devised for the

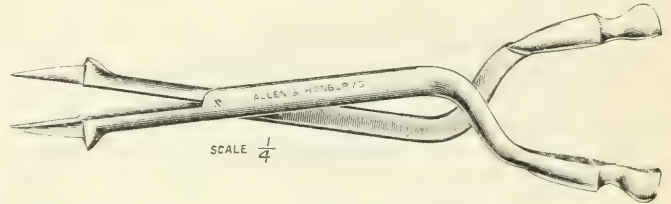


FIG. 11.—Oldham's Perforator.

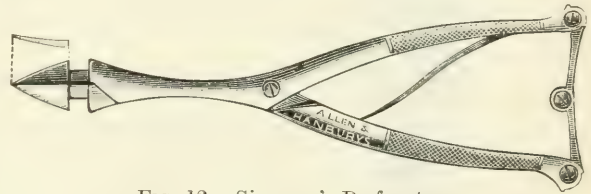


FIG. 12.—Simpson's Perforator.

purpose. The types in common use in this country are Oldham's (Fig. 11) and Simpson's (Fig. 12).

The bladder and the rectum are first evacuated as before forceps delivery. The patient is then placed in the lithotomy or the Sims' position and anæsthetized. The left hand is now passed into the vagina until the tips of the fingers reach the vertex. The perforator, which should always be very sharp, is guided by the right hand up to the foetal skull. Under the guidance of the fingers of the left hand the point of the instrument is placed upon the most presenting portion of the vertex—usually the anterior parietal bone—as far forwards as possible. In brow presentations the perforation will be through the frontal bones; in face presentations through the orbit or mouth, and in the after-coming head in the occipital region. Bone should be perforated and sutures and fontanelles should be avoided. At the same time an

assistant fixes the foetal head in the pelvic brim if it be not firmly engaged in the pelvis; then the operator, holding the perforator securely with the right hand between the handles and in a line with the point, thrusts the blades through the foetal skull as nearly as possible *at right angles to the surface*, great care being taken to prevent the points slipping. When the blades have entered up to the shoulders of the instrument the handles are pressed together and the cutting blades separated. Next, the instrument is partially withdrawn, turned through a quarter of a circle, reinserted, and the blades again separated. When perforation of the after-coming head is being carried out, an assistant should make traction on the legs of the child. A large aperture having been made, the point of the perforator is thrust on into the cranial cavity, to destroy the brain and medulla. The contents are then washed out of the cranium with sterile water.

Crushing and Extraction

For vertex presentations with the head low in the pelvis, ordinary forceps may sometimes be effectively used after perforation. But as a rule extraction is best accomplished by the three-bladed cephalotribe (Fig. 13), which is

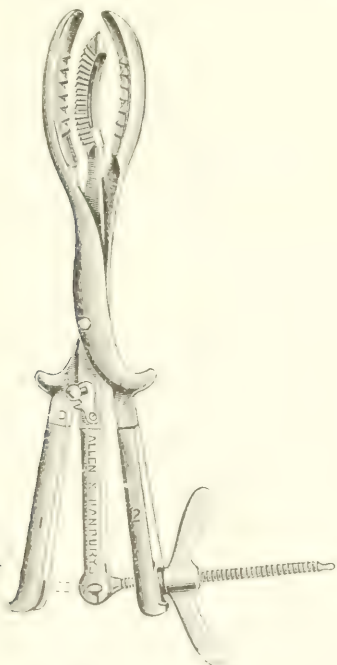


FIG. 13.—Three-bladed Combined Cephalotribe and Cranioclast.

really a combination of the cephalotribe and cranioclast. This instrument is used for crushing previous to extraction, in the following manner. After perforation and evacuation of

the cranial contents have been effected, the assistant steadies the foetal head while the operator inserts the middle blade of the instrument through the perforation aperture and right on to the base of the skull.

Next the first external blade should be applied over the face, being introduced in the same manner as one blade of a pair forceps. When this has been adjusted the screw is tightened and the face crushed. Next the second blade is introduced, placed over the occiput and adjusted. The posterior portion of the skull is then crushed in a similar manner (Fig. 14).

Extraction is now accomplished by rotating the head so that the flattened-out skull lies in the transverse diameter. Traction must be made well backwards in the direction of the axis of the brim.

The after-coming head can usually be extracted with the crochet (Fig. 15) after perforation.

Instruments have also been devised and used for removing pieces of the perforated vault of the skull (cranioclasts). The same instruments (cranioclasts) may be used for traction, one blade being inserted inside the vault and the other outside. The cranioclast, however, has been almost entirely superseded by the three-bladed instrument described above. Another

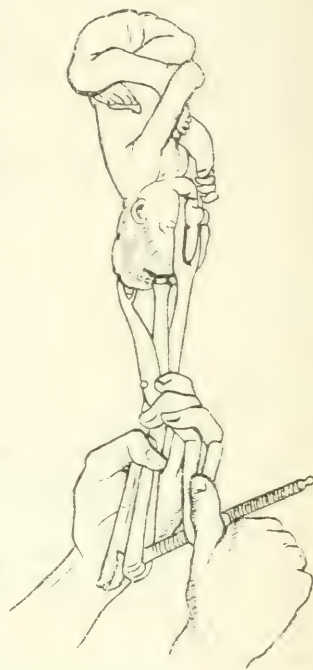


FIG. 14.—The combined Cephalotribe and Cranioclast in position. The blade over the face has been screwed up and fixed. The blade over the occiput is being screwed tight to crush the posterior portion of the head.

(After Munro Kerr.)

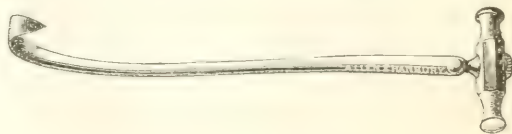


FIG. 15.—The Crochet.

instrument—the basilyst—was devised to break up the base of the skull. The best type of instrument consists of three blades. Two are arranged like a perforator, and terminate to-

gether in a screw which, after being screwed into the base of the skull, can be separated like the blades of the perforator. When fracture of the base of the skull has been accomplished the outer blade is adjusted to effect extraction by obtaining a grip outside the skull after the manner of a cranioclast. This operation (basilysis) is rarely performed and could only be called for in extreme degrees of pelvis contraction, in which, as already stated, craniotomy is rarely justifiable.

Cleidotomy.—This operation, which consists in the division of the clavicles, may be performed after perforation of the vertex in the case of an exceptionally large foetus—such as is occasionally seen in post-maturity. The operation diminishes considerably the bis-acromial diameter, and allows a large trunk to be delivered with comparative ease.

Technique of the Operation

The clavicles are best divided with a long, strong pair of scissors with sharp-pointed blades. Two fingers are passed along the ventral aspect of the child and the clavicle identified; the scissors are then passed up under the protection of these fingers and the sharp point of one blade is pushed through the skin and under the clavicle, which is then snipped through. A similar proceeding is carried out on the other side.

Evisceration.—Evisceration of the foetus may be performed, together with perforation of the skull, in cases of extreme pelvic contraction. It is also performed alone or with perforation of the skull in pathological conditions of the foetal viscera, such as abdominal tumours and ascites; also in transverse presentations when the head cannot easily be decapitated, and in some monsters.

Technique of the Operation

The foetus is fixed from above by an assistant while the operator opens the abdomen or thorax with a perforator or scissors. If evisceration be performed in a transverse presentation the foetus may be fixed by the assistant exerting traction on an arm.

After an opening has been made in the abdomen the viscera are removed manually. Attention is next turned to the contents of the thorax; access to this may be gained through the diaphragm, and the lungs and heart delivered through the abdominal opening. In some cases it is necessary to open both the abdomen and thorax. The eviscerated child can be delivered doubled up, by traction on the legs or in some cases by the crushed head.

Spondylotomy.—This operation, usually carried out together with evisceration, may be performed in cases of impacted transverse presentations in which the neck is out of reach, and in which decapitation is therefore impossible. The operation consists in the division of the vertebral column which is localised with the left hand in the vagina. The section is accomplished with scissors under the guidance of the localising fingers.

After complete division of the trunk has been effected the lower half of the foetus is extracted by the legs, the upper part being delivered subsequently.

Great care must be taken lest the projecting foetal bones lacerate the vagina of the patient.

Decapitation.—Decapitation of the foetal head is an operation which is sometimes necessary before delivery can be satisfactorily accomplished.

Indications

1. Transverse presentations in which the membranes have ruptured and the foetus has become impacted.

2. With double-headed monsters one head must be decapitated before delivery can be effected.

3. With "locked twins," when the after-coming head of the first child is locked with the fore-coming head of the second, the head of the first should be decapitated to allow of the removal of the trunk of this child in order that the second may be delivered safely.

4. With an after-coming head, when the pelvis of the mother is contracted or when the foetal head is hydrocephalic, decapitation may sometimes be performed to facilitate delivery.

The decapitated head should be removed from the uterus after delivery of the trunk with forceps or with the crochet, if there be no great disproportion between the foetal head and maternal pelvic capacity. If there be any difficulty the head should be crushed.

Contra-indications to Decapitation

In some cases of impacted transverse presentations the lower uterine segment may be unduly thinned; in such circumstances there is danger of rupture of the uterus if decapitation be attempted, consequently the operator may decide that evisceration and spondylotomy are safer procedures. So, too, when the neck is out of reach and decapitation is therefore impossible the procedures just mentioned should be adopted.

Technique of the Operation

Many different instruments have been devised for the purpose of decapitation. Ramsbotham's

hook either with a serrated or smooth cutting edge (Fig. 16) or Jardine's cutting hook (Fig. 17) are most generally used in the United Kingdom.



FIG. 16.—Ramsbotham's Decapitation Hook.

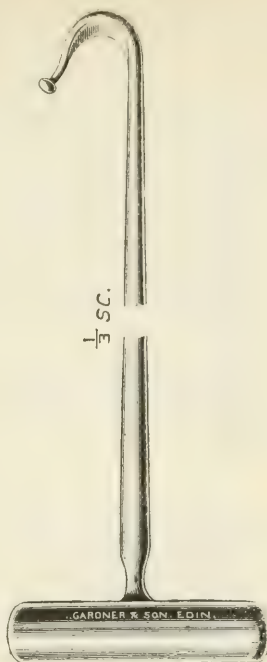


FIG. 17.—Jardine's Decapitation Hook.

The latter is probably the better of the two instruments. Braun's hook for dislocating the

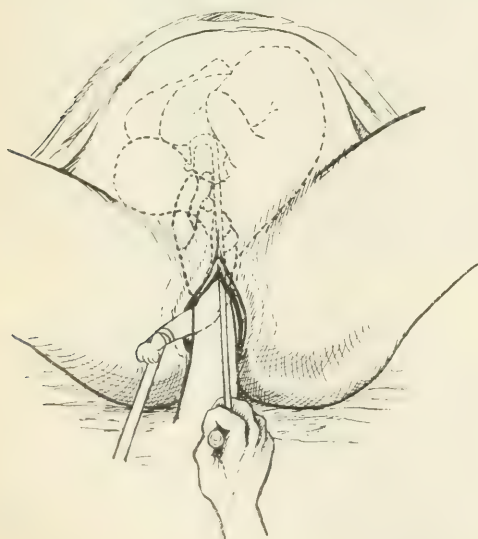


FIG. 18.—Decapitation of the Foetal Head.

vertebræ, the soft structures of the neck being subsequently divided with scissors, is but rarely used in this country, but is recommended by many American authorities.

The method of decapitation used in an impacted transverse presentation will be described here, since it is chiefly for this condition that decapitation is performed.

The operation is carried out in the following manner. The operator first inserts his left hand into the vagina, and locates the neck. If an arm present this should be dragged down by an assistant in order to fix the neck at the brim of the pelvis. The hook is then passed up along the palm of the left hand, over the shoulder or chest of the foetus according to the presentation, and so on to the anterior surface of the neck. The hook is now pushed on until the free extremity reaches the upper border of the neck, when the handle of the instrument is rotated so that the neck lies within the cutting edge. The instrument is carefully guarded by the hand in the vagina so that no damage shall be done to the maternal parts (Fig. 18).

Finally a sawing movement is imparted to the cutting edge by the right hand of the operator, and the foetal head is severed from the trunk.

Complete Embryotomy.—This involves not only the operations mentioned above for reducing the size of the child, but also the complete dismemberment of the foetus, so that it may be removed piecemeal. While all the above embryotomical operations are very rare in the present day, this procedure is probably the rarest of all and should only be resorted to in cases of extreme difficulty.

III.—Operations for the Repair of Parts lacerated during Parturition

Repair of Lacerations of the Cervix.—Some degree of laceration occurs in almost every first confinement. When the membranes have not ruptured early, and when dilatation has been slow and regular, lacerations are less likely to occur. But when the membranes have ruptured early or manipulations have been carried out before the cervix is fully dilated, then serious tears may result.

It is most important that all lacerations which can definitely be detected should be repaired with sutures, either at the conclusion of parturition or under more satisfactory conditions on the following day. Otherwise the patient may become infected at the sites of laceration, or more remotely she may suffer from leucorrhœa from the everted mucosa, or even develop cancer at the site of injury. Lacerated cervixes are far too commonly ignored at the time when they might with every advantage be repaired.

Technique of the Operation

After the delivery of the placenta the cervix is exposed with a speculum and carefully

examined with the finger and by direct observation. If a laceration be detected the anterior and posterior lips should be seized in two pairs of volsellum forceps and the uterus gently drawn down. With a full curved needle two or three chromic catgut sutures are inserted and tied in such a way as to bring together the raw surfaces (Fig. 19).

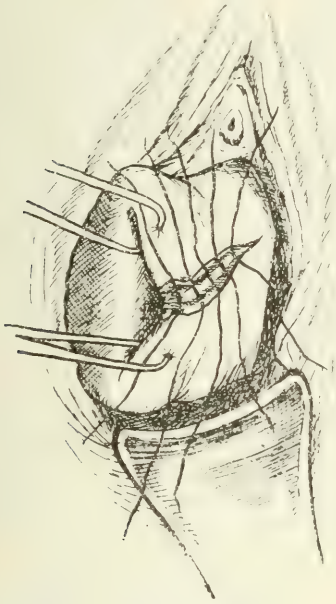


FIG. 19.—Repair of Recent Laceration of the Cervix.

The operation is an extremely simple one; but the recognition of small tears in the cervix is not easy owing to the swollen and congested condition of the parts immediately after delivery.

Repair of Lacerations of the Vagina and Perineum.—All lacerations of the vagina and perineum should be repaired immediately, or, as with cervical tears, on the day following parturition if better conditions of light and assistance can be obtained.

As a rule lacerations of the perineum are associated with lacerations of the vagina, although the vagina alone may sometimes be lacerated in the upper part by forceps or other instruments which have slipped, or by exposed and jagged foetal bones. Laceration of the vaginal canal should be repaired with chromic catgut sutures in the ordinary way, just as any cut or laceration is sutured; such wounds of the vagina are usually superficial. But when there is a vaginal tear associated with incomplete laceration of the perineum—that is to say when the rent does not extend into the rectum—more careful suturing is necessary.

Incomplete Lacerations of the Perineum and Vagina

If the laceration extend far up the vagina it is advisable to commence by suturing the upper end of the vaginal laceration, for there the wound is most superficial. The vaginal laceration is directed, as a rule, laterally up the side of the rectum. But when the perineum is reached the stitches are passed from the vaginal surface very deeply and widely on each side so as to include the muscular and fascial structures that have been torn asunder (Fig. 20). Care

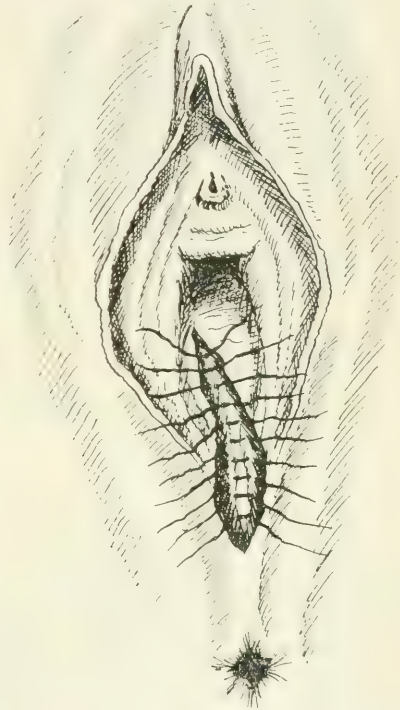


FIG. 20.—Repair of an Incomplete Laceration of the Perineum.

must be taken not to pierce the rectum. The sutures are tied from above downwards after all have been inserted.

Finally the skin surface of the perineum is closed with a *subcutaneous suture*. If this form of suture be used infection is much less likely to occur than with sutures passed through the skin.

Complete Laceration of the Perineum

In complete laceration of the perineum the vagina is also torn as with incomplete lacerations. But while the laceration in the vagina is superficial in the upper part, the tear through the perineum involves the rectum. First of all the rectum must be repaired, and this should *not* be done with interrupted sutures tied in the

rectum, as almost universally recommended. Such a procedure courts disaster by allowing infection to spread from the rectum along the sutures.

The rectal laceration must be repaired by means of a turning-in stitch of fine chromic catgut (Fig. 21). The needle takes a bite of the

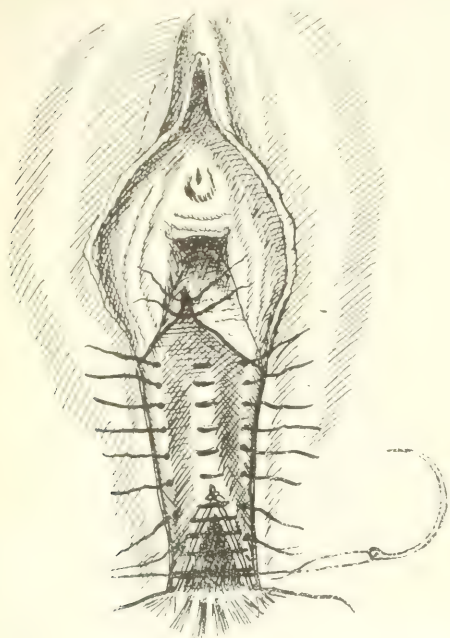


FIG. 21.—Repair of a Complete Laceration of the Perineum.

rectal wall on each side alternately without penetrating into the rectum. In this way subsequent infection is avoided. Next a suture of the same material is passed to include and bring together the separated ends of the sphincter ani muscle (Fig. 21). Attention is now turned to the vagina and perineum, which are repaired in the manner already described for incomplete lacerations, the skin surface covering the perineum being approximated as before with a subcutaneous suture.

After-treatment of Operations on the Perineum and Vagina

This is important. It is advisable to irrigate the vagina daily through a double channel irrigator with a weak antiseptic lotion, such as two drachms of tincture of iodine in a pint of water. When the laceration does not involve the rectum the bowels should be kept acting daily from the second day. If the feces be hard olive oil should be injected into the rectum to soften them some hours before the bowels are expected to act. When the laceration is complete the patient should be kept on fluids, with plenty of milk, for six days. On the

sixth day the bowels should be opened by means of an aperient, following by an olive oil enema very carefully given.

Such is a brief *résumé* of the main principles of obstetrical operations as carried out at the present time. With the advance of surgery measures conservative both to the child and mother have obtained a firmer footing. But in spite of this there is ample room for improvement in our technique, and in our methods for dealing with some of the more serious conditions, such as infected or "suspect" cases with contracted pelvis in which destruction of the child is still the best method of treatment. We hope for that day when it will never be necessary to sacrifice normal children. And all our hopes seem to centre not so much on aseptic midwifery on the part of the general practitioner—that is almost universal—as on the proper observation of the patient during pregnancy, and on the full investigation, anatomical and physiological, of every woman before she is called upon to make her contribution—especially her first—to the perpetuation of the race. W. B. B.

THE ABNORMAL PUERPERIUM

The abnormalities of the puerperium will be dealt with under the heads of *Fever*, *Pain*, *Hæmorrhage* and *Sudden Death*. *Puerperal Insanity* is treated of on page 943.

I.—Fever in the Puerperium

Fever occurring in the puerperium is, in the vast majority of cases, due to septic infection of the genital tract.

The subject of puerperal sepsis will therefore be first considered, after which the slighter and less common causes of fever will be dealt with.

Puerperal Sepsis

Pathology

Puerperal infection is either *heterogenetic*, the organisms being conveyed from any outside source by the medium of hands or instruments, or *autogenetic*, the organisms being already resident in the woman.

In regard to the first of these, the infective character of puerperal fever is well known, and is especially exemplified by the recurring epidemics that used to break out in lying-in institutions in the pre-antiseptic era. Now-a-days, owing to the general adoption of antisepsis, such evidence of conveyance from person to person is much more rarely met with, and then chiefly in the practice of lower-class midwives.

In regard to the second, it may be premised that though the uterus of a parturient woman is normally sterile, the vagina and vulva always contain organisms, though not commonly of an active pathogenic character. On occasion,

however, streptococci or virulent strains of staphylococci may be obtained therefrom.

It follows, therefore, that anything passing through the vagina into the uterus necessarily carries organisms into the cavity of the latter. Further, it may be pointed out that the closely adjacent bowel swarms with organisms, many of them of a potentially pathogenic character.

Under circumstances of tissue damage it is known that organisms may migrate from relatively distant parts to the injured area and set up inflammatory changes there.

It is for this reason that labours involving much damage to the uterine tissues are liable to be followed by sepsis, even though conducted with the greatest precautions, the infecting organisms having migrated from the bowel or spreading by upward growth from the vagina. This latter method of infection is facilitated if the uterus and cervix be unduly relaxed for want of firm retraction of the uterine muscle.

A further incentive to serious infection is the retention in the uterus of fragments of placenta or blood clot, for not only do they maintain the uterus in a relaxed state, but they provide the invading organisms with a medium on which to grow, uninterfered with by the cells of the patient.

In the large proportion of severe cases of puerperal sepsis the primary infection is a streptococcus. In many this is complicated by a secondary infection of *B. coli commune*, staphylococci or other organisms.

Occasionally the pneumococcus, gonococcus or staphylococcus assume the place of the streptococcus as the primary infection, and exceptionally organisms still less common than these are found in this rôle.

In the milder types of puerperal sepsis (termed "sapramic") the writer and A. G. R. Foulerton found that staphylococcus albus and *B. coli commune* were the organisms most commonly isolated. In many of these cases the interior of the uterus is sterile, the infection being limited to tears of the perineum, vagina or cervix.

The lesions of puerperal sepsis are of three kinds: (1) the primary lesion; (2) the consecutive lesions; (3) generalized or metastatic lesions.

1. *The primary lesion* is in almost all severe cases the placental site, but in slight cases a cervical or perineal laceration may take its place. The state of the primary lesion varies. It may be gangrenous, diphtheroid, or frankly suppurative.

2. *The consecutive lesions* comprise extension of infection to the tubes (salpingitis), the peritoneum (peritonitis), the broad ligament veins (thrombophlebitis) or the pelvic cellular issue (cellulitis).

In regard to these it may be remarked that where the infection is overwhelming inflammatory reaction may be entirely absent. Thus, on autopsy, it is quite common to find the peritoneal cavity contains a quantity of blood-stained serum, which, when examined, is found to swarm with streptococci, though signs of salpingitis and peritonitis are entirely lacking; and the same applies to the state of the pelvic cellular tissue.

3. *The generalized lesions* are those due to the presence in the blood of the toxins absorbed from the seats of the primary or primary and consecutive lesions, or to the entrance into the circulation of the bacteria themselves. The lesions are therefore of two types—toxæmic and septicæmic. To the first category belong the acute degenerations affecting the cardiac, hepatic and renal tissues which are always found post-mortem in fatal cases. To the second belong such conditions as septic pneumonia, pleurisy, pericarditis, cerebral abscess and endocarditis.

It may be emphasized here that toxæmic lesions are present in varying degree in all cases of puerperal sepsis, the leading symptoms of fever, rapid pulse and general illness being produced, of course, by the absorption of toxic substances from the seat or seats of infection. Septicæmic lesions, on the other hand, are limited to the graver cases only. They are, of course, accompanied by the lesions due to toxæmia.

The distinction between a condition of profound toxæmia and one of septicæmia *plus* toxæmia depends upon the presence in the latter case of actual organisms in a specimen of withdrawn blood and the occurrence of secondary inflammatory foci, only to be explained on the assumption of transportation of the organisms by the blood stream.

Symptoms

The symptoms of puerperal sepsis usually appear in the first week, and most commonly from the third to the fifth day. In very acute cases they may occur still earlier, or even date from the labour itself. In those cases in which they are postponed till the second week or later, some circumscribed local condition, such as pelvic cellulitis or thrombo-phlebitis, is probably present.

The onset of the pyrexia may be abrupt, with a rigor ("septicæmic" type), or may be gradual ("sapramic" type). In regard to the two terms quoted, it must be pointed out that the conception of a toxic condition solely due to the presence of saprophytic organisms in the uterus is bacteriologically unsound. These slighter cases of puerperal sepsis, commonly called "sapramic," are shown to be due to the

presence of the less virulent parasitic bacteria, such as the colon bacillus and staphylococcus albus.

It is not uncommon for the milder type to pass into the more severe type after a few days. The pulse-rate is, of course, quickened in proportion to the severity of the infection.

The mental condition of the patient varies. In the slighter forms much headache is complained of, and the patient feels languid; but in most of the severe cases the mind is unusually alert almost to the end. Sleep is broken or absent altogether. Pain is not a marked feature as a rule. The uterus is subinvolved and tender as a rule, and when the infection has spread to the broad ligaments these regions may also be complained of. As has been already stated, typical acute peritonitis is uncommon, the condition usually being one of passive infection. Moderate flatulent distension of the abdomen is present in these cases, with some tenderness on pressure, but the classical signs of peritonitis are absent. The discharge from the uterus varies. It may be very foul, grumous, puriform or absent altogether. The latter condition is characteristic of pure streptococcal infection with coagulative necrosis of the placental site.

If lacerations exist in the perineum they will be found either frankly suppurating, covered with a diphtheroid film or actually sloughing. In all bad cases looseness of the bowels is present, but vomiting is not common. In patients fatally ill there is nearly always complete loss of control of both the vesical and anal sphincters.

Course and Types. The foregoing are the leading symptoms generally met with, but in a condition so variable, not only in the nature of the infection, but as regards the location and extent of the lesions, it is obvious that the clinical picture varies in different cases; a rough classification of the different forms is, however, feasible.

The Mild Type. In these cases, commonly described as cases of "sapræmia," the fever is moderate in extent, rigors are absent, and the pulse-rate may at no time exceed a hundred. The lochial discharge is usually foul and may be excessive, the uterus being tender and abnormally large. The patient has a sallow languid look, complains of headache, and is often emotional. Such cases, if untreated, may after some days develop acute symptoms. As has been stated, this condition is usually due to infection by staphylococci or an exalted strain of the colon bacillus. In many the infection is limited to perineal or cervical lacerations, and the interior of the uterus escapes altogether; in such the uterus involutes normally and is not painful.

The Fulminant Type. The onset is abrupt,

with a shiver or rigor, the pulse is very fast—130 and over—and the temperature high, with but little remission. In the worst cases the fever has existed practically since the labour. No pain is complained of as a rule. The abdomen is somewhat distended, the bowels loose, and, in spite of the striking activity of the mind, complete incontinence both of feces and urine exists. The duration of these cases is usually short, death occurring in from three to five days of the onset of the symptoms.

The Acute Type. This is often called the "septicæmic" type, though septicæmia is not necessarily present. The onset is usually from the third to the fifth day, but examination of the chart shows that the temperature has never been quite satisfactory since the labour. Not infrequently for several days prior to the onset symptoms of the milder type of infection previously described have been present. The temperature rises sharply, often with a rigor, the pulse is rapid—110 to 120—the mind is usually clear, but delirium may occur. The uterus is subinvolved and often very tender. Much pain may also be complained of in the region of the broad ligaments. The symptoms in general are the same as those seen in the fulminant type, but less severe. The course varies. In many cases death occurs; others pass into the continued type, next to be described.

The Continued Type. In these cases the fever continues high for many days; marked remissions may occur, and repeated rigors. In such the principal lesion present is thrombophlebitis of the pelvic veins (see p. 933). In others a more continued pyrexia is present. The pulse is fast, the patient rapidly wastes, and profuse sweating may be noticed. A definite collection of pus may form in the cellular tissue of the pelvis—most commonly on the left side. Femoral thrombo-phlebitis is often present as well. The discharge from the uterus is probably purulent. Sub-involution may or may not be present.

Abortive Type. Sudden subsidence of the symptoms is commonest in the milder types of the disease. Occasionally, however, acute streptococcal infection may abort. These cases are important in that the infective nature of the condition may be unrecognized, and precautions against its conveyance to other patients hence may be neglected.

Late Types. When signs of sepsis manifest themselves late in the puerperium one of three conditions is usually present: pelvic cellulitis, ilio-femoral thrombo-phlebitis, or pyosalpinx.

Pelvic Cellulitis. Infection of the cellular tissue is a common consecutive lesion in cases of puerperal sepsis that occur early, but it is then merely one of many such lesions; further,

in such cases the condition is like that occurring in the peritoneum under similar conditions, namely one of the infection without inflammation, so that no definite swelling is formed in the broad ligaments.

When pelvic cellulitis begins in the second or third week, however, the lesion is uncomplicated and distinct as a rule. The route of infection in such cases is probably via an infected laceration of the cervix, and thus most commonly affects the left side.

The onset is abrupt, with much pain and tenderness over the involved area. On vaginal examination painful swelling, and, later on, induration of the affected cellular tissue is noticed. The mass formed varies in location, usually extending in a buttress-like manner from the side of the uterus and upper part of the vagina to the lateral pelvic wall (lateral cellulitis). At other times it may lie in front of the vagina, between it and the bladder (anterior cellulitis), or it may extend posteriorly into the recto-vaginal septum and round the sides and back of the rectum (posterior cellulitis). Finally the entire cellular-tissue area of the pelvis may be affected (complete cellulitis). On abdominal examination no definite swelling can at first be made out, but after the lapse of some days an indurated mass appears tending outwards to the iliac fossa, parallel with Poupart's ligament.

The subsequent course varies; the attack may abort and the swelling subside, abscess formation may occur, or a state of chronicity may be attained—the indurated mass remaining.

If pus forms it may point above Poupart's ligament or into the vaginal vault. Large abscesses frequently find their way into the thigh either under Poupart's ligament or through the obturator or sacro-sciatic foramina. Spontaneous discharge may take place into the cervix, vagina, rectum, or through the skin above Poupart's ligament, or over the saphenous opening. In prolonged cases the general condition of the patient suffers much from toxic absorption, great wasting and profound anæmia being present. Ilio-femoral thrombo-phlebitis may complicate the condition.

Ilio-Femoral Thrombo-Phlebitis (White Leg). Thrombo-phlebitis of the iliac and femoral veins may be present as one of the consecutive lesions of acute puerperal sepsis occurring in the first week, but its presence then is merely a detail in the general condition.

Typical cases of "white leg," or "phlegmasia alba dolens," begin from the tenth to the fourteenth day, and in them the vein lesion is the predominant one. The route of infection is not clear, but it is probably via the uterine lymphatics which pass outwards through the broad ligament to join the lymphatic chain along the external iliac vein. It is nearly

always the left leg that is first or exclusively affected. The first symptom of thrombo-phlebitis is pain, referred to the thigh, and rise of temperature. In about twenty-four hours the thigh is visibly enlarged. Two types of swelling are recognized: (a) that in which pitting œdema is present, and (b) that in which the œdema is solid. The latter is the more severe form, and in this it would appear that lymphatic obstruction is present as well as blockage of the venous return. Very frequently the area of solid œdema is limited to the thigh, the leg below this pitting on pressure. The pain in the leg is severe and the constitutional signs marked. The acute phase lasts about a week, but the return of the leg to the normal takes much longer—six weeks being a fair average. In bad cases the limb remains permanently enlarged.

Pyosalpinx. Passive infection of the tubes is a common consecutive lesion in acute cases of puerperal sepsis, and then coexists with diffuse peritoneal infection. Localised pyosalpinx is, however, not common, and when occurring always appears late on in the puerperium.

The onset is abrupt, with signs of pelvic peritonitis and the appearance per vaginam of a tender swelling to the sides of and behind the uterus. Fever is high, vomiting is present, the lower abdomen is rigid and distended, and sooner or later a swelling can be felt emerging from the pelvis, but not tending to extend outwards as is the case in pelvic cellulitis.

The course varies. If the salpingitis has not gone on to the formation of pus, spontaneous resolution may take place. If pus forms it may discharge itself through the bowel or, less commonly, the vaginal vault. As a rule, however, it tends to become sequestered in the distended tube or tubes, and the case passes into one of subacute and finally chronic pyosalpinx.

Diagnosis

The diagnosis of puerperal sepsis is easy if it is constantly borne in mind that *fever in the puerperium in the vast majority of cases is due to septic absorption from the genital tract.*

There is a natural tendency on the part of any one to dissent from the opinion that a case under his charge has become septic, and the self-persuaded judgment seeks to suggest some other cause for the fever, which may in consequence be attributed to the state of the breasts, to emotion, constipation or influenza. It is thus that the time for successful treatment may be allowed to slip by. Every case of fever in the puerperium should be regarded as due to sepsis unless it can definitely be proved otherwise. The other causes of puerperal pyrexia will be dealt with presently; they are all either

uncommon or trivial. *A temperature of 100° F. maintained for twenty-four hours is an indication for action. A temperature of 101° F. is an indication for immediate action.*

Treatment

Preventive Treatment. Introduction of organisms from without can be prevented by sterilizing (by boiling or otherwise) all instruments and appliances used in the conduct of labour, and by the habitual use of rubber gloves. The use of gloves is not only beneficial to the patient, but it protects the practitioner's hands from infection, and safeguards his reputation and peace of mind from imputation or suggestion in the event of the case becoming septic.

The conveyance of organisms from the vulva into the vagina is to be minimized by sterilizing the former region as much as possible before performing vaginal examinations or manipulations, and by restricting these to such as are necessary.

At the termination of the labour the vagina should be thoroughly irrigated with an antiseptic solution, and during the puerperium the patient should be douched at least twice a day. The teaching that vaginal douching after labour is attended by risk of introduced sepsis is entirely untenable, not to say unsurgical. The rapidity with which blood becomes foul when exuded into a warm bacteria-laden cavity need not be insisted on. In the case of hæmorrhage into all such cavities except the vagina the practice of irrigation to prevent or keep down bacterial growth is universal. Its prohibition in the case of the vagina is a sign that not even yet are all obstetricians surgeons.

When in the course of labour it has been necessary to pass either hand or instrument into the uterus it may be assumed as a fact that *bacteria have been conveyed into this previously sterile cavity.*

This point recognized, the corollary is obvious—namely, that the uterus should be thoroughly irrigated at the termination of the third stage in every case in which intra-uterine manœuvres have been necessary. A well-retracted empty uterus is the best fitted to withstand infection, while the retention in its cavity of fragments of blood clot, membranes or placenta is a direct incentive to sepsis.

Finally may be emphasized the importance of saving the tissues of the genital canal from the bruising and devitalization produced by prolonged pressure.

Curative Treatment. The Importance of Early Recognition. The importance of early recognition has already been touched upon. The prognosis of puerperal sepsis varies in a great measure according to the period at which it comes under treatment.

The nature of the infecting organism must be at once investigated. For this purpose a sample of the uterine contents is desirable, and may be obtained either by passing a swab up the cervix or by preserving some of the débris brought away by digital exploration. For immediate purposes a boiled swab passed up to the vaginal vault and subsequently put into a boiled glass tube or bottle will suffice. In either case the swab or specimen of the uterine contents should be dispatched to a bacteriologist with a request for (1) an immediate report on a "smear," (2) a report on the results of culture, and (3) preservation of the strains isolated in case a vaccine is required later on.

Uterine Exploration. The first thing to do in the bulk of cases of puerperal sepsis seen early is to explore and wash out the uterus. The exceptions are those in which it is practically certain that the infection is limited to the perineum or cervix. For its efficient performance a general anæsthetic is a necessity. The operation is best performed with the patient lying in bed on a douche bath, because more direct pressure can thus be brought to bear on the uterus from above. If a douche bath is not obtainable she had better be put in the cross-bed position, with her legs held up.

The gloved index finger, and subsequently the second finger of the right hand, are introduced through the cervix, and the uterus being pressed down on them from above, the cavity is thoroughly explored and all detached fragments felt are removed. The placental site is then thoroughly scraped with the finger tips, and all loose fragments having been removed, a tube is passed up and the cavity is irrigated with a large quantity (four quarts) of a weak antiseptic solution at a temperature of 118° F.

The effect of this operation is usually excellent if carried out early, but its efficacy diminishes with every day of its postponement. Its good results are probably due (1) to removal of infected tissue, (2) to improved drainage, and (3) to increased tone of the uterine wall.

Curettage. Curettage of the uterus by a sharp instrument is favoured by some authorities. I, personally, do not think well of it. Its object is to ablate all the infected tissue, an impossible proceeding, rendered the more dangerous by the fact that it leaves a large raw surface open to reinfection. If carried out the patient must be placed in the lithotomy position and a very large curette must be used. After the ablation the interior of the uterus should be swabbed over with a strong antiseptic solution (iodine or formalin), to prevent reinfection as far as is possible.

Drainage of the Uterus. The uterus may be drained after exploration or curettage, either by gauze packing or by the insertion of a glass

or rubber drainage tube. If gauze is used it should be impregnated with iodoform or bismuth. A tube is probably the more efficient method. If, however, the cervix has been previously opened up to the extent of admitting two fingers, the probability is that an aperture quite sufficient for drainage is created.

Irrigation of the Uterus. The uterus should never be irrigated until it has been digitally explored. To douche a uterus efficiently without an anæsthetic is a difficult proceeding even to those accustomed to such manœuvres. The organ is tender and painful, the perineum sensitive from laceration, and the patient distressed and ill. Under these circumstances it is no wonder that in many cases the nozzle never passes much beyond the cervix. Even should it reach the top of the uterus the fluid probably flows back by the return path, and is not distributed over the interior surface. Further, in many of these cases the placental site is covered by a layer of blood clot or débris, which effectually prevents the antiseptic from reaching the infected surface underneath. In short, intra-uterine douching is only efficient as a rule when carried out under an anæsthetic immediately after the performance of digital exploration. If these measures have not succeeded in improving the condition, repetition of the douche is not as a rule indicated.

Intra-Uterine Applications. The application of strong antiseptics to the interior of the uterus, if practised at all, should be done after the cavity has been explored or curetted.

The objection to all these vigorous methods is that where the infection is superficial, simple exploration is sufficient, while in serious cases the organisms have already invaded the deeper parts of the uterine wall and are beyond reach. Many substances have been used, iodine solution (five per cent.) and formalin (five per cent.) being probably the two best. To carry it out an anæsthetic is necessary, and the cavity should be emptied and mopped as dry as possible before the application.

Vaginal Drainage of the Pelvic Cavity. In cases in which consecutive peritoneal infection is suspected drainage through an incision in the posterior vaginal vault has been advocated. As already stated, symptoms of acute peritonitis are rarely present; generally there is merely slight abdominal tenderness and some flatulent distension. The method may be legitimately tried in such cases, though the outlook is a bad one. An anæsthetic is required, and the patient must be placed in the lithotomy position. The peritoneal cavity being opened, drainage must be promoted either by stitching in a large-sized drainage tube or by packing the aperture with iodoform or bismuth gauze.

Abdominal Drainage. The pelvic cavity may

be drained through an abdominal wound. It may be carried out alone, or subsequently to the removal of the tubes or uterus. Where there is evidence of peritoneal infection the proceeding is legitimate and may be combined with vaginal drainage.

If diffuse peritonitis or evidence of peritoneal infection is found, additional tubes should be inserted into the iliac and loin regions through separate openings. The vagina should also be opened through the front of Douglas's pouch and a tube inserted. The great difficulty, however, is to decide which cases are suitable for such a proceeding. It is useless to perform it if the patient is already septicæmic, but the distinction between septicæmia and profound toxæmia of local origin is not easy. Moreover, in these severe cases peritoneal infection is rarely the only consecutive lesion present; the broad ligament veins, the trunk lymphatics and the cellular tissue being also affected. Further, the patient is already very ill and stands the shock of an abdominal operation badly. It follows, therefore, that great judgment is required in determining whether to operate or not.

Salpingectomy. If on opening the abdominal cavity the tubes are found exuding pus they should be ligatured and removed. Drainage should then be performed in the manner already described.

Hysterectomy. Removal of the uterus for puerperal sepsis is only justifiable under three conditions: (1) when it has been ruptured or perforated; (2) when it contains a sloughing myoma; (3) when its wall is the seat of abscess formation. In the absence of one of these conditions hysterectomy should never be performed, for by the time a patient is so ill as to warrant resort to an operation of such magnitude the infection has spread beyond the limits of the uterus, so that the extirpation not merely fails to remove the septic focus, but opens up large areas of connective tissue to further infection and adds great shock. Hysterectomy for puerperal sepsis has a very high mortality.

Ligation of the Pelvic Veins. It has been shown that thrombo-phlebitis of the pelvic veins is one of the commonest consecutive lesions of severe puerperal sepsis. Freund first proposed and carried out their ligation on the analogy of ligation of the internal jugular vein for lateral sinus thrombosis. The ovarian veins and their branches are those most commonly affected, but in the worst cases the uterine veins are involved as well.

The mortality attaching to the operation is high on account of the severe type of case dealt with, but the procedure, nevertheless, is of theoretical propriety. The chief difficulties in its application are these—that the fact of

thrombo-phlebitis is difficult to be certain of, and that where it exists it is often complicated by other lesions such as peritoneal infection or septicæmia.

Repeated rigors are generally held to indicate thrombo-phlebitis. Tenderness over the course of the broad ligaments or a definite swelling there are confirmatory signs.

Though the veins can be approached by an extraperitoneal operation the transperitoneal route is the best. After opening the abdomen the ovarico-pelvic ligaments should be sought for and examined to ascertain the state of the ovarian veins. The ligature must be applied above the thrombus, and if this is found to extend up for some distance the vein must be traced upwards under the peritoneum. In bad cases the uterine veins are also thrombosed. In this case it would either be necessary to ligature them separately (there are several on each side), or, better, to ligature the internal iliac vein on one or both sides.

The operation is still on its trial in this country and at present no definite judgment of its value is possible. The cases most likely to succeed are those in which the attack of serious pyrexia occurs late, having been preceded for several days by slight fever. The occurrence of a sudden "fainting" attack has been pointed out by Blair Bell as probably pointing to dislodgment of part of a thrombus, and forms an indication for the operation.

The presence of obvious peritoneal infection or of septicæmic signs contra-indicates it.

Drainage of the Pelvic Cellular Tissue. Where localised cellulitis is the result of puerperal sepsis incision is required in the event of abscess formation. Most cellulitic abscesses are best opened just above Poupart's ligament, but if a fluctuating swelling bulge into the vaginal fornix, an opening should be made here also. Large collections of pus may require incision and drainage at several points, especially if they have penetrated into the thigh.

Vaginal Douching. In all cases of puerperal sepsis the vagina should be frequently douched to prevent accumulation of bacteria-laden discharge, and directly to influence cervical or perineal laceration if such exist.

Serum Therapy. The use of antidotal serums in puerperal sepsis is always indicated at the outset of the disorder. Before a bacteriological report as to the nature of the infective organism is to hand antistreptococcic serum should be given, because the large proportion of cases of serious puerperal fever are due to the streptococcus. Later on a serum should be chosen in keeping with the bacteriological findings. The serum should be administered in full doses—20 c.c. immediately, 20 c.c. six hours later, and 10 c.c. six hours after that. If no result has been

produced the advantage of continuing this treatment is problematical, but in the case of streptococcal infection another brand of serum may with advantage be tried, because the strain of streptococcus met with in this disorder varies in different cases.

While some cases react very favourably to serum therapy, on the whole its results must be deemed disappointing.

Vaccine Treatment. Vaccine treatment is best suited to the more prolonged type of case, especially that in which markedly remittent fever continues for many days. In fulminant cases it is of no use.

The vaccine is best made from the organism isolated from the uterus, but if this is impossible a stock preparation may be employed instead. In the case of streptococcus infection very small doses of the vaccine (not more than 5,000,000) should be given to start with. I have seen two cases in which comparatively mild symptoms were converted into those of the utmost severity by an overdose of streptococcic vaccine. An interval of at least five days should be allowed to elapse between the injections, which should be given during a phase of temporary clinical improvement if possible.

Saline Infusion. In bad cases, especially those marked by signs of peritoneal infection, and more particularly those in which drainage of the peritoneal cavity has been adopted, the administration of saline infusion is valuable.

It is best given by the rectum (six to ten ounces every three hours, or continuously), but unfortunately these patients usually are unable to retain it, owing to the diarrhoea from which they are suffering.

In this event continuous infusion into the cellular tissue must be carried out.

Two needles should be used, attached to a rubber tube by means of a T-piece and two shorter pieces of tube. The fluid should run in by siphonage and the rate must be slow, *i. e.* not more than half a pint an hour. The water-head to secure this is not more than a foot. The needles are best passed just beneath the axilla and should be in the subcutaneous tissue. Directly swelling is noticed in the region of the needle the inflow should be stopped until it subsides.

Drugs. It is obvious that drugs can have but little influence on the course of puerperal sepsis. Alcohol is the most useful and should be given freely as brandy or champagne if the condition of the patient indicates it.

Antipyretics are not of service except in sudden hyperpyrexia, when aspirin, antipyrin or phenacetin may be given. Quinine is very commonly prescribed, but it is doubtful if it ever does any good.

Strychnine is a useful drug, and should be

given in conjunction with alcohol if the pulse is weakening. Digitalis may be combined with it if the heart action is very rapid.

Hypnotics are often needed, but opium or morphia do not act well unless there is much pain. Sulphonal, veronal or "bromidia" are preferable as a rule.

If the bowels are constipated castor oil is the best purgative, aided by a grain of calomel laid on the tongue. Diarrhœa is much more common than constipation, however, and is difficult to check. Irrigation of the rectum or colon with boracic solution should be tried, and opium may be given by the mouth.

Nursing and Diet. Nursing is a very important item in the treatment of puerperal sepsis.

The patient should be kept elevated in the bed by means of a bolster under the thighs which is held in position by stout bandages fastened to each end and attached above to the bedpost.

In irrigating the vagina the nurse must be careful to give as little pain as possible if painful lacerations of the outlet are present. If these are suppurating or sloughing warm boracic fomentations should be applied three-hourly.

The mouth requires constant attention, and should be frequently washed out with an antiseptic such as "glycothymolin" or "Sanitas." If the tongue is dry a mixture of glycerine acid borici one part, water five parts, and a few drops of lemon juice is very relieving.

The greatest care must be taken of the skin of the back and buttocks. In prolonged cases a water-bed or, at least, a water-pillow is desirable. The parts should be washed twice a day, dried and powdered with a mixture of zinc oxide two parts, fuller's earth three parts, and boracic acid one part. If incontinence is present the skin round the anus should be kept protected by vaseline.

If there is much flatulent distension of the abdomen the rectum should be washed out every six hours by means of a long rectal tube. A rectal "wash-out" may consist of boracic acid solution, saline solution, or a mixture of soap and water with turpentine ($\frac{3}{4}$ ss ad O i) well stirred in.

The fluid is run into the rectum by means of a funnel attached to the tube, about eight ounces at a time, and after being allowed to remain in a few minutes is evacuated by lowering the funnel into a basin. This proceeding aspirates the bowel contents. It should be repeated until the whole of the solution made (one to two pints) has been used up.

If there is much abdominal pain warm boracic fomentations should be applied.

In the case of femoral thrombo-phlebitis the leg must be kept elevated and immobile by

means of a pillow and sandbags. The severe pain is relieved by fomentations.

The nurse should keep careful watch over the quantity of urine passed per diem, and should inspect the abdomen lest retention is occurring. When passing the catheter the external parts should be very carefully swabbed beforehand with an antiseptic solution lest any of the infected uterine discharge be introduced into the bladder.

As regards the diet, fluid nutriment at frequent intervals is required. The maintenance of the patient's strength is all-important. If food cannot be retained by the mouth rectal feeding must be resorted to. If this also is not possible, continuous infusion of saline solution into the cellular tissue is a last resort.

Treatment of Particular Types of Case

Mild Cases. In cases of mild uterine sepsis (so-called "sapræmia") the immediate exploration of the uterus and irrigation give excellent results. If the uterus is markedly subinvolved an acid mixture of ergot, quinine and strychnine is of service after the exploration.

In cases in which it is inferred that the uterus is not at fault on account of absence of tenderness, normality of the discharge, and satisfactory involution, and some obvious lesion in the cervix or vagina is present to account for the symptoms, uterine exploration is not indicated.

Suppurating perineal lacerations are benefited by the application of hydrogen peroxide and subsequent fomentation.

Tears of the cervix are to be treated by frequent vaginal irrigation. Peroxide of hydrogen is a useful application in these cases also.

Fulminant Cases. If the patient is seen within twenty-four hours of the rise of temperature the uterus should be explored and washed out. After this period but little is to be hoped from this proceeding unless it is certain that gross masses of placenta or blood clot are retained in the uterus.

Serum treatment should be immediately undertaken. In the presence of signs of overwhelming sepsis without definite uterine symptoms it is doubtful whether any operation should be performed, but if any intra-uterine operation is undertaken after the first twenty-four hours some strong antiseptic had better be applied to its interior and drainage subsequently established either by tube or gauze.

The question of the advisability of peritoneal drainage must be decided on the merits of the case. In general it may be said that the prognosis of these fulminant cases is extremely bad—in many, indeed, it is quite hopeless from the beginning.

Acute Cases. Here, again, the uterus should

be explored if the case is seen within twenty-four hours of the onset of the fever. After this period the utility of the operation rapidly falls, but each case must be decided on its own merits. Cases seen later are often likely to stand a better chance if the uterus is let alone, but in some the application of a strong antiseptic to its interior, followed by drainage, may appear advisable. Serum treatment should be begun at once. Vaccines are contra-indicated unless the case passes into one of continued fever.

The Continued Type. In these cases intra-uterine exploration or applications to its interior are both contra-indicated. The question of the advisability of peritoneal drainage must be decided according to whether peritoneal signs are present or not.

It is in cases such as these presenting rigors that the propriety of ligaturing the pelvic veins must be taken into consideration. A succession of rigors with pain and tenderness over the broad ligaments, but unaccompanied by signs of peritoneal infection or gross involvement of the cellular tissue, would constitute a typical case for the operation. Still more so if a mass of thrombosed veins could be felt, or if the patient had had an embolic attack.

Serum treatment is less called for in cases of continued fever. A vaccine, on the other hand, is more likely to succeed.

Cases with Gross Cellulitis. Uterine exploration is absolutely contra-indicated. The affected side of the abdomen should be fomented and the vagina douched frequently. As soon as the presence of pus is suspected the swelling should be superficially incised with the scalpel and then explored either with the finger or a blunt pair of forceps. The pus having been found, a large drainage tube should be inserted. If the abscess is large several openings and counter-openings should be made. Through the tubes thus inserted the cavity should be subsequently irrigated with hydrogen peroxide (ten volumes).

White Leg (Phlegmasia Alba Dolens). The leg must be raised on a pillow and held immobile by sandbags. Fomentations relieve the painful tension to a degree, but morphia is usually necessary at first.

The patient's blood should be examined for contained organisms, and if such are found a vaccine should be prepared. The leg should not be lowered till all fever and pain have disappeared. An elastic crêpe bandage should be worn for a while when the patient first begins to get about.

A pulmonary embolism must be treated as described on p. 941.

Pyosalpinx, Uterine Abscess or Sloughing Myoma. If one of these gross intraperitoneal lesions is present abdominal section is called

for. Tubes distended with pus must be removed.

Abscess of the uterine wall or necrosis of a myoma there call for hysterectomy, but in the case of the first-named drainage after opening and stitching to the abdominal wound might be preferable.

Fever due to an Inflamed Tumour

Uterine myomata or ovarian cysts are liable to become inflamed during the puerperium. In the case of a myoma the event is generally but an incident in septic infection of the uterus, but the process may be primary and limited to a pedunculated fibroid bruised during the labour, or having undergone axial rotation afterwards.

Of ovarian cysts small dermoids fixed in the pelvis are the most likely to become inflamed and suppurate. With all cysts there is a special liability for torsion of the pedicle to occur after labour, owing to the alteration in the relation of the parts.

Diagnosis. In the case of either cyst or myoma the onset is abrupt, with fever and severe pain.

The diagnosis rests on the fact of finding a tumour at the outset of the symptoms. Conditions like cellulitis, salpingitis or abscess of the uterine wall eventually form a tangible mass, but not until some days have elapsed. In the case of an inflamed or twisted tumour the mass is there from the beginning.

Treatment. Immediate abdominal section is imperative. A cyst must be removed. Myomata usually require removal of the uterus, but at times the organ can be conserved.

Reaction Fever

Immediately after severe labours, especially in sensitive patients, a temporary rise of temperature is sometimes seen. True reaction fever should not be maintained for more than a few hours. After this period the onset of some form of acute uterine sepsis must be suspected.

Fever due to the Breasts

The term "milk fever" has been responsible in the past for many serious mistakes in diagnosis. While it is true that the pain and discomfort of overturgid breasts may, in sensitive patients, produce a slight rise of temperature, it is of the highest importance to remember that the fever beginning on the third or fourth day of the puerperium is in the vast bulk of cases due to septic infection of the genital tract.

Painful swelling of the breasts can at the most only produce a slight degree of pyrexia. Any grade higher than 100° F. is most unlikely to be due to this cause. The practitioner is only

justified in thus attributing pyrexia when, in addition to its being slight, careful examination fails to reveal any abnormality of the uterus or vagina.

Definite mastitis is, of course, a cause of pyrexia. A typical mammary abscess practically never occurs in the first week, but a variety of acute lobular mastitis, known as "flushed breast," is not uncommon. It is characterized by a very abrupt rise of temperature to 101° F. or over. On examination of the breast a flushed area is found, roughly triangular in shape, with the apex towards the nipple. This area is somewhat tender to the touch and corresponds to a group of swollen mammary lobules. Under suitable treatment it rapidly subsides—suppuration never occurs.

Mammary abscess rarely appears before the third week, *i. e.* after the period of genital sepsis is past. The painful swelling of the breast is obvious, and prevents any doubt in the diagnosis. Painful cracks of the nipples, especially if they become infected, may be a source of fever, both from mental suffering and toxic absorption.

Treatment. Over-turgid breasts are best treated by warm boracic fomentations and gentle massage towards the nipple. For this purpose the fingers should be anointed with sterile oil or vaseline.

Flushed breast is to be treated by warm fomentations and the temporary withdrawal of the child from suckling on that side. If the breast becomes painfully swollen in consequence it may be relieved by the occasional use of the breast-pump.

Mammary abscess must be treated by radial incision so soon as the presence of pus seems probable. Before this period the application of antiseptic fomentations, combined with suspension of the breast, gives great relief.

Cracks of the nipple are to be prevented by proper care of the nursing breast. If they occur the child should be withdrawn from that side for twenty-four hours and the nipple dusted with boracic acid powder and covered with cyanide gauze. When the child is returned to the breast a shield should be used for a few days. If the cracks are infected the child must be withdrawn for a longer period, painful turgidity being avoided by occasional use of the breast-pump. The crack must be treated by warm boracic fomentations until all inflammation has subsided. In bad cases the child should be withdrawn altogether, and the breast bandaged over the fomentations.

Fever due to Inflamed Hæmorrhoids

Inflamed piles during the puerperium are capable of producing a good deal of fever and constitutional disturbance. The worst cases

are seen in patients who, in addition to having piles, have incurred a deep laceration of the perineum down to or even penetrating the anal margin. In such an event both piles and perineal laceration may be inflamed together.

Treatment. The patient should be nursed lying on her side. Great relief is experienced by painting the piles with a ten per cent. cocaine solution, or by applying a five per cent. cocaine ointment, after which a warm boracic fomentation should be placed over the parts. This should be repeated every three hours. The insertion of a suppository containing cocaine and adrenalin also gives good results.

If a suppurating perineal laceration is present as well, this should be irrigated several times a day with hydrogen peroxide (ten volumes) and the part included in the area of fomentation. The vagina should be douched several times a day.

If the pain is very severe, morphia by hypodermic injection is indicated. The use of enemata should be avoided, the bowels being opened when necessary by a saline aperient.

Fever due to Inflamed Varicose Veins

A patient who during pregnancy has suffered from varicose veins of the leg is liable to phlebitis during puerperium. If the extent of the inflammation is considerable, a good deal of constitutional disturbance may result. The internal saphenous vein and its tributaries is most commonly affected.

Treatment. The leg must be raised on a pillow and warm boracic fomentations frequently applied. Suppuration is rare.

Fever due to Conditions of the Bladder

Inflammation of the bladder during the puerperium may be due to careless catheterization, to extension from septic conditions of the genital organs, especially cellulitis, or to sloughing or injury of the vesical wall following prolonged or difficult labour. The urine contains pus and is alkaline and ammoniacal in the more severe cases. Much pain is present, together with frequency of micturition.

Treatment. Inability for lying-in women to pass water is common. This can often be avoided by letting the patient sit up in bed to micturite from the beginning of the puerperium. The strictest care should, of course, be taken by the nurse if catheterization is a necessity.

If cystitis appears the bladder must be washed out twice daily with warm boracic acid solution. Urotropin, salol or some other urinary antiseptic should be given by the mouth. Hyoscyamus and buchu relieve the painful spasms.

In the case of a vesico-vaginal fistula forming irrigation of the bladder should be performed every six hours, and the vagina must

be frequently douched. No attempts should be made to close the fistula until every vestige of infection has departed.

Fever due to Adventitious Causes

A recently-delivered woman is, of course, not immune against those causes of fever which bear no relation to the puerperal state. As a matter of fact, however, fever in the puerperium not connected with the childbirth is extremely rare, and for this reason it behoves the practitioner to be very chary of making such a diagnosis unless the possibility of septic infection of the genital tract can be excluded with practical certainty. This particularly applies to the diagnosis of "influenza," which is commonly made in the early stage of puerperal sepsis and is responsible for grave loss of time in setting about its proper treatment.

Scarlet fever in the past was held to bear a relation to puerperal fever, but proved scarlatina in a lying-in woman is very rare indeed, much more commonly the condition is one of septic genital infection with a scarlatiniform rash. Puerperal sepsis may be productive of various forms of skin eruption: erythematous, liable to be mistaken for measles; papulo-erythematous, mimicking scarlet fever; sudaminal and petechial.

II.—Pain in the Puerperium

After-Pains.—The only normal cause of pain in the puerperium is after-pains. They are commonest in multiparæ, and when excessive suggest retention in the uterus of clot or portions of chorion or placenta.

Treatment. As a rule no treatment is required. If associated with abnormal size of the uterus and undue loss the cavity of the organ should be explored under an anæsthetic (see p. 934).

Ergot, though it accentuates the pains, aids the uterus in expelling retained clots or gestational fragments, and so shortens the period over which they occur.

If the pains disturb sleep aspirin or "bromidia" may be given.

Pain due to Septic States.—The amount of pain in puerperal sepsis varies. In many cases—especially the worst ones—it is absent altogether. In others it may be considerable, especially in the case of peritonitis, cellulitis, and ilio-femoral thrombo-phlebitis. Inflamed piles, cystitis and inflamed varicose veins are also productive of much pain.

Treatment. The treatment of these various conditions has already been discussed (pages 934-938).

III.—Abnormal Hæmorrhage in the Puerperium

Subinvolution.—Delay in the involution of

the uterus may be due to: (1) natural atony of the uterine wall; (2) retention of gestational products or clot in its cavity; (3) septic infection.

Of these the first two are always associated with excessive bleeding. In the third condition, however, the loss may be less than normal or suppressed altogether.

In regard to simple atony of the musculature, it is most often seen in women who have borne many children. A soft relaxed state of the uterus in the puerperium has been shown to be an incentive to septic infection. It is also the cause of puerperal retroversion, the heavy but soft organ sinking backwards in the pelvis. A uterus thus retroverted and retroflexed involutes very slowly, and in many cases never regains its normal size.

The subject of retained products or clots will be dealt with in the next section.

Septic infection of the puerperal uterus is the most potent of all the causes of subinvolution. In extreme cases the organ may be found at the end of a fortnight just as big as it was immediately after delivery.

Treatment. Where subinvolution is due to simple atony, unaccompanied by signs of sepsis, and there is no reason to believe that placental or chorionic fragments are retained in its cavity, the administration of full doses of ergot combined with strychnine in an acid medium should first be tried. If this fail and the hæmorrhage continue, the uterus must be explored.

In the first ten days the introduction of two fingers is easy, but where the patient is not operated upon till two or three weeks have elapsed dilatation of the cervix by graduated dilators will be called for, and after one finger has been introduced to ascertain the state of the cavity, the endometrium should be thoroughly scraped with a flushing curette. Although patients almost invariably attribute prolonged bleeding to "something left behind" at the labour, in the majority of these cases the curette removes nothing beyond some thickened mucosa. Nevertheless, the results of the operation are eminently satisfactory, the hæmorrhage ceasing almost at once.

The treatment of subinvolution due to sepsis is that for puerperal infection.

Retained Products of Conception.—Retention in the uterus of portions of placenta or chorion prevents involution. Hæmorrhage is nearly always free in these cases, and in a certain proportion signs of septic infection sooner or later appear.

Treatment. If it is suspected that something is retained in the uterus its cavity should at once be explored under an anæsthetic (see p. 934).

Extrusion of a Myoma.—The extrusion of a uterine myoma during the puerperium is an uncommon event. The process is associated

with a good deal of bleeding and griping pains, and in some cases with fever, the tumour having become infected and necrotic.

Examination per vaginam to ascertain the cause of the bleeding reveals a firm rounded mass protruding through or hanging from the cervix.

Diagnosis. The presence of the uterus in the abdomen will distinguish it from an inverted fundus. A portion of retained placenta in process of extrusion has its own soft spongy character.

Treatment. The mass should be removed under an anæsthetic. If the pedicle is thin it may be twisted off. If it is broad the mucous capsule covering the tumour should be incised and the myoma enucleated, after which the collapsed capsule and pedicle should be twisted and cut away. In either case the uterine cavity should be washed out, and, if there is much bleeding, packed with gauze for twenty-four hours.

Inversion of the Uterus.—Inversion of the uterus usually takes place in the third stage of labour. Occasionally, however, it is postponed until some days later, when, after a period of griping pains and hæmorrhage, a mass will be felt coming through the cervix, while on abdominal examination the uterus is found to be absent from its proper situation.

Treatment. An anæsthetic must at once be given and the mass pushed back. In the event of being unable to accomplish this it would be best to open the abdomen and remove the uterus.

The Presence of Malignant Disease.—Carcinoma of the cervix may pre-exist labour. In this event its radical extirpation by the modern method ("Wertheim's" operation) must at once be performed.

In the late puerperium may develop that most interesting type of growth known as chorio-epithelioma. This neoplasm, which develops from the cells of the foetal trophoblast, is fortunately very rare, for it is intensely malignant. Recorded cases show that in most instances the persistent hæmorrhage caused by it has been attributed to retention in the uterus of portions of placenta, and that not infrequently, even after operative evacuation of the uterine contents, the gravity of the case has not been recognized.

It is to be remembered, therefore, that persistent hæmorrhage coming on late in the puerperium, and more particularly after the normal lochial discharge has ceased, is not characteristic of retained placenta. When, therefore, such a case is investigated under an anæsthetic and a quantity of apparently organized blood clot and placental débris is removed, it is most important that the material be microscopically investigated.

In the event of its proving chorio-epithelioma the freest possible removal of the uterus and adnexa is indicated at once.

Sudden Death in the Puerperium.—Sudden death in the puerperium is most often due to pulmonary embolism. Patients with fatty and degenerated hearts are liable to sudden attacks of syncope, which may prove fatal, and cases of advanced valvular disease or pulmonary tuberculosis may succumb during this period.

Of these conditions pulmonary embolism is the most important. The seizure usually occurs towards the end of the second week, *i. e.* just about the time the patient gets out of bed. It is an interesting fact that these patients very rarely have any previous signs of thrombophlebitis, the lying-in up to the time of the occurrence having been normal. It is probable that a thrombus formed almost passively as an extension from the physiological clots in the uterine sinuses is less closely attached to the vein wall than are the products of definite phlebitis.

Clinically there are two types of case. In the first there is deep cyanosis and great dyspnœa, and respiration stops some time before the heart ceases to beat.

In the other the patient is pallid and the heart stops almost at once.

In either the attack comes on with dramatic suddenness and is usually fatal. Occasionally, however, after a parous period of dyspnœa and distress, the patient recovers. In these cases pain in the side commonly follows, indicating the region of pulmonary infarction, and some blood-stained expectoration is coughed up for several days. These slight attacks may be repeated.

Treatment. In pulmonary embolism artificial respiration must be employed at once, and brandy, ether or strychnine be injected hypodermically. If the heart has stopped, direct massage through an abdominal incision might be tried. In cases with deep cyanosis and the heart still beating, venesection and the administration of oxygen are indicated. V. B.

ASPHYXIA NEONATORUM

Asphyxia in new-born children occurs in two varieties, *Livida* (*Blue Asphyxia*) and *Pallida* (*White Asphyxia*).

In **Blue Asphyxia** the face is purple and the body firm. The cord continues to pulsate and the reflexes are not abolished. If the child's foot is tickled movements are induced and efforts to swallow result from the placing of a finger far back in the mouth.

Treatment. Every effort should be made to prevent the child breathing until all mucus has been cleared from the mouth. If this has not

been accomplished before the first breath, the mucus is certain to be drawn into the lungs and a condition of great danger is likely to supervene. So long as blood circulates through the attached placenta, oxygen will be supplied to the infant and there will be no danger of suffocation. For this reason the cord should not be severed before it has stopped pulsating.

The most effective means for removing mucus from the mouth is by the use of a catheter. This should be passed over the back of the tongue into the pharynx and sucked; then withdrawn and emptied by blowing through it. This process should be repeated several times. If a catheter is not available the child may be held up by the feet and a finger passed into the mouth. These manipulations are generally found effective.

When once the throat is cleared the child will cry, and this crying can be hastened by gently slapping it on the buttocks or sprinkling it with cold water. It is a mistake to tie the cord until it has ceased to pulsate.

In **White Asphyxia** the reflexes are all abolished, the child is very pale and has all the appearance of being dead. The cord is shrivelled and has stopped pulsating, and the feeble heart-beat felt by pressing a thumb over the nipple and a finger deeply under the ribs alone indicates that the child lives. We have seen such a child pronounced to be dead and laid aside unattended to, until a feeble cry awakened the nurse to her error of judgment.

Treatment. The cord should be ligatured and severed without delay, and whilst this is being done by the doctor the nurse should prepare a warm bath. To ascertain the proper heat of this bath her bare elbow should be placed in the water. The elbow is much more sensitive than the hand, and the water which feels comfortably hot by this test is of a proper temperature in which to place the infant. Shock from the cold atmosphere is the greatest danger to which the child is subjected, and nothing tends to lessen this shock so much as the hot bath. Great care should be taken to keep the nose and mouth above water, for if this precaution is not attended to, a sudden inspiratory effort might result in rapid death. Whilst in the bath the mucus is to be sucked from the mouth and then the chest may be gently and intermittently pressed on or the tongue drawn slowly backward and forward by means of forceps. Mouth to mouth insufflation may be practised and is effective in inflating the lungs. It should be performed intermittently and the chest compressed immediately after it. There is some danger of embarrassing the heart by this manœuvre, for air is at the same time forced into the stomach.

If these means fail the child should be taken from the water and well dried before resorting

to artificial respiration, which can be done in many ways, but in my opinion the method of Schultze is by far the best.

Schultze's Artificial Respiration. This method requires considerable practice for its proper per-



FIG. 1.

formance, and should be mastered in its every detail, with the aid of a dead child or doll. The figures explain the manner of holding the child. The index fingers are

placed in the axillæ, whilst the thumbs are placed in front of the chest over the clavicles; the little fingers support the occiput and steady the head, whilst the middle and third fingers pass down the child's back. The child should swing between the operator's legs. This is the inspiratory position. A to-and-fro movement should start the first stage and will give an impetus to the bold forward swing which follows and culminates in raising the infant above the head into the position indicated by the plate. The

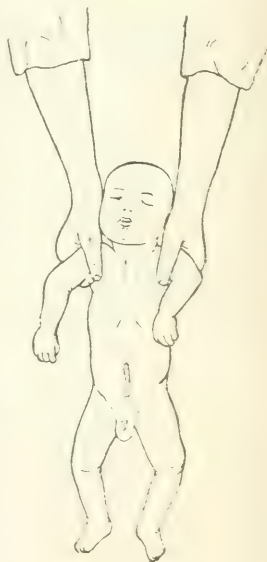


FIG. 2.

weight of the legs, aided by compression of the hands, will drive the air out of the lungs; and a reverse movement will bring the child back to its first or inspiratory position. Very little time should be wasted in the expiratory manipulation,

but in the inspiratory position a delay of several seconds is advantageous. These movements should be discontinued after the process has been gone through six or seven times, to allow the child to be again placed in the hot bath, for the cooling effect of the rapid movements through the air is one of the real objections to this method.

It often happens that mucus is sucked up by the catheter after the second immersion more readily than after the first. A continuation of the process has frequently been rewarded by success after the lapse of half an hour, and it must not be discontinued so long as the heart is felt to throb. It is well to vary the process occasionally by some other device, and, provided the legs of the child are fixed, Sylvester's artificial respiration will prove an effective substitute.

Good results have been reported from direct massage of the heart in the most desperate cases of white asphyxia. A small incision is made into the abdomen just below the diaphragm, through this the gloved finger is passed up to the diaphragm. The thumb placed above the nipple supplies the counterforce for rhythmical massage of the heart.

The objections urged against Schultze's methods are: (1) meningeal hæmorrhage, (2) rupture of the liver, (3) the danger of letting the child slip through the fingers, (4) fracture of various bones, (5) shock induced by rapid cooling. None of these objections, however, have any weight provided the manœuvres are skilfully carried out, and an enumeration of the possible dangers is all that is necessary to insure their avoidance. E. H. T.

CHILDBIRTH AND INSANITY

The association between the puerperal state and mental disorder is well recognized, and "puerperal insanity" has usually been dignified by a special chapter in textbooks of mental diseases. In recent textbooks, however, there has been a tendency to omit such a special chapter and merely to refer to the relationship under the headings of various forms of mental disease. The occurrence of acute insanity in connection with childbirth is, however, always a clinical phenomenon of great importance to the practitioner, and therefore there need be no excuse for its special consideration.

Cases of insanity following childbirth constitute from four to five per cent. of female patients admitted to asylums, the percentage being higher in the pauper than in the private class. If, however, patients who break down mentally during pregnancy or lactation are included, the percentage rises to over seven per cent. for all cases connected with the bearing of children.

Etiology. 1. Insane or neurotic inheritance is found in a considerable proportion of cases. Of cases under my care at Bethlem Hospital a family history of insanity or other neuroses was found in twenty-five per cent., but in cases seen in private practice the percentage has been as high as fifty-nine per cent. In thirty per cent. of these cases there was direct inheritance. Not infrequently the patient's mother has suffered from puerperal insanity.

2. Previous attacks of insanity or other neuroses before or after marriage predispose to insanity following childbirth, and have been found to have existed in twenty-eight per cent. of my cases. Patients who have been advised to marry after recovering from mental disorder, with the belief that marriage will put everything right, are very likely to break down with the first child, and subsequently to have recurrent mental disorder of the mania-depressive type either after childbirth or independently of it. I have known a patient to break down mentally after each of five confinements.

3. Ill-health during pregnancy, whether due to malnutrition, exhaustion and stress, or due to organic disease or alcoholism and constant vomiting during pregnancy, leading to malnutrition, exhaustion and insomnia, may lead to a breakdown after confinement.

4. Moral causes, such as fright or shock from accidents, death or illness of the husband, children or other relatives, the worry of an incompetent or drunken nurse, illegitimate birth, desertion by the husband or lover, apprehension of the effects of labour, may all conduce to instability of the nervous system and consequent insanity.

5. In over forty per cent. of cases the insanity occurs after the birth of the first child, but may also occur after subsequent parturitions, even as late as the twelfth child. In about one-third of the cases following a first confinement the mother's age has been found to be over thirty. In institutions admitting a large number of acute cases, many women, however, between the ages of twenty and thirty, or even younger, are admitted with puerperal insanity after their first confinement.

When insanity follows a first confinement it is more commonly after the birth of a male child, when there is greater risk of delayed labour or of injury to soft parts, with possibility of septic complications, than at the birth of a female. Sometimes a woman has passed safely through her first and possibly second delivery of female children and then breaks down after the birth of a male, and in some cases this only occurs after the birth of male children.

6. Although in a large proportion of cases the labour seems to be normal, and apart from physical and emotional disturbance and the

alterations in circulation and nutrition attendant upon parturition and commencing lactation there seems to be no reason other than a neuropathic diathesis why the nervous system should have given way, yet in other cases some complication has taken place. Thus in twenty-three of one hundred consecutive cases at Bethlem Hospital there has been delayed labour, instrumental delivery with or without the use of anæsthetics, ruptured perineum, post-partum hæmorrhage, offensive lochial discharge, pelvic inflammation or generalized septic poisoning.

Although such accidents are more common in primiparæ, they may be factors in leading to insanity in later confinements. In modern midwifery the chances of septic infection are much reduced, yet puerperal insanity occurs in about the same proportion of cases as before. As in other cases there is usually a combination of causes. It is important therefore to obtain an accurate history as to inheritance, the patient's constitution and temperament, previous attacks of mental disorder, the possibility of septic poisoning, or of any of the causes enumerated above.

Symptoms. The onset of puerperal insanity commonly takes place with almost dramatic suddenness. A young woman has perhaps just been delivered of her first child without any special difficulty, and for the first three or four days all seems to be going on well, then occurs slight depression, change in manner and sleeplessness, followed almost immediately by motor restlessness and excitement, incoherence, hallucinations, delusions as to and hostility towards husband or child, noisiness, violence and loss of control in cleanliness. The pulse becomes quick, the milk often fails, the tongue is furred and tends to become dry, the temperature rises slightly, the bowels are commonly confined, there may be loss of appetite and refusal of food, and insomnia persists. The patient rapidly becomes confused and has disorientation of time and place, eroticism may be marked and the conversation obscene. She is with difficulty controlled in bed and resists all attention, struggling and resisting against feeding, washing and changing linen. The patient may be impulsively suicidal or may sustain injury as the result of sudden explosive violence, and is most likely to be dangerous to the child if it is not removed from her vicinity.

In cases where the milk does not fail the breasts will often become swollen and painful and abscesses may form. Although in many cases of this type there may be no evidence of bacterial infection and the lochia may be normal, in others there may be offensive lochia, considerable rise of temperature, uterine tenderness, and evidence of infection by staphylococci,

streptococci or bacillus coli. The greater number of cases marked by maniacal excitement are of this confusional type of varying intensity which has been called "Puerperal Mania," and following the excitement there is likely to be a stage of secondary stupor. More severe cases of the acute delirious type are generally associated with offensive lochia and definite evidence of septic infection. In such cases the confusion and disorientation become extreme, there is constant delirious chatter with hallucinations, the temperature is definitely raised though running an irregular course, the tongue becomes dry and brown, sordes collect on the lips and teeth, the pulse becomes very rapid and feeble, the patient emaciates and quickly becomes prostrate, and there is danger of exhaustion, coma and death from pulmonary hypostasis and pneumonia. Such cases tend either to a fatal termination or to recovery after a short but very acute illness.

In another group the disorder is of the mania-depressive type, in which there is much excitement and motor restlessness, with loquacity, eroticism and impulsive violence, but without marked confusion, at any rate in the earlier stages, and followed by a stage of depression with marked self-accusation and suicidal tendency.

In some patients during delivery or immediately afterwards there is an attack of frenzy ephemeral in duration, characterized by sudden extreme violence, in which an impulsive homicidal or suicidal act may take place, of which the patient is unconscious at the time and of which there may be complete absence of memory.

Cases marked by excitement, of whatever type, usually occur with the first fortnight after delivery. In my experience fifty-six per cent. of all cases occur within that time, and of these seventy-three per cent. were characterized by excitement. In contrast to the cases marked by excitement are those characterized by melancholic depression. Occasionally this begins immediately after confinement or may have begun to appear towards the end of pregnancy, but more commonly it begins after the first fortnight, but within the first six weeks or two months after delivery, after which the case is considered to be lactational.

Puerperal Melancholia may be of the simple type of depression without definite delusions, or there may be delusions of the religious, self-accusing, hypochondriacal, persecutory variety, or the stuporous type with katatonic symptoms may be prominent. In all these cases there is great risk of suicide. The risk to the child in cases of puerperal melancholia should never be lost sight of. It is more apt to be left in the mother's care in the earlier stages than when there is maniacal excitement; as a result the

mother may kill it from some delusion respecting its health or condition, from the dread that it is to be starved or tortured, or from a sudden impulse. She may attempt to drown herself and the child together or may try to poison it and herself. In all such cases there is deficient sleep, tendency to refuse food and personal neglect. The milk fails gradually, although there have usually been attempts to nurse the child at first; there is anæmia, constipation and amenorrhœa. Puerperal melancholia begins later after the confinement, and also lasts longer than puerperal mania.

Chronic delusional insanity with organized delusions of persecution may begin at the puerperal epoch, especially in those of neurotic inheritance.

Prognosis. In the great majority of cases a good prognosis can be given, about eighty per cent. recovering. In the cases marked by excitement or delirium there is greater risk to life from exhaustion or septic complications than in the depressed cases, but in my experience a fatal termination has only been reached in two per cent., though others give a larger proportion. Many cases in which the attack, although acute, is very short never reach asylum care and recover within a month, and among those who need such care recovery is often reached in three or six months. The cases marked by mental depression as a rule last longer and are not placed under care so early, and in these the chief risk is from suicide. As long as there is amenorrhœa and improvement is taking place in the general condition the prognosis may be considered as good, but it becomes bad when menstruation is re-established without corresponding mental improvement. When fixed delusions occur or dementia supervenes the prognosis is bad.

Chronic instability remains in many cases, so that there is likelihood of further attacks from renewed pregnancy or other causes, such as the climacteric in later life.

Treatment. In all cases constant skilled nursing is needed from the outset and immediate removal of the child from the mother's vicinity. The risk of fatal injury to the child is so great that every care should be taken to prevent the mother from becoming a criminal lunatic by infanticide. The patient should not be left alone as, even where there is no mental depression, there may be an impulsive attempt to suicide. The physical condition should be carefully examined for evidences of septic poisoning and appropriate treatment for this adopted. The treatment of the insanity must be carried out on the same principles as in other acute mental disorders. At first the patient should be kept in bed, with constant attention to feeding, sleep and the state of the bowels.

Artificial feeding has to be resorted to in many cases, and where this is frequently needed asylum care is generally necessary. If drugs are needed for sleep, paraldehyde, sulphonal, trional, chloralamide and veronal are preferable to chloral hydrate, opium, morphia or hyoscine. As strength is regained exercise in the open air, abundant food and tonics are required. Amenorrhœa usually requires no special treatment, but if delayed, emmenagogues may be administered. It is important to warn the patient and her husband as to the risk of further pregnancy.

R. P. S.

THE HEALTHY INFANT

Before the physician leaves a case of midwifery he should examine the infant to see if it is physically perfect. The mouth, the limbs, the anus, the cord and the prepuce should receive special attention.

If it is found normal, he should instruct the nurse as to the best method of directing its progress day by day. His general skill is frequently gauged from the impression he makes in respect to his knowledge of infantile conditions. A woman is not capable of appreciating the value of aseptic technique, but she is a shrewd judge of the welfare of her child.

Infantile ailments have to be recognized by different processes from those which lead to a diagnosis of ill-health in adults. From transitory signs a sufficient knowledge has often to be obtained to direct treatment. These signs, too, may be difficult to interpret. Children are exceedingly fickle in health and often change in an astonishingly short time from a normal state to a serious illness. Therefore one should be guarded in prognosis and be prepared for disappointments. The history the mother or nurse supplies is frequently distorted by a desire to hear a favourable report. Direct questions concerning food, indigestion, sweating, diarrhœa, etc., will often prove the readiest means of extracting the required information. Great deference should be paid to the fears expressed by the mother, even though the child's condition does not appear to justify her anxiety. She is constantly watching it and can often detect the finer changes which may escape the doctor's notice. When an infant is said to be ailing, make the mother or nurse undress it. The excuse may be urged that the child has just gone to sleep or that the day is cold, but one should not be turned aside from one's purpose by such subterfuges. The ear should be placed directly to the chest, for this is less likely to make the child cry than the use of the stethoscope; for a similar reason, auscultation should precede percussion. Before proceeding to a description of the unhealthy infant,

it is necessary to have a clear acquaintance with the characteristics of health.

The majority of children are born healthy, and will remain so if not neglected. Even women dying from phthisis or other chronic disease will frequently be delivered of healthy offspring.

A healthy child is plump, takes the breast or the bottle readily, is not flatulent, does not vomit, has free actions of the bowels four to five times in the twenty-four hours, has a temperature under 100° F., voids yellow, digested and inoffensive fæces, has a clean tongue and no skin eruption. It should increase in weight about seven ounces a week, though such increase need not be exactly maintained, or in some weeks a gain of only one or two ounces may be made good in subsequent weeks by a much larger increase.

A child's forehead should not be bathed in perspiration; sweating usually denotes that it is too heavily clothed. Finally, the condition of the anterior fontanelle is an important guide. In ill-health it is sunk, and it is said to be raised and tense in conditions which predispose to convulsions.

The first three days of life exceed all others in importance, and on the skill of management during this time will to a large extent depend the future well-being of the child.

The urine should be passed within the first twelve hours. It is very rare that this does not happen, though nurses frequently assure one to the contrary. Scepticism on the point is allowable, provided no spherical tumour (the bladder) can be discovered by sight or percussion above the pubes. If in doubt, wash the prepuce with cotton-wool and if it is tight stretch it with the aid of a sinus forceps, then place the infant in a hot bath and give a teaspoonful of cold water, for such means almost invariably bring about the desired result. Should this fail, and should the bladder tumour be felt or seen, a No. 1 silver catheter must be passed.

Meconium. This is the dark, tarry excretion that passes from the child for the first twenty-four hours or so. If it does not come away the anus should be carefully examined. This is best done by passing a thermometer through the sphincter—a plan which will readily detect the presence of an imperforate anus.

Few organs of the body spring into full action at once. The lungs are not fully inflated for many hours. The new paths of the circulating blood take time to become completely established. There must be a heat-regulating centre, which has to be set for the new conditions, and above all the digestive organs need time to develop their full functions.

A child should be encouraged to cry, for in this way the lungs are best inflated.

It is a mistake to wrap the child up in too warm a manner, for if it is allowed to kick in a warm room without much covering there is no fear of its catching cold.

The abuse of the digestive organs is a common offence, nurses are fond of dosing the new-born with castor oil, butter and sugar or some other nostrum equally deleterious. The infant needs little or no nourishment for the first three days. Milk does not enter the breast until then, and the health of the child will be best promoted by adhering to Nature's rules.

Colostrum is the secretion which is present in the breast until the establishment of the milk. It contains free albumen, fat cells and no casein. In the lower animals, and almost certainly too in human beings, it contains antigens, substances capable of exciting the formation of antibodies which combine with the constituents of normal food. Colostrum, then, must be considered a most important factor of normal digestion, and the new-born child should be put to the breast twice within the first twenty-four hours, three times during the second twenty-four hours, and on the third day regular meal hours should be insisted on, every three hours during the daytime counting from the beginning of one meal to the beginning of the next. There should be only one meal given at night, with an interval of five hours before and after it.

The infant starts its career with an excess of blood in its body, or should do so, for if the cord is not severed before it has ceased to pulsate, the amount of blood in the body above the normal is estimated at three ounces. This excess will satisfy the child's needs for the first three days.

Early and abundant secretion of milk is a frequent source of indigestion, and if present care should be taken to see that the child partakes of it sparingly.

In other cases the milk does not appear until the fourth or fifth day, and this late appearance often accompanies a mild condition of sepsis. Again, towards the end of the first week the milk secretion often becomes scanty, and many children are mistakenly taken from the breast under the impression that the milk has dried up. Patience and a plentiful supply of fluid will cause re-establishment of the flow, as a rule, within thirty-six hours. Children should be wakened up to be fed, and crying or crossness is not to be considered as an indication for feeding outside the regular hours.

Should the child fall to sleep whilst nursing, it must be immediately removed and put back in its cot, nor should it be again fed until the next meal hour is due. It possibly may be hungry before this, but a little hunger will prove beneficial and will rapidly train the

infant into a regular mode of existence. It is known that the digestive juices are secreted with periodical constancy and that digestion cannot be carried on as a continuous effort. The child, then, who is fed irregularly and too frequently must eventually suffer from the violation of these well-known physiological laws.

Upon digestion depends health, upon discipline stability of character, and the foundation stones of these cannot be laid too early.

Method of Breast Feeding. When the mother is in bed she turns on the side of the breast which is to be used and holds the nipple between her first and second finger to direct it into the infant's mouth. The nipple should have been previously washed with pledgets of cotton-wool soaked in clean warm water. Care must be taken not to press the child's nose against the breast, for if this is done it cannot breathe freely while sucking, and such discontinuance is often wrongly attributed to a weakness on its part. The child should be put to one breast only for a feed. The other breast is used for the next feed. Twins should have one breast each, and if there is not sufficient nourishment for both the meals may be supplemented by bottle diet, for the objection to mixed feeding has no true basis.

A child has a tendency to sleep by day and be wakeful by night; the tendency must be counteracted from the first, for if its importunities are yielded to and an irregular meal be given, it becomes a very difficult matter to correct the error afterwards.

The mother should be careful to note the length of time for which the child nurses, and it may be left on the breast until it goes to sleep or until it desists of its own accord, provided that no part of the meal is possetted. Such regurgitation clearly shows that the stomach has been overloaded and indicates that a shorter time of nursing should be given in the future.

Many infantile complaints are attributable to sore and infected nipples. To avoid maceration of the epithelium the nipples should be washed with warm water and after nursing dried off with spirit or eau-de-Cologne. If they crack, the application of solution of nitrate of silver, friar's balsam, or glycerine of tannic acid may be usefully applied to promote healing. A nipple shield is a great advantage in such cases.

The nipples may be depressed, yet it is astonishing how a baby will draw them out. The action of the infant's mouth is rather to press back the tissues away from the nipple than to draw it out. This action the mother can also aid by pulling back the tissues with her fingers or pressing them back with an umbrella ring. If these methods fail a nipple shield should be used.

Nursing women eat too much, as a rule, and constant feeding is most injurious to their digestion. Regular meals, with intervals of four to five hours, should be insisted on. The bowels should be kept regular, and a small quantity of fruit or green vegetables does not appear to have any harmful effect on the child.

More fluid should be given if the milk runs short, and many recommend stout, beer or milk to increase the flow. Water answers the purpose equally well and is not so likely to interfere with appetite.

Much excitement and the constant visitation of friends is harmful to the nursing mother. She frequently hears the statement made that she cannot nurse, that she is too delicate, or that it will interfere with the pursuit of her social obligations. The monthly nurse not infrequently believes that a flatulent or crying child is the result of an insufficient food supply. Finally a nervous woman may find nursing very painful. These suggestions should not readily be yielded to, for it is rare to find breast milk actually disagreeing. It is better to nurse even for a week than not at all, better not only for the child, but also for the mother.

Care should be taken in the administration of drugs, for many substances, such as belladonna, opium, iodide of potassium and cathartic drugs, are excreted by the milk and upset the digestion and temper of the infant.

Nursing should not be permitted in women who have phthisis or heart disease, with sepsis, interstitial mastitis, or marked anæmia, or by women who are insane, whilst those who have to work for their living often find it impossible to bring up a child otherwise than by artificial means.

The flow of milk can be almost entirely stopped by placing a tight binder around the chest shortly after delivery. Nurses attach great importance to cere cloths consisting of linen on which is spread yellow wax one part, olive oil eight parts. Belladonna liniment is also credited with much power in preventing the formation of milk. The free administration of salines and the curtailment of fluid are valuable adjuncts. When the breasts become very painful, relief will follow the removal by suction of a small quantity of secretion, one or two drachms. The breast should never be emptied in this way, for the elastic pressure exerted by the tense skin is of great importance in determining the disappearance of milk.

Children that must be Spoon-fed. (1) Undeveloped and premature children. (2) Children with cleft palate and bad harelip. (3) Children with syphilitic or painful ulceration around the mouth.

Wet nurses are now hard to obtain, but at times their services are still available. They

ould come from respectable households, and ould be able to show a healthy infant of an age not far removed from that of the child who is to be cared for. They must be free from all suspicion of disease, with no marks of ulceration on the throat or on the legs; their teeth should be sound and their habits orderly. These women should undergo a medical examination before being hired, and a Wassermann's reaction should prove negative.

Artificial Feeding. Cow's milk is the most convenient food for infants after human milk. It differs essentially from the latter.

Cow's milk contains two or three times as much proteid, which occurs in two forms, casein and soluble proteid.

Casein is a phosphorus combined with lime and albumin. It is not coagulated by heat, but it is thrown down in the form of curd by acid or rennin.

The soluble proteids are the most readily digested of all forms of albumin. They are present in relatively greater amount in human milk than in cow's milk.

Sugar occurs as lactose in both, but in human milk it is two to three times more abundant than in cow's milk.

The amount of fat is about the same, but human milk contains a greater proportion of it with a low melting-point, and therefore a greater digestibility.

Lecithin, a constituent of nerve structures, is greater in amount in human milk than in cow's milk.

Human milk contains citric acid and cow's milk does not. Human milk is also alkaline and faintly acid in reaction and quite sterile.

Cow's milk is acid in reaction from the bacteria it contains, which may amount to two hundred millions per c.c. Even when obtained by the most up-to-date aseptic methods a limit of twelve thousand bacteria per c.c. is permitted.

But above and beyond these chemical distinctions there are more subtle differences to be noted. Newly born animals are poorly supplied with complement and antibodies to enable them to repel germ invasion or to assimilate food. The early milk of a cow is rich in antigens, substances capable of exciting the formation of antibodies in the calf.

Again, it is impossible to rear guinea-pigs weaned from the first, but after they have suckled the mother for three or four days they can be most successfully reared by artificial methods. Experience makes us attach a similar importance to colostrum and early milk in promoting the well-being of the infant.

From what we have said it is obvious that to alter cow's milk so as to make it resemble human milk is a difficult and unsatisfactory problem.

The curd of cow's milk is in larger and harder masses than that of human milk. Barley water mechanically divides up the curd. Citrate of soda, one grain to every ounce of milk, or the use of lime water as a diluent, exercises a similar effect and makes the curd more flocculent.

The less cow's milk is allowed to stand and the fresher it is the less acid it will be. Rapid cooling, cleanly milking, and collection in sterile and covered vessels are all important factors in its usefulness as a food.

Young infants as a rule thrive well on the following milk modification—

Lime Water . . .	1 tablespoonful
Top Cream . . .	2 "
Milk . . .	3 "
Solution of Sugar of Milk	3 "
Citrate of Soda . . .	2 grains.

Solution of sugar of milk is made by adding three ounces of milk sugar to a pint of hot water. This can be kept in a clean bottle and used as required. The proper proportion of citrate of soda can be added to it if desired.

If the milk supply is doubtful, pasteurization for ten minutes should be adopted. This mixture may require certain modifications in respect to the amount of cream, sugar, milk or lime water, and with this reservation the mixture will be found most satisfactory for children up to five or six weeks old.

Barley water may be substituted for lime water. It is made by adding two teaspoonfuls of well-washed pearl barley to a pint of water, boiled down to three-quarters of a pint and strained. It must be freshly made morning and evening.

Lime water is a saturated solution. It is made by shaking up unslaked lime with water in a clean bottle and then pouring off the supernatant clear fluid. There is a popular belief that this lime forms an important constituent of the bones, but for such belief there is no foundation. In the first place it has never been shown that animal protoplasm can assimilate salts of lime in this crude form, and secondly there is much more lime combined in casein than in lime water.

Cream that has been centrifugalized at the dairy contains between forty and forty-five per cent. of fat. If the centrifugalized cream cannot be obtained, good milk placed in an open bowl will produce on its top layer a cream containing fifteen per cent. of fat.

For children a month old and older, undiluted milk is a very suitable and satisfactory food, but it is not to be recommended unless care and intelligence is possessed by those who employ it. Cow's milk when pure will give the right amount of fat, and when a little sugar

is added it will also contain the proper proportion of carbohydrates. It is not so rich in soluble albumin as human milk, and contains casein in excess. The disadvantage of this excess has been much exaggerated, for it will be found that it can pass away in the stools without inconvenience or harm. The stools are large, and often whitish, but this matters nothing so long as the infant is well. The unused curd stimulates the intestines, so that constipation is rarely encountered. It is advised that this milk be sterilized by a process which lasts for forty minutes. We have always followed this rule until the child is three months old, but then have gradually diminished the period, for the nutritive value of milk is much impaired by prolonged sterilization, and we have not seen a satisfactory explanation offered as to its absolute necessity. This milk is made a more suitable food by the addition of citrate of soda in the proportion of two grains to the ounce; if given in larger quantities the milk turns brown from the formation of caramel.

Sufficient nourishment is obtained from a comparatively small quantity of this food. It has, therefore, no tendency to dilate the stomach, and the gastric juice is poured out in full concentration to perform the work of digestion satisfactorily. Children fed in this way will suffer from thirst if water is not given towards the end of the digestive process. Water either cold or warm is a very useful adjunct to all forms of feeding, and it should be offered to every crying child on the supposition that it may possibly be suffering from thirst. Children too frequently fed often suffer from a paucity of fluid in the system, for the too-frequent feeding causes regurgitation of fluid, and it is the more watery portions of the food that are regurgitated. The times of feeding, too, may with advantage be extended when whole milk is employed. From a very extended experience we can fearlessly assert that there is no more satisfactory method of artificial feeding in vogue than this. Children look well, increase steadily in weight, have firm flesh, sleep well, are not cross or fretful, are neither subject to cramp or constipation, and do not become loaded with unhealthy fat. It is not, however, a plan that should be blindly persisted in, in spite of consequences. It is also a mistake to start abruptly on such a line of feeding; the child should be gradually accustomed to it by giving one such meal a day at first and then increasing to two and so on after some time.

The type of bottle to be used is of immense importance, and we have a strong prejudice against those which contain vulcanite valves or those with long rubber tubes attached or shaped in a manner that is difficult to clean.

When milk is pasteurized or sterilized it is best to feed directly out of the bottle which is a part of the sterilizing apparatus.

Pasteurization does not render the milk germ free. It does not kill spores, and in some instances babies have died of acute enteritis due to germ-contaminated milk which had been pasteurized. These cases are very rare, and it is an undoubted fact that large numbers of the most deleterious bacteria are rendered inert by the method, and, speaking generally, the smaller the dose of bacteria, the less destructive is their action.

Method of Pasteurization. There are a number of appliances on the market for the purpose of pasteurizing and sterilizing on both a large and small scale. The Soxhlet is a good example of the latter. It consists of a cruet-stand which holds ten bottles and it fits into a saucepan. The milk or mixture is poured into the bottles, one feed in each, which will mean between two and a half and five ounces the first six months, and between five and ten ounces the second six months. Cover the mouth of each bottle with the little rubber cap. Pour water into the saucepan until the bottles are three-quarters immersed. Then raise the water to boiling-point. The milk does not itself boil. It only attains to a temperature of 160° to 170° F. at the end of ten minutes. The mixture is kept in the boiling water for ten minutes, for a longer exposure diminishes its nutritive qualities by raising its temperature nearer to the boiling-point. For the first three months whole milk is kept in the boiling water for forty minutes, thus being sterilized, that is, raised to the boiling-point. A quarter of an hour suffices after the third month. It is best to prepare the milk morning and evening. The rubber cap, which gets sucked a little into the mouth of the bottle as the latter cools, keeps the air from the contents. Cool the milk rapidly by plunging the bottles into cold water. Bottles are apt to crack if very hot and plunged immediately into cold water. Keep them in a cool place.

When the child is to be fed the nurse takes one bottle, warms the milk in it by putting the bottle in warm water, removes the cap, and with clean fingers fits on a rubber teat. These rubber teats she scrubs inside and out, boils preferably before each feed, but at least once a day, and keeps in soda solution. The child is fed straight from the bottle. There is, of course, no air vent, but it manages its feed successfully, letting go of the teat occasionally to let air enter. If it seems to have difficulty, see whether the hole in the teat is large enough. Feeding by the bottle takes a long time, sometimes up to half an hour, but this is not a disadvantage. It must always be fed, never

allowed to suck the bottle in its cot, sleep, wake and suck again.

The first teeth appear about the sixth month. We then thicken the milk with a little infant food, preferably Mellin's, Benger's, or Frame food. Put a teaspoonful in a saucepan with some milk and boil for five minutes. Add the thickened compound to the bottle contents. From the eighth to the tenth month we wean the baby from the breast or bottle.

The mothers of poor children are unable to make the mixture we advocate, or to buy a Soxhlet's sterilizer. Give them a bottle of Syde's Soda, and they can buy some Demerara Sugar.

After the second day, then, such children have as artificial diet—

Milk	1½ ounce
Barley-water	3 "
Demerara Sugar.	One smoothed teaspoonful
Citrate of Soda .	A pinch.

They can put the mixture in an ordinary bottle and put the bottle into a saucepan of cold water. Then boil the water in the saucepan for ten minutes. If this cannot be managed they can cut the feed in a small saucepan, heat until the milk rises (170°), and then let it cool rapidly by putting the saucepan in cold water. The mixture should be kept in a clean corked bottle out to stand in cold water. E. H. T.

THE UNHEALTHY INFANT

(Under this heading only those affections which come more especially under the ken of the obstetrician will be dealt with.)

Infantile ailments prove a great difficulty to the young practitioner, and he is frequently consulted when, so far as he can see, no abnormality is present.

Occasionally the instinctive fears of the mother prove a better index to disease than the knowledge of the most careful physician, but much more frequently it is neglect to fully avail himself of all the well-known channels of knowledge which leads him to disastrous errors of prognosis and brings discredit on the profession. A systematic examination of every sick child will be the best means of avoiding gross blunders.

The nurse should undress the child before a fire, for without this precaution it is impossible to make a thorough examination. Inspection will show many abnormal conditions, rashes on the skin, pemphigus on the palms and soles, redness of the buttocks, umbilical or inguinal hernias, deformities, protruding abdomen and the presence of snuffles, of parched skin or attenuated muscles. The anterior fontanelle should be pressed on, the mouth should be

opened and the fauces explored, the condition of the nose must be observed, and the abdomen palpated, whilst of course auscultation and percussion constitute a part of the routine in all examinations.

The child's weight should be carefully inquired into. Progressive increase does not always imply perfect health, but in the presence of steady decrease ill-health may with confidence be prognosticated. Inquire carefully into the condition of the bowels and examine the napkins, which should have been kept for inspection. If the stools are green, lumpy, contain much mucus or curd, possess a sour or offensive odour, or are white and waxy in consistence, the infant is certainly not in good health.

The urine should not stain the napkin deeply, if it does it means that the child is not getting enough water or is feverish. A thermometer, if placed in the groin, will accurately record the temperature. This should be not over 99° F., but transitory and slight causes are able to make it suddenly rise. High temperatures have not the significance in infants that they have in adults. The hours of feeding, as well as the variety and amount of food taken, must be carefully inquired into and questions asked to find out whether the child sleeps well, is cross, is flatulent, or whether it vomits curds or possets its food.

An examination on these lines will enable us to gain a sound notion as to the cause of the ill-health. In the majority of cases there is some mismanagement. If an error of management is discovered, rules for future guidance must be laid down with precision. They should be given with a confidence that will compel respect, for many mothers study the question of baby management in small handbooks and endeavour to guide rather than be guided by the doctor.

The chief causes of ill-health will be found in defects of diet. Food may be unsuitable, it may be too strong, too weak, given in wrong quantities, too frequently administered, or the child may gulp it down too rapidly. Mismanagement in other respects must also be taken into consideration. It frequently happens that the child is kept too much under the bed-clothes and in impure air, it may be kept too warm, or may have some general disease.

If the food given is too strong the child will probably suffer from gastric trouble. It will posset or regurgitate food immediately after being fed, and will also throw up curds and whey throughout the intervals between the feeds. It will suffer from cramps and frequent attacks of loud crying. If the vomited matter is chiefly of the consistence of whey, constipation with flatulence and continuous thirst will

probably be found, or the curds may set up intestinal irritation, causing looseness of the stools or diarrhoea; the napkins will show the undigested character of the food.

If the child be fed on the breast, symptoms such as these are sure indications that a less quantity of milk should be given and at longer intervals. To make these conditions certain the nursing should be regulated by the clock, and feeds of ten minutes, seven minutes, or five minutes insisted on until health is restored. If bottle-fed, the same rules hold good, and some one or all of the ingredients mixed in the meal will require to be diminished.

It is a good plan, too, to let a meal be occasionally missed and to offer the infant as much water as it cares to consume.

Children of the well-to-do seldom suffer from hunger, though there frequently is grave deficiency in some special item of necessary food. A starved child has a characteristic appearance, it is pale, wrinkled and emaciated, has sunken eyes and retracted abdomen, whines, is constipated, but not flatulent, and does not vomit.

A careful examination of the breast and the use of the breast pump will reveal a paucity of milk, and should there be plenty of secretion it must be gathered in a bottle and chemically examined. Deficiency in fat is by no means an uncommon defect of human milk.

Bottle-fed children of the poor frequently illustrate the condition of starvation due to lack of quality rather than quantity of the food given. All such deficiencies should be carefully sought for and remedied without delay.

Irregularity in the times of feeding is a common error. Some mothers put the infant to the breast whenever it cries. The food quiets it for a time. Later it cries again and is fed. This irregularity of feeding must end in stomach derangement. Rest in the cot after feeding should be insisted on, and, lastly, greedy children can be prevented from gulping the milk by either squeezing the nipple or diminishing the hole in the rubber teat.

We have little control over the constituents of the mother's milk. If it is too rich something may be done by lessening the diet, keeping the bowels well open, and insisting that more water be drunk. Deficiency of fat can be made up by giving cod-liver oil to the infant, and if it is impoverished in other respects the natural food may be supplemented by one or more bottles, for there is no disadvantage whatsoever in mixed feeding.

In hot summer weather breast milk is very likely to be deficient in its watery constituents.

With bottle feeding we have much more control over the different constituents of diet, and should a child waste or not increase in

weight from week to week, should it be flatulent, cramped, wakeful and fretful, vomit, be constipated or suffer from diarrhoea, it is reasonable to assume that it is the victim of grave defects of diet, the alteration of which must be our first care. The diluent may be at fault. If children fed on barley water are permitted to become constipated they will suffer from flatulent dyspepsia due to fermentation.

Lime water may be substituted if there are symptoms of gastritis. Lime water interferes with the formation of rennin curd, and the stomach is therefore relieved by a diminution in the amount of casein thrown down. One or two grains of bicarbonate of soda have often a salutary effect. They combine with excessive hydrochloric acid and by so doing render the clot more digestible. Rice water is serviceable when there is any tendency to looseness of the bowels; oatmeal water when there is constipation. Oatmeal water is made in the same way as barley water. Rice water is made by boiling a teaspoonful of rice in a pint of water for ten minutes and straining. Finally, plain water is often the best diluent.

Fat may be in excess or deficient in quantity; the former will make its presence known by loss of appetite, vomiting, and greasy, white smears in the stools. These white masses are sometimes mistaken for casein curd.

With bottle-fed children deficiency of fat is more often experienced, and this deficiency causes constipation and loss of weight, or failure, at all events, to steadily increase in weight.

It is often advised to add cream or butter to the diet of such infants, but unless cream can be obtained fresh and from a pure milk supply, cod-liver oil is a better fat to use. As for butter—it has no advantage over cod-liver oil.

There may be too much or too little *sugar* in the diet. Cane sugar is very liable to ferment in the intestines, and flatulence, with frequent crying attacks, will occur if this is in excess. Children fed with excess of sugar are pale and flabby, sleep badly and have protruding abdomens. Symptoms such as these are often noted in babies who are fed on some forms of condensed milk. A diminished sugar supply leads to constipation. Sugar of milk is the form in which this carbohydrate is usually advised, but clean Demerara sugar or glucose in the form of honey or treacle seem to be equally serviceable and are much to be preferred to cane sugar.

Casein is the curd which is thrown down by rennin or acid from milk. It is a combination of phosphorus and calcium with albumin and is necessary for growth. It readily combines with hydrochloric acid to form paracasein, a compound which requires pepsine, with active

stomach peristalsis, for its digestion. When peristalsis fails in consequence of an overloaded and tired stomach, paracasein hydrochloride is formed, and this forms a very tough and indigestible curd. The lesson to be learned from these facts is that a due interval should be allowed between the infant's meals, so as to permit the stomach to empty itself and rest from its exertions. Such rest cannot be procured save by allowing intervals of three hours, with even a longer rest at night.

It is not important to discover the precise amount of casein which can be assimilated, for the infant's digestive apparatus has the power of passing on unchanged the excess. For this reason we think that too much stress has been laid on the dilution of milk in order to diminish the amount of casein. *Children thrive well when fed on a whole-milk diet.*

In rare cases it may be advisable to diminish the amount of casein which has to be dealt with by the stomach. This may be done by increasing the amount of diluent, by substituting whey in part for the milk taken, by peptonizing the food, by giving citrate of soda, or by feeding on certain patent foods which are free from casein.

Whey contains less than one per cent. of casein, it also contains less fat than milk and can be given in the following mixture—

Whey	1½ oz.
Gravity Cream	1 "
Lime Water	1 "
Citrate of Soda	2 gr.
Solution of Sugar of Milk	1½ oz.

and to this with advantage may be added from five to ten grains of glidine. Gratifying improvement will often follow from a diet such as this in cases where the stomach has become intolerant to the previously given food.

Some children do quite well on Nestle's condensed milk, but we think such a diet is not suitable after the third month. The sweetened variety contains too much sugar, and it should therefore be made weaker than the printed directions. It is poor in fat, and cod-liver oil should always be given as an adjunct.

As a temporary expedient in gastritis, peptonization of the milk may prove beneficial. It allows the food to pass into the intestines more rapidly and thus rests the stomach. Citrate of soda has the same effect but acts in a different manner. It prevents some portion of the casein being acted on by hydrochloric acid and allows it to pass unchanged through the pylorus.

When milk in any form cannot be borne, much benefit may follow the substitution of some of the patent foods which do not contain milk. These foods may be made entirely on

water and the necessary proteid supplied by adding two or three teaspoonfuls of egg albumen to each feed. The albumen solution contains the white of one egg to a pint of cold water. It must be distinctly understood that such a diet as this is a mere temporary contrivance and should not be continued for a longer period than one or two weeks, for, as we have previously mentioned, there is no proper substitute for casein.

Nurses frequently complain that the infant is suffering from **Cramps and Colicky Pains**. The condition points to an error in diet, which should be discovered and treated on the lines already indicated. To alleviate a fit of crying due to this cause the child should be placed in a hot bath and given a dose of castor oil. A powder consisting of sodium bicarbonate (2 gr.) with grey powder (½ gr.) to be given night and morning, or a mixture composed of bicarbonate of soda two grains, pepsin five minims, compound tincture of cardamoms three minims, to a teaspoonful of water as a dose, are useful remedies for the condition.

Looseness of the Bowels without change in the colour or consistence of the stool is nearly always an indication of over-feeding. It is to be distinguished from infective enteritis or green stools (cholera infantum). Few bottle-fed children escape green diarrhœa in a milder or more severe form, particularly during the hot and dry seasons of the year. The napkins are stained a grass green, and the stools are frequent and very irritating to the buttocks. The latter become red and sometimes ulcerated. Vomiting occurs, and the child too often sinks into a condition of collapse with persistent wakefulness, hollow sunken cheeks and a pallor which is the precursor of death. The condition is always due to milk infection, and there is a clear indication to abstain from milk diet so long as the green colour persists. Castor oil should be given in repeated doses, and the lower bowel should be washed out by warm boric solution, passing up from a half to two ounces at a time. If the stomach is irritable it should be washed out by a soft rubber catheter to which a funnel is attached, and before its withdrawal from a half to two ounces of warm water may be poured into the stomach and allowed to remain. The diarrhœa quickly drains water from the system, and this must be counteracted by giving frequent sips of malt glidine or Mellin's food made with water, alternating with plain albumin water—these are foods to rely on as substitutes for milk; and amongst the many drugs which have been found beneficial for the condition the following may be mentioned: calomel, grey powder, bicarbonate of soda, petroleum emulsion, subnitrate of bismuth, borax and soda.

The red buttocks are treated by strict cleanliness, and by the free application of zinc ointment or saturated solution of picric acid.

Thrush or Aphthous Stomatitis is a disease of the mouth due to infection from a dirty nipple or bottle. The tongue and the cheeks are covered with white patches due to the growth of a mould. A saltspoonful of glycerine of borax placed in the mouth three times a day is an efficient remedy. Some of this will be swallowed, with benefit to the child.

Marasmus is the name given to general emaciation due to one of many dissimilar conditions. The fault is generally found in error of diet, but is sometimes due to a faulty glandular innervation, to syphilis, to pyloric obstruction and to other causes.

Careful attention to diet, with gastric lavage, will produce good results in cases that can be cured without surgical intervention, and the drug which will be found most generally useful is grey powder in half-grain doses three times a day. The great popularity of this drug has probably been gained because of its specific action on syphilitic lesions.

Many children inherit syphilis, and it may show itself shortly after birth, but more frequently at the second or third month. Occasionally symptoms do not develop until towards the end of the first decade. Infants have a wizened, old-man expression of countenance, suffer from chronic nose catarrh, and show red discoloration of the buttocks, with eczema or psoriasis, particularly on the hands and feet. The mouth may be inflamed, and the long bones tender at the epiphyses.

Mercury in all forms is borne well in infancy, and the inunction of six to eight grains of blue ointment into the abdomen and back is a good method of administering the metal. In all possible cases a Wassermann's reaction should be obtained. The injection of a small dose—·5 to 1·5 gr.—of salvarsan has worked wonders in skilful hands.

Phimosis is treated by dilating the foreskin with sinus forceps and separating the adhesions between the glans and prepuce. If this simple operation were regularly done shortly after birth, there would be very few cases in which circumcision would be found necessary.

Circumcision.—This procedure finds favour with many obstetricians, and is much approved of by the general public.

We do not think, however, it possesses the many advantages with which it is credited, and, provided the foreskin can be freely retracted, there is no reason why the glans need not be kept clean.

Circumcision is a very simple procedure if performed before the first month. It does not entail the necessity for general anæsthesia,

and as there is little or no hæmorrhage, one or two catgut sutures will be found quite sufficient to secure the mucous membrane to the skin. In older children an anæsthetic is desirable and almost a necessity. Hæmorrhage, too, may be quite persistent, and the operation is by no means free from danger. We know of cases where death has followed from anæsthesia, and also from hæmorrhage, and have seen several in which anxiety arose from subsequent loss of blood. Sloughing from septic infection and great œdema of the loose areolar tissue are amongst other disadvantages which are observed with too great frequency.

The anæsthetic should be entrusted to a trained anaesthetist and an assistant should fix the limbs by grasping the ankles firmly. The foreskin should be pulled forward by a catch forceps and the required portion quickly snipped off by sharp scissors in an oblique direction, so as to take more tissue from the dorsal than from the frænal surface. A director is now pushed under the mucous membrane and is made to separate this structure freely from the glans. The mucous membrane should be divided down to the corona, its redundant structure snipped off, and then folded backwards to make a cuff. This cuff is secured to the skin by interrupted catgut sutures which encircle the penis. If the extremities of these sutures are left long they serve as a very excellent method of fixing a permanent dressing, consisting of a narrow strip of iodoform gauze, which can be made to cover the whole raw surface and be kept in position by knotting the ligature ends over it. These sutures disappear by absorption and save the necessity of being cut out. It is most essential to see that all adhesions between the mucous membrane and glans are completely broken down. A young child need not be kept in bed for more than two days.

Birth Injuries

Depressed Fracture of the Skull and Facial Paralysis.—These have been described under injuries from forceps.

Fractures and Dislocations.—Fractures of the limbs or clavicles sometimes occur as the result of difficult births. The arm may be broken when bringing it down in a difficult breech delivery, or the leg in an impacted breech. In treating these fractures the displacement should be reduced and the arm bandaged to the chest and the forearm immobilized by flexing it and enclosing it in the chest bandage. The thigh and leg should be flexed along the body and bandaged there in treating fractures of the thigh. In treating dislocations immobilize the joints. The bandages should be removed early and careful massage and passive motion carried out.

Brachial Paralysis.—Paralysis of the arm is a rare sequel to a difficult labour. Unlike facial paralysis, it frequently remains permanent. On account of this difference Küstner carefully investigated these cases, and came to the conclusion that there had always been some fracture or dislocation of the humerus at the same time. Those cases of birth palsy known as "Erb's paralysis," characterized by wasting of the deltoid, pectoral muscles and brachio-radialis, belong to a different category. Here the lesion would appear to be rupture of the fifth cervical cord; the symptoms of pronation of the forearm with inability to raise the arm are sufficiently characteristic, and in these cases the treatment of permanent paralysis ought to be at first by massage, and if no improvement takes place after some months, freeing the nerves, and if necessary reuniting them.

Cephalhæmatoma.—A cephalhæmatoma is an effusion of blood beneath the periosteum of the skull, which appears on the second or third day. It does not, therefore, extend beyond a suture. In this way a cephalhæmatoma can be diagnosed from a caput succedaneum, the swelling of which is not limited by sutures. From a meningocele it is differentiated by the time of its appearance, as well as its situation, the latter being over a gap in the bones which is readily felt, also by the fact that a meningocele connected with the cavity of the cranium becomes tense when the child cries. Nothing need be done, for the blood is absorbed after some time.

Hæmatoma of the Sternomastoid.—See *Surgery of the Neck*.

Cerebral Hæmorrhage.—Cerebral hæmorrhage may result from a difficult labour. This is, more commonly than is generally supposed, a cause of sudden death occurring soon after birth. Its symptoms depend on the amount of blood poured out. Convulsions may be followed by death. Some of the cortex may be destroyed, causing various birth palsies.

Congenital Malformations

With **tongue-tie, cleft-palate, and harelip** we have already dealt under interference with the baby's power of sucking.

Meningocele, Encephalocele, Spina-Bifida.—The immediate treatment of these conditions is to cover them with cotton-wool in order to keep them from friction or injury.

Club-Foot.—The proper immediate treatment of club-foot is movement from the very first. Six to eight times a day the feet should be pulled into the right position by the nurse, beginning from the time of birth. Further treatment is given under *Deformities*.

Umbilical or Inguinal Hernia.—These herniæ

may be aggravated by straining due to phimosis, in which case circumcision is advisable.

An umbilical protrusion may usually be cured by folding the skin over the protrusion by means of a strip of plaster or strapping, or keeping a penny or the cork of a pickle bottle over the hernia by strapping.

In some instances the child is born with a large hernial protrusion, in which the intestines can be seen in a thin sac. This sac gives way, in a few hours, so that an immediate operation must be undertaken. In the course of the operation we have found the sac so intimately connected with the bowel that it was safer to leave parts of it than risk tearing the bowel in trying to peel it off entirely. We have also experienced great difficulty in returning the hernia. Therefore, we insert all the sutures, leaving them untied, and then push back the intestines and tie the sutures one by one. The treatment of inguinal hernia belongs to general surgery.

Imperforate Anus.—If there is only a thin partition this can be divided.

When there is no proper anus the operation consists in making a vertical incision with a knife in the middle line where the anus should be. If the bowel is not exposed, the incision must be deepened, cutting as close to the sacrum as possible to avoid the bladder. When the bowel is seen bulging down, open it carefully by puncture. Do not pull the bowel down, but pass the little finger or a bougie daily to prevent the incision closing. Be very careful to stop all hæmorrhage after this operation. Infants are apt to die from quite a small loss of blood.

Mastitis.—The breasts of both male and female infants sometimes secrete after birth. If let alone this will cease spontaneously. If interfered with by the nurse an abscess may form.

Treatment. Protect the breast with pads of wool. If an abscess forms, open it in the usual way.

Gum or Strophulus.—"Gum" consists of little red pimples crowned by a vesicle or yellow crust, which appear when a baby is too hot or has indigestion. For example, they may be seen on a baby's cheek that has been resting against the breast of the mother.

Treatment. Keep the child cooler and use a dusting powder. Attend to its digestion.

Jaundice.—Slight jaundice is common about the third day of infant life. Treatment is not necessary, but two or three grains of phosphate of soda may be given three times a day, and frequent teaspoonfuls of warm water.

More severe and deeper jaundice is due to some congenital or acquired disease of the liver or stenosis of the bile duct, and ends fatally.

Jaundice may also be a feature of umbilical sepsis, when it is of quite secondary importance.

Sepsis of the Umbilical Cord.—In spite of every care in dressing, the umbilical cord may become infected by pyogenic organisms, but the greater the care the less is the risk.

Two conditions may result. The first is a phlegmonous inflammation of the abdominal wall about the umbilicus, the second is a general septicæmia. Frequently the two occur together. All the signs common to septicæmia occur. Thus the baby is exceedingly ill, petechiæ and jaundice appear, the cord may begin to bleed, the pulse is very rapid, and death supervenes.

Treatment. In the general septicæmic form nothing can be done. When there is a local phlegmonous inflammation, it should be treated like cellulitis elsewhere, by incisions and fomentations. Remove the child from the mother, for the virulent germs that are killing it may give the mother some form of puerperal infection.

Hæmorrhage from the Cord.—Hæmorrhage from the cord, unless due to looseness of the first ligature, is a very serious sign. The hæmorrhage is either due to sepsis, or hæmophilia, and in either case will probably lead to a fatal result. Subcutaneous hæmorrhages and melæna may accompany it.

Treatment. Put another ligature on the cord closer to the umbilicus. This usually fails to stop the hæmorrhage. The next method is to underpin the umbilical vessels. Pick up the umbilicus and pass two long needles under it from side to side. Now wind a piece of woollen thread boiled in solution of corrosive sublimate in a figure of eight about the needles and so compress the umbilical vessels. Guard the points of the needles with pieces of cork. We have several times stopped bleeding successfully by this plan.

Melæna.—The baby may swallow blood at the time of delivery or suck it from a cracked nipple and pass it per rectum. More frequently it vomits such swallowed blood. Duodenal ulcer and intussusception have been found in babies a few days old. True melæna is due to a hæmophilic condition and is serious. It is sometimes associated with subcutaneous hæmorrhage and bleeding from the cord, and is frequently fatal.

Treatment. First examine for cracked nipples.

In the dangerous cases give little or no food until the bleeding has stopped. Give water by the mouth. Calcium lactate three grains, with adrenalin chloride one minim every four hours, will prove effectual in many cases. If it seems successful, continue it three times a day until there has been no bleeding for a week.

Infantile Convulsions

Causes. The nerve centres in infancy and childhood are always in a comparatively unstable condition, and are apt to manifest this instability by convulsive storms. Thus the processes of early dentition, or the onset of the acute infective fevers, such as scarlatina and measles, may be associated with convulsions.

Very young children may develop convulsions as the result of brain lesions inflicted at the time of birth; or they may arise from lesions of which the origin is obscure. Hereditary syphilis, too, may occasion them, and it is probable that true epilepsy develops at an early period of infancy.

To make an accurate diagnosis of the cause is often a matter of extreme difficulty, and many of the diseases associated with convulsions do not fall within the province of the obstetrician.

A much more common cause of convulsions than any of the above will be found in the digestive disturbances of infancy, and to these we desire to call special attention.

Few children brought up by the bottle fail to develop green stools during some portion of the period of bottle feeding. These green stools are not infrequently connected with convulsions. They occur with diarrhœa (which is sometimes very severe), but they are occasionally seen with constipation. They arise, too, as a result of gastric disturbance, or of thrush. This green pigmentation is due to germ invasion, and the stools in which it is found are apt to be very toxic.

We have frequently noted that the occurrence of convulsions has followed misdirected efforts to arrest green diarrhœa. They have also seemed to us to follow excessive abstraction of fluids from the infant's body, in cases where severe vomiting and diarrhœa coexist.

Given a child in convulsions, who at the same time has been suffering for some days from green stools, vomiting and diarrhœa, with red buttocks and evidence of thrush, with a depressed fontanelle, pale sunken cheeks and eyes, the probability that convulsions have arisen from these associated conditions will be strong, and treatment which does not take this morbid state into consideration will be of no avail.

Treatment. The above diseases have already been fully dealt with, but we would again emphasize the point that castor oil in full doses should be at once administered.

Float a drachm and a half of castor oil on the top of a wineglassful of hot water. From the water it is readily skimmed, and can be easily administered.

All other available methods to effect elimination of toxins should be adopted; these will

clude enemas of soap and water, or plain salt and water. From one to two ounces of fluid may with safety be injected into an infant's rectum; a larger quantity is unnecessary and has been known to cause rupture of the bowel. If there is any suspicion that the stomach contains indigestible matter it should be promptly washed out with saline solution, and through the tube used for this purpose the oil can be conveniently poured. If the child's system requires fluid this can be given by the mouth, per rectum, or by subcutaneous hypertonic saline injections. We have employed all three methods with satisfactory results.

Whilst these remedies are being prepared the child should be placed in a hot bath to which a teaspoonful of mustard has been added. A handkerchief wrung out in cold water and laid on the head whilst the child is still in the hot bath is a mode of treatment which some have found efficacious.

We have anæsthetized the child with chloroform as a temporary expedient, but cannot say that we have ever observed benefit to

result from the treatment, and confess ourselves prejudiced against it.

Where a rapid amelioration of symptoms seems urgently called for, give morphia. One minim of liq. morphinæ may be given every half-hour for three doses if symptoms continue, or better still half this dose may be given hypodermically and repeated every half-hour whilst necessary. The following is a good sedative mixture, which can be administered when the acutest symptoms have subsided:—

Sodium Bromide gr. xxiv

Chloral Hydrate gr. xii

Tinct. Belladonæ ℥ xii

Glycerine ʒ ss

Water ad ʒ i ss. Ft. Mis.

Such a mixture may be given in drachm doses every hour whilst the child is awake and the convulsions continue, and from two to three times a day so long as it shows from twitching muscles that there is still a tendency towards convulsions.

Do not lose sight of the child until normal digestion has been established. E. H. T.

II.—GYNÆCOLOGY

NORMAL MENSTRUATION

THE periodic discharge from the uterus occurring between puberty and the menopause is an indication of certain ill-understood metabolic changes, probably intimately associated with calcium metabolism and certain of the ductless glands.

It is certain that ovulation has no connection with menstruation, since the former frequently occurs in the absence of the latter; neither is menstruation a necessary preparation for pregnancy, since it is now known that only a small portion of the mucosa is discharged with the menstrual flow, and there are records of women who have had children in the absence of menstruation.

Local Changes Associated with Menstruation.—

Menstruation normally occurs once a month, and Heape, in his investigation of menstruation in the higher apes, found that this month could be divided up into four stages, and other later observers have satisfied themselves that stages more or less corresponding to these can be detected in the human female.

These stages have been given different names and we may classify them as follows—

1. Premenstrual, or the stage of preparation.
2. Menstrual, or the stage of bleeding.
3. Postmenstrual, or the stage of recuperation
4. Intermenstrual, or the stage of rest.

Premenstrual Stage—

Endometrium particularly.

1. The glands become swollen and discharge a secretion containing mucus and compounds of calcium and other salts (Blair Bell).

2. The stroma cells increase markedly in size.
3. The capillaries are dilated.

The total result is that the mucous membrane becomes thicker and congested and its colour is several shades darker than normal.

Uterus as a whole.

1. The body becomes a little larger and softer.
2. The cervix becomes softer and dilates a little.

General Changes.

1. The pulse-rate, blood pressure and temperature are a little raised.
2. There is an increased excretion of urea and calcium salts.
3. There are signs of congestion in other parts of the body, such as the breasts, which become firmer and often tender, the thyroid, which

increases in size, and the vulva, which at times becomes hot and swollen.

4. The woman may be irritable and complain of backache and depression.

Menstrual Stage—

Endometrium particularly.

1. The capillaries rupture and under the epithelium interstitial hæmorrhages can be identified, forming lacunæ or "blood lakes." The blood thus effused, by destroying the epithelium covering it, escapes into the uterine cavity. As, however, only a small portion of the epithelium is thus cast off, it would appear probable that most of the blood escapes from the congested endometrium by a process of diapedesis.

Uterus as a whole.

1. The uterus has the same general characters as were noted in the premenstrual stage.

2. Intermittent uterine contractions are set up and help to expel the menstrual discharge.

These contractions are said to be dependent on the calcium salts circulating in the blood (Blair Bell).

General Changes.

1. When menstruation is established the pulse-rate, blood pressure and temperature fall.

2. There is a diminished excretion of urea.

3. The signs of congestion in other parts of the body subside.

4. The patient complains of a certain amount of weakness and is unable to follow her usual avocations with the same zeal.

Composition of the Discharge.

1. The first day the discharge is pale and consists of mucus and blood and contains an excess of leucocytes.

2. The second day the discharge consists mainly of pure blood, is darker in colour, and vaginal and endometrial cells can be identified with the microscope.

3. The mucus from the cervix, when present in sufficient quantities, prevents the blood from clotting, and this as a rule obtains; but if the loss is a little excessive, though still within the limits of normality, then there being insufficient mucus, small clots may be discharged.

4. The fourth day the bleeding stops and the discharge consists of mucus and old blood, so that the colour is of a brownish tinge and the odour a little offensive.

Cause of Menstrual Cessation.

1. The contractions of the uterus becoming more marked, compress the capillaries and prevent further exudation from them.

2. The calcium content of the blood becoming raised owing to diminished loss, coagulation is further excited.

Postmenstrual Stage—

Endometrium particularly.

1. The damaged areas of endometrium are repaired, the new epithelium growing from the glands.

2. The capillaries are repaired.

Uterus as a whole.

1. The body gradually returns to its proper size and consistency.

2. The cervix becomes harder and its dilatation passes off.

General Changes. The general changes correspond to those noted under the menstrual change. The feelings of the patient will depend on a good deal on the amount of blood lost.

Intermenstrual Stage.—In a healthy woman during this stage the uterus, both as regards its endometrium in particular and its condition as a whole, is normal, as is also her general condition.

The First Menstruation.—The age at which menstruation first appears in human females varies in different species of the same race and in different races. Longitude and latitude have nothing to do with the matter.

The average age for Europeans is fourteen. 88·4 per cent. of females menstruate between the ages of twelve and seventeen; 6·1 per cent. between the ages of eighteen and twenty-six; 5·5 per cent. between the ages of nine and twelve.

Menstruation before the age of nine is very rare, and although there are records of girls having menstruated regularly from infancy, the onset of menstruation having been accompanied by other signs of puberty, such as development of the breasts and appearance of hair on the pubes, nevertheless most of the cases of bleeding from the genital passages under the age of nine have some pathological cause.

On the other hand, whilst the first menstruation may occur late in a perfectly normal young woman, in a certain percentage of the women with delayed puberty the genital organs are not fully developed.

The Last Menstruation.—The menopause or “change of life” occurs in the majority of women between forty-eight and fifty years of age. Of the minority the greater number cease menstruating between forty-four and forty-eight, or between fifty and fifty-two, a small percentage only between forty and forty-four.

Early Menopause.—Cessation of the periods before the age of forty is certainly abnormal, and although it has been reported in women under thirty who otherwise appear to be perfectly normal, nevertheless in most of these

cases the cessation has followed some serious illness, or profound nervous disturbance, the uterus has undergone superinvolution after childbirth, or the uterus and ovaries are not perfectly developed.

Late Menopause.—The occurrence of periodic bleeding after the age of fifty-two should be regarded with great suspicion, since although healthy women may menstruate even up to fifty-five, the loss of blood is mostly due to local disease, often to cancer, so that early recognition is of vital importance.

Menstruation may come to an end suddenly or gradually.

It is rare for the menopause to occur suddenly, although in some women who have been menstruating regularly the “change of life” is notified by absence of the period at the expected time, never to occur again.

Artificial Menopause.—The *complete* removal of both ovaries brings on the menopause. Removal of the uterus does likewise, but whereas the menopause induced by double oöphorectomy or ovariectomy is acute and causes much distress to the patient, that induced by hysterectomy alone is more gentle; so in hysterectomy one or both ovaries, if possible, should be conserved.

The “change of life” is generally gradual, the periodicity and the amount lost becoming irregular.

The irregularity mostly takes the form of fewer periods, so that the woman may miss one or more months, and diminished loss; the time elapsing before the final cessation averaging between three months and three years.

Less often the periods become more frequent and the loss excessive; rarely it may be serious.

Whilst, however, these excessive losses, even amounting to “flooding,” may occur in women with perfectly normal genital organs and are probably due to vasomotor changes, the practitioner must never lose sight of the fact that these excessive losses are more often due to local disease. The idea that is prevalent that the climacteric is commonly ushered in with “floodings” and frequent periods is responsible for many deaths, since the commonest cause of these symptoms is cancer of the uterus.

General Changes at the Menopause.

1. Vasomotor phenomena known as “flushing,” with sensations of heat all over the body, and especially in the face. These attacks, which are often very distressing, last several minutes and may occur several times a day. They are followed by “cold sensations” and perspiration.

2. The gastro-intestinal tract is deranged, so that nausea or vomiting and constipation are frequent concomitants.

3. The nervous system is affected. Headaches

are particularly common. The woman may suffer from giddiness, depression and irritability.

4. There is in many a noticeable increase in the subcutaneous fat.

The frequency with which women in the menopause suffer from such symptoms varies. In some few the "change of life" appears to cause no discomfort, but so great a majority do suffer in this way that the above may be regarded as normal manifestations.

Local Changes. The following local changes take place as the result of the menopause, the time of their occurrence varying in different women and depending somewhat on their civil state.

Breasts. These organs shrink from glandular atrophy and loss of fat.

Vulva. The pubic hair is gradually shed and changes colour.

The labia majora atrophy and become dry and shrivelled.

Vagina. This becomes gradually diminished in size, especially at its upper part, so that digital examination may be difficult or impossible.

Cervix Uteri. The vaginal portion gradually atrophies until the external os is flush with the vaginal vault.

Corpus Uteri. The body of the uterus shrinks and becomes fibrous; the endometrium eventually disappears.

Ovaries. The ovaries become shrivelled and fibrous, their surface becomes irregular, and the Graafian follicles vanish.

Fallopian Tubes. The tubes atrophy and become fibrous.

Diseases More Particularly Associated with the Menopause.—The menopause is a dangerous period, in which many serious conditions make their first appearance, particularly cancer. Other diseases now met with are senile vaginitis, senile endometritis and kraurosis vulvæ. Fibroids of the uterus may become a source of danger from atrophy, septic infection, or degeneration. Of the general diseases, most of them have reference to the nervous system and include insanity.

Treatment. The patient must not be encouraged to regard herself as an invalid. The bowels must be kept very regular; alcohol should be avoided, for habits of intemperance are apt to arise, possibly commencing with its use as a medicine. Sedatives also should be withheld. If unavoidable, a mixture containing the bromides of ammonium and potassium, ten grains each, will be found useful.

Occasionally ovarian extract appears to relieve the symptoms, but in most cases it proves a disappointing remedy.

The following statistics of 1000 cases are taken from *Menstruation and its Disorders*, by Arthur E. Giles.

Periodicity of Menstruation.

In 82 per cent. of women menstruation is regular, occurring—

Every lunar month in	40 per cent.
Every calendar month in	32 "
Every 21 to 26 days in	9 "
Every five weeks	1 "

In eighteen per cent. of women menstruation is irregular.

Duration of the Flow.

In 70 per cent. of women the flow lasts 3 to 6 days	
In 20 " " " " " 7 days or more	
In 9 " " " " " 1 to 2 days	
In 1 " " " " " was variable	

Quantity of Blood Lost.

The average amount of blood lost is four to five ounces. The extremes within normal limits are two to eight ounces.

The loss was moderate in	46 per cent.
The loss was scanty in	25 "
The loss was free in	22 "
The loss was profuse in	7 "

Pain.

Dysmenorrhœa was absent in	35 per cent.
Dysmenorrhœa was moderate in	36 "
Dysmenorrhœa was severe in	29 "

Constitutional Disturbances.

There was no constitutional disturbance in 36 per cent.

Languor, weakness and fatigue were present in	30 "
Headaches were complained of in	19 "
Sickness or nausea, anorexia or bilious attacks in	8 "
"General Illness" was the description in	5 "
Various disturbances were noted in	2 "

Psychical Disturbances.

There was no psychical disturbance in	52 per cent.
Depression was the complaint in	18 "
Irritability was the complaint in	19 "
Depression and irritability were observed in	11 "

C. B.

MENORRHAGIA—METRORRHAGIA

A woman is said to have menorrhagia if the loss of blood at the periods is excessive, and metrorrhagia if she has any loss between the periods.

These two conditions so often own the same cause that it will be convenient to discuss them together, with this distinction, that whereas metrorrhagia is always due to local disease, menorrhagia is occasionally due to some general pathological condition.

The causes of abnormal uterine hæmorrhage may be classified according to whether or not they date from some particular pregnancy, labour, or puerperium, and, further, these causes may be divided into general and local.

Abnormal Hæmorrhage dating from some Particular Pregnancy, Labour or Puerperium

General Causes—

Hyperlactation. A woman should, if possible, nurse her child for nine months, but not longer. To save the price of cow's milk poor women will prolong the nursing period, whilst both poor and rich often do so in the mistaken belief that lactation will prevent conception.

Prolonged nursing will not prevent conception whilst the woman keeps in good health, and when the health is deteriorated thereby menorrhagia and metrorrhagia often result.

Local Causes—

Subinvolution of the uterus, with or without a portion of retained placenta, membrane or hydatid mole.

Displacement of the uterus, such as backward displacement, downward displacement, or chronic inversion.

Chorion epithelioma, which is a very rare disease and is more liable to complicate hydatidiform degeneration of the chorionic villi.

Pelvic inflammation due to an attack of puerperal sepsis.

Fibroid tumours of the uterus that have undergone the change known as red degeneration; have become infected from uterine sepsis or from pressure during labour; or from being interstitial have become submucous or polypoid owing to the involution of the uterus.

Extra-Uterine Gestation. In these cases irregular bleeding may take place. It is generally small in quantity and occurs after a period of amenorrhœa, usually of six weeks' duration but extending at times up to three months; occasionally the bleeding appears before the next period is due.

Abnormal Hæmorrhage apart from some Particular Pregnancy, Labour or Puerperium

General Causes—

Diseases of the Blood. Anæmia, with the exception of chlorosis, which is commonly associated with amenorrhœa, may give rise to abnormal bleeding, as also may hæmophilia, scurvy and purpura.

A deficient calcium content, by reducing the clotting power of the blood, may be a cause of menorrhagia (Blair Bell).

Conditions leading to Congestion of the Genital Organs. Chronic constipation, with associated pressure on the pelvic veins; pressure of ovarian or other tumours on the great veins of the abdomen; and also conditions leading to back-pressure on these veins, such as cirrhosis of the liver, Bright's disease, and rarely valvular disease of the heart. Late hours, both in getting up and going to bed, excessive indulgence in rich food, and insufficient exercise,

all tend to increase pelvic congestion, causing excessive menstruation, as also does recent marriage and temporary alcoholic excess. Chronic alcoholism is more often responsible for amenorrhœa.

Nervous Disorders. Excessive menstruation may follow a shock to the nervous system, such as fright, bereavement or an accident.

Disease of the Blood-Vessels. In common with the arteries in other parts of the body, the uterine arteries suffer from the degeneration associated with Bright's disease, and may be a factor in the excessive loss.

Puberty and Menopause. At times puberty is ushered in with excessive menstruation, the loss accompanying the first few periods being in excess of the normal, sometimes amounting to a flooding of a dangerous character from which death has resulted. No pathological cause can be discovered in these cases.

The periods are also at times brought to their normal permanent cessation (menopause) by a series of irregular and often profuse losses, and, again, in a few cases no pathological cause can be determined. In both instances the excessive loss is probably due to some vasomotor change. The practitioner, however, must remember that excessive and irregular losses at the menopause are chiefly due to very definite and often serious disease, such as cancer.

Local Causes.—These are best dealt with under the particular organ affected—

Fallopian Tube. In carcinoma of the Fallopian tube (a very rare disease) there is an intermenstrual discharge of a watery, cherry-coloured fluid.

Ovary. Ovarian tumours may be the only discoverable disease associated with the uterine hæmorrhage, in which case they are generally small. Ovarian tumours are most commonly associated with amenorrhœa, but this is only when they are large enough or of such a nature as to have depreciated the general health.

An excessive ovarian secretion is also thought to be a cause of menorrhagia.

Uterus—

1. *Body. Innocent Tumours.* Adenomyomata, interstitial or submucous fibromata and fibroid polypus; adenoma and its polypoid form (mucous polypus).

Malignant Tumours. Carcinoma; sarcoma.

Displacements. Retroversion, retroflexion, and chronic inversion.

Inflammation. Chronic endometritis; fibrosis.

2. *Neck. Tumours.* Innocent and malignant, as already described under *Body*.

Ulceration. Due to the pressure of a pessary, to the friction of a prolapse, or to the action of the tubercle bacillus or the spirochæte.

Vagina. *Ulceration* due to the pressure of a

pessary, to the friction of a prolapse, or to carcinoma, sarcoma, tubercle or syphilis.

Vulva. Ulceration due to carcinoma, sarcoma, tubercle or syphilis.

Diagnosis. It is best to ascertain first whether or not the abnormal menstruation dates from some particular pregnancy, labour or puerperium. If so, the cause will most probably be a local one and a local examination should be made. If not, the practitioner will then decide whether there is excessive bleeding with the periods, or bleeding, excessive or not, as the case may be, between the periods. In many cases the two are combined in the same patient.

Care must be taken in interpreting the history; because the monthly loss is large it must not be assumed that the patient has menorrhagia. Examples will often be found where the loss has always been regular and excessive and yet the patient is in good health, since menorrhagia in one woman may be normal menstruation in another.

If metrorrhagia is diagnosed, a local examination is imperative, since this symptom denotes organic disease. If the complaint is one of menorrhagia only, it may be advisable in a few cases to postpone local examination till after the effects of medicinal treatment have been observed.

If the case is one of menorrhagia and metrorrhagia, then certainly a local examination should be made.

Again, it is well to remember that a *serious* hæmorrhage has nearly always a uterine origin.

Care must also be taken to ensure that the hæmorrhage complained of does really emanate from the genital tract; the bleeding may come from the urethra (caruncle, carcinoma), the bladder (tumour, calculus) or the rectum (hæmorrhoids).

The age and position of the patient seeking advice will also be of use in determining the cause of the abnormal bleeding. Thus a patient can be classified under one of the following headings:—from birth to puberty, from puberty to marriage, from marriage to the menopause, after the menopause.

Birth to Puberty. Bleeding from the genital tract during this period is rare. Occasionally newly born female infants have a slight discharge of blood from the uterus, which is of no serious significance, and menstruation may commence a few years before the age of fourteen, whilst rarely it has become established at a very early age and appeared regularly thereafter.

Very early bleeding is more often due to some pathological condition, such as sarcoma of the uterus or ovary, than to genuine menstruation.

Puberty to Marriage (say at twenty-five years

of age). Apart from the menorrhagia of puberty, abnormal hæmorrhage during this period is generally due to some congestion of the uterus and is menorrhagic in character, so that in the majority of cases medicinal treatment alone may be prescribed, although if the congestion is due to a backward displacement of the uterus, relief cannot be expected till this is rectified. Backward displacement in this period, however, is not common and, if present, may give rise to no symptoms.

Rarely metrorrhagia is complained of during this period, when it may be found to be due to a malignant ovarian tumour, sarcoma of the uterus, mucous polypus of the uterus, or ulceration due to a pessary inserted to correct displacement or to some foreign body inserted by a neurotic female herself.

At this age fibroids and adenomyomata are very rare.

Carcinoma of the body of the uterus may also be certainly excluded.

Marriage to the Menopause. Apart from the temporary menorrhagia due to congestion in the newly married, the majority of cases of abnormal hæmorrhage for some ten years following marriage depend upon pregnancy, labour or the puerperium, as already indicated. The frequency of fibroids and adenomyomata is somewhat increased, but carcinoma of the cervix is still uncommon and below thirty rare. From the age of thirty-five to the menopause, fibroids, adenomyomata and malignant disease of the cervix become increasingly common and most common of all at about the age of forty-five, after which the frequency of carcinoma of the body increases.

It will be found that fibroid tumours and carcinoma of the body are commoner in women who have not had children, whilst the association of childbirth and carcinoma of the cervix is marked.

A frequent cause of uterine hæmorrhage in the early years of married life is infection of that organ, most commonly due to sepsis following labour or miscarriage, and almost as frequently the sequel of gonorrhœal infection. The infection may more rarely be a descending one from some septic abdominal condition (appendicitis) via the Fallopian tubes.

Between thirty and forty-five hæmorrhage may also arise from adenomatous disease or its localised form, mucous polypus.

It is during this period also that the excessive bleeding due to fibrosis of the uterus, most often a condition in which the muscular tissue of the uterus is replaced by fibrous tissue, first declares itself.

After the Menopause. It has already been mentioned that irregular and severe losses may occur at the menopause, due to vasomotor

changes, but such losses are nearly always due to disease. Hæmorrhage from the genital tract after the menopause has generally a serious aspect, since in most cases it is due to malignant disease of the body or cervix, and until this can be excluded no other diagnosis should be made.

Rarer causes of hæmorrhage after the menopause are ovarian tumours, fibroid and mucous polypi, degenerating fibroids, senile endometritis, and ulcerations due to prolapse and pessaries.

I have operated upon two women over seventy years of age who for the twenty years following their menopause had no loss, and then bleeding commenced and became very bad. On dilating the cervix, in each case a small fibroid polypus was detected and removed.

Carcinoma in an Atrophied Uterus.—After the menopause the uterus gradually becomes smaller, more particularly the vaginal portion of the cervix, which may entirely disappear, leaving only a small orifice in the roof of the vagina. Carcinoma of the cervix then occurring in the supravaginal portion of the cervix is impossible to diagnose in its early stages unless the cervical canal is dilated, and it may only herald its arrival by a small discharge of blood. Again, the cause of the metrorrhagia may be carcinoma of the body, associated with diffuse ulceration of the endometrium without enlargement of the body.

Fibrosis of the Uterus.—This is a condition difficult to diagnose even when the cervix is dilated, since it may cause but little or no enlargement of the uterine cavity, and nothing striking is found. There are two signs, however, which are of value, more especially to one who has had frequent opportunity of examining these cases; these are an undue hardness of the uterus and a uterine wall which can be felt, between the index finger of one hand in the cavity and the other hand pressing from the abdomen, to be much thicker than usual. A diagnosis of this condition may have to be arrived at after the various methods of treatment have failed to give relief.

Senile Endometritis.—This condition, which may come on many years after the menopause, is associated with hæmorrhage and a leucorrhœal discharge which is at times offensive. It will need a dilatation of the cervix, and perhaps a microscopical examination of the curetted endometrium, to establish a diagnosis from carcinoma of the body.

It is very frequently associated with senile vaginitis.

Adenomatous Disease.—Adenomatous disease of the uterus, whether diffuse or polypoid (mucous polypus), can, especially if the polypus

be at the fundus, only be diagnosed by dilatation of the cervix and digital examination of the cavity.

Hæmorrhage due to Puberty and the Menopause.—This is diagnosed by the elimination of disease. In the case of puberty, the practitioner may try medicinal treatment for a little while, as the bleeding at this time has rarely any pathological significance. At the menopause, on the contrary, the patient, married or single, must be carefully and locally examined.

Treatment. The treatment of abnormal bleeding from the genital tract must depend in the first instance as to whether the loss is severe and dangerous or not.

Severe and Dangerous Hæmorrhage.—In these cases the bleeding must be stopped as soon as possible. As such bleeding, except in the rare complication of puberty or the menopause, arises from some local disease, a pelvic examination is imperative, and if any condition be found that should be immediately removed, such as a polypus, this must be done, otherwise the symptom of bleeding must be treated for the time being, and afterwards, when the necessary arrangements can be made, the cause may be dealt with. Hæmorrhage from the genital tract may be combated with drugs, hot douches and packing.

Drugs. Of all the drugs that have any effect on the uterus, ergot is the most reliable, and in such cases as those under discussion ten minims of the hypodermic injection of ergotin B.P. should be given.

In addition, local styptics may be applied to the endometrium, such as adrenalin, hamamelis or perchloride of iron; the last, though very efficacious at the time, should be reserved for those cases where everything else has failed, since the endometrium will slough after its application.

Hot Douches. A vaginal, and, if the cervix is sufficiently dilated, an intra-uterine douche will aid materially in stopping hæmorrhage. The temperature of the water should be about 118° F.

Packing the Vagina and Uterus. A very good method of controlling excessive uterine hæmorrhage is to pack the vagina tightly with sterilized gauze. The uterus may also be packed if the cervical canal will admit the gauze.

The packing, to be of any use, must be efficient, the chief points being:—(1) empty the bladder; (2) wash the vagina out with a hot douche; (3) pack tightly, commencing at the fornices and gradually filling up the vagina from above, using a Sim's speculum if one is available; (4) put on a pad, to keep the packing in situ; (5) Apply a T bandage to keep the pad

in position; (6) remove the packing within twenty-four hours and douche.

Hæmorrhage not Severe or Dangerous.—When the loss is not so severe or dangerous as to require the treatment just outlined, more attention can be given to the appropriate remedies indicated by the condition, and these will be found fully described in the chapters dealing with those diseases. It will only, therefore, be necessary to indicate the general lines upon which the treatment should be conducted.

Hæmorrhage from the Fallopian Tubes, Vagina or Vulva, or due to the Ovaries.—Excepting that due to traumatic, syphilitic or tubercular ulceration, bleeding from disease of these structures must, if possible, be treated surgically.

Hæmorrhage from the Uterus.—Bleeding from the uterus may be due to congestion, to the fact that having a tumour in its substance (whether fibroid, adenomyoma or retained products) it is unable to contract properly during menstruation, and so close the vessels or else that its vessels are diseased (Bright's disease), that in addition its muscle is replaced partly by fibrous tissue and thus handicapped in its contractile power (fibrosis), because the blood does not clot as well as it should, thus postponing the formation of thrombi (the various anæmias and other blood diseases, lessened calcium content of the blood); to the fact that the uterine cavity is larger than normal, there is more endometrium, and therefore there are more vessels to rupture during menstruation (subinvolution, adenomatous disease), or because some form of ulceration is proceeding, and blood-vessels are opened during its progress (traumatic, malignant, syphilitic, tubercular). In most of these cases the appropriate treatment will be found under the disease indicated.

Congestion.—The menorrhagia of uterine congestion is best treated with rest, saline aperients, and a light diet from which all stimulating articles have been eliminated. If there is any general condition giving rise to the congestion, this, of course, must be remedied as much as possible.

Deficient Clotting Power.—Menorrhagia due to this cause may at times be very effectually treated by the administration of calcium lactate, 30 gr. in a tumblerful of water at night-time every day for a week, and then every other day. Horse serum 10 c.c. three times a day in addition, for the week preceding the period, may at times prove very useful. There are always a certain number of cases the exact diagnosis of which is not at first determined, or having been determined, it is decided to postpone operative treatment until medicinal treatment has been given a trial. Hæmorrhage in these cases is often very difficult to control.

Of all the drugs employed for the treatment of bleeding from the uterus, ergot is by far the best, and it is almost certain that if ergot fails to afford relief, the practitioner will generally find other drugs equally disappointing, although rarely one of them, either alone or in association with ergot, will control the bleeding. Ergot, when given for a long time, is apt to damage the cardiac muscle, since by raising the blood pressure it increases the strain on the heart, on a heart, be it remembered, which may already be degenerate from the prolonged anæmia due to the hæmorrhage. Ergot may be given in the solid form of pil. ergotin, 1 to 3 gr. three times a day, or in the liquid form, which is more efficacious, either hypodermically as ergotin, 10 minims, or more usually in a mixture, as the the liquid extract. It acts better when combined with strychnine and an acid as follows—

R Ext. Ergot. Liq. \bar{z} i
 Liq. Strychninæ Hydrochlor. \mathfrak{M} v
 Acid Hydrochlor. dil. \mathfrak{M} x
 Spirit. Chloroform. \mathfrak{M} x
 Aquam distillat. ad \bar{z} i
 t.d.s.

Hydrastis and hamamelis may be given in the form of the liquid extract in doses of 30 minims, either together or separately, and in association with ergot or not. Some women are unable to take ergot, in which case these two drugs may be found useful. If these fail, styptol can be given in doses of 1½ gr. three times daily, stypticin may be given in one-grain doses at the same intervals.

If the hæmorrhage cannot be controlled by drugs, electrical treatment by the ionization method may be tried, in which a positive electrode composed of zinc or copper amalgamated with mercury is inserted into the uterus. When the electrical action starts, particles of mercury with the zinc or copper penetrate into the uterine tissues. I can imagine that this treatment might be of some use in cases of chronic inflammation, and in some of the cases where no definite cause for the bleeding can be found, but personally I have not experienced that benefit which its more enthusiastic advocates claim, in fact it has failed where I most expected its success. C. B.

RETAINED MENSTRUATION

The causes of retained menstruation are generally classified with those of amenorrhœa and the subject discussed under this heading. Since, however, the patient does menstruate, such a method of description is obviously inaccurate, for retained menstruation has no

connection with amenorrhœa, and we therefore deal with it separately.

The menstrual discharge is retained because there is some hindrance to its escape either at the cervix, in the vagina, or at the vulva. The obstruction may be primary, inasmuch as the menstrual discharge has never escaped since puberty supervened, in which case the obstruction is due to a congenital malformation, or secondary, inasmuch as menstruation had been occurring normally for a variable period before it was retained, in which case the obstructive adhesions are the result of inflammation.

Congenital Causes. Imperforate cervix, vagina, or hymen. To understand the nature of the obstruction it is necessary to say a few words concerning the development of the uterus and vagina.

Development of the Uterus. The uterus is formed from the fusion of a portion of the Müllerian ducts. If that portion of the fused ducts which forms the uterus is not canalized, there can obviously be no uterine cavity. Rarely the canalization stops short of the cervical canal, when a condition of imperforate cervix results.

Development of the Vagina. The vagina is developed in two ways—

1. The urogenital sinus (which is that part of the cloaca shut off from the rectum by the cloacal septum) is divided into two portions by the downgrowth of a vesico-vaginal septum, the anterior part forming the base of the bladder and urethra, the posterior part the lower third of the vagina. The fused Müllerian ducts extend downwards from the uterus into the top of this posterior part of the urogenital sinus (lower third of the vagina), and, becoming canalized, form the upper two-thirds of the vagina. This is the commonest method of formation. If that portion of the fused ducts forming the upper two-thirds of the vagina does not become canalized, the patient has an imperforate vagina.

2. The vesico-vaginal septum, instead of dividing the urogenital sinus into two parts, simply fills up the posterior part with a solid column of tissue. The fused Müllerian ducts, to reach the surface, have then to penetrate this solid posterior portion of the urogenital sinus and, becoming canalized, the vagina is eventually formed. If the fused ducts do not penetrate the solid portion the patient has an imperforate vagina. This is the rarest method of formation, and is the one usually responsible for the malformation of the vagina resulting in the condition known as "retained menstruation."

Development of the Hymen. The hymen represents the remnant of the membrane which covered in the cloaca, and if it fails to become perforated obstruction to the escape of the men-

strual fluid results. An imperforate hymen as a cause of obstruction is second in frequency to a septum across the lower end of the vagina. The result of an obstruction is that the menstrual discharge collects, and so the organs above the point of obstruction become gradually dilated, the dilated vagina being known as a hæmato-colpos, the dilated uterus as a hæmatometra, and the dilated Fallopian tube as a hæmato-salpinx. The degree of and the time taken in the dilatation depend upon the position of the obstruction and the organ affected. Thus the walls of the vagina and Fallopian tubes being much thinner, these structures will dilate more readily than the uterus with its thicker walls. If the obstruction is low down the uterus will be a very long while before it dilates, and before this organ gives way to the pressure the vagina will become enormously stretched; whereas if the obstruction is high up in the vagina or at the cervix, the uterus will dilate more rapidly.

Symptoms. The patient gives a history of never having menstruated. In addition she may complain of periodic pain in the abdomen and back and of a gradually enlarging abdominal tumour; she may also complain of pain on passing water, and at times the first symptom complained of may be retention of urine. The age at which patients are brought for advice depends partly upon the care bestowed on them by their mothers, partly upon the date of onset of menstruation and the amount of discharge. When the amount is small the local disturbance may be very slight, and for some years no complaint will be made either of pain or swelling, so that a girl may be sixteen or seventeen years old before she seeks advice, or even older if menstruation has developed late. On the other hand, if menstruation commences before the average age or the amount lost is more than a little, the stretching of the vagina will be much more rapid and the complaint of pain with an abdominal tumour likely to be made sooner.

Signs. Taking a typical case, on abdominal examination a fixed fluctuating median swelling will be found extending above the pubes. The percussion note may be dull or resonant, according to whether there is a dilated bladder or intestine in front of the swelling. On the summit of the swelling, which is more or less dome-shaped, a hard round movable body can be felt, which is the uterus.

On vaginal examination, when the labia are separated a tense swelling will be found projecting from the vaginal orifice, purple-red in colour and covered by a normal hymen.

A recto-abdominal examination will show that the pelvis is filled by a fluctuating swelling continuous with the abdominal swelling above and the vaginal swelling below.

If the condition is more advanced than this

the uterus will also be felt to be distended, that is, the swelling on top of the distended vagina will be much larger and softer than that mentioned in the typical case. Under these circumstances, also, it may be possible to feel certain irregular projections in the neighbourhood of the uterus, which are the dilated Fallopian tubes.

Imperforate Hymen.—The symptoms and signs will be similar to those already described, only in this case the hymen stretching over the vulval swelling will be found to be imperforate.

Imperforate Cervix.—This is a rare congenital malformation.

Symptoms. The symptoms in this case will be similar, except that as the vagina will not be dilated, the bladder will not be pushed up or the urethra stretched, so that urinary troubles will be absent, and as the rectum will not be pressed upon, there will be no trouble there.

Signs. The abdominal signs correspond to those already mentioned when the vaginal obstruction had been present for a long while.

The vaginal examination depends upon whether the vagina is patent or not. In some cases the vagina is found to be absent or its lower third only represented by a cul-de-sac. If the vaginal canal is patent the cervix will be felt as a smooth fluctuating swelling and no external os can be seen.

Suppuration may take place in the retained fluid, so that pyocolpos, pyometra or pyosalpinx may eventuate.

Retained Menstruation in one half of a Double Vagina or Uterus.—When discussing the development it was pointed out that these organs were formed by the fusion of the two Müllerian ducts. If these ducts do not fuse the result is the formation of a double uterus, or double vagina or both, and the congenital atresias that have already been described may occur on one side only. This may lead to a certain amount of difficulty in diagnosis, since the girl may be menstruating normally from one uterus, and so the fact that the menstrual fluid from the other uterus is being retained escapes notice and the swelling is regarded as a cyst.

Treatment—

Imperforate Vagina at its lowest limit or Imperforate Hymen.—The treatment of these two conditions is the same.

Preparation of the Patient. The vulva should be shaved and the patient should then have a bath, especial attention being devoted to the locality of the operation.

The external genitals are then rendered as sterile as possible by swabbing with ethereal soap, which is then removed with warm water, after which the parts are finally swabbed with biniodide of mercury (1 in 2000) and a compress consisting of a pad of gauze tissue wrung out of

biniodide of mercury (1 in 2000) is adjusted over the vulva and kept in position by a T bandage.

Operation. A small incision is made in the bulging septum or hymen as the case may be, from before backwards, and the sticky fluid, consisting of blood and mucus, allowed to escape without any assistance such as pressure on the uterus.

When the flow of retained fluid decreases the incision is enlarged and another made at right angles to it. If the vagina alone is distended the retained fluid should be evacuated as completely as possible by gentle irrigation with boric acid solution. Where the uterus itself is distended no attempt should be made to empty it, but it should be allowed to drain by itself.

Dangers. The dangers connected with this operation are those of sepsis and hæmorrhage.

Sepsis is a very real and serious danger and is due to organisms entering the dilated genital tract and finding therein a retained fluid upon which they can thrive. The distended state of the Fallopian tubes which is sometimes present forms a direct route to the peritoneum, and double suppurating hæmatosalpinx and general peritonitis have often resulted.

Hæmorrhage, intraperitoneal in character, is due to the rupture of the Fallopian tube or tubes. The fact that the tubes are dilated may not at first be ascertained, and for this reason the abdominal swelling should not be pressed upon, since if the tubes are distended it is a proof that their ampullary ends must be sealed, and the peritonitis causing this may have so fixed them that when pressure is applied there is a danger of their being ruptured or of the adhesions fixing them being torn.

If after evacuation of the retained fluid the patient shows signs of intraperitoneal bleeding, the abdomen should be opened and the condition dealt with, which should also be done if the Fallopian tubes are ascertained beforehand by bimanual examination to be dilated.

Dressing and After-Treatment. The sterilized pads are to be removed when soiled, and if the patient shows any signs of sepsis the vagina must be douched twice daily with a warm solution of 1 in 4000 biniodide of mercury. The patient should be made to sit up, so that better drainage may be obtained.

Absence of the Vagina in some part of its length—

Operation. A sound is passed into the bladder and held by an assistant.

The operator, having introduced the index finger of his left hand into the rectum so that it, together with the sound in the bladder, may act as a guide, makes a transverse incision in what should be the vaginal orifice, and then with the index finger of his left hand and scissors, if necessary, gradually enlarges the wound in an

upward direction, taking care to avoid the rectum and bladder, until the vaginal canal is reached, when the retained fluid is allowed to escape, with the same precautions already mentioned. If possible, the skin at the orifice should be dissected free all round and then sutured to the mucous membrane of the vagina, so that the raw surface is covered.

Dangers. Besides those already mentioned, a careless operator might wound the bladder or rectum, and if the raw surface has not been covered with skin the wound is very likely gradually to contract, so that in a few months the patient is in practically the same state as before.

Dressing and After-Treatment. Following the operation the newly formed vaginal canal is kept patent first with a plug of lint and in a few days later with a perforated glass tube made especially for the purpose. This glass dilator will have to be worn for some hours a day for many months, since if its use is omitted there is the greatest risk of the canal closing. Patients for this reason have had to be operated upon many times, and in intractable cases the question of hysterectomy has to be carefully considered.

Total Absence of the Vagina.—When the vagina is absent, or practically so, and the uterus is functionally active and dilated with menstrual fluid, the best and proper operation is total hysterectomy.

The Fallopian tubes should be removed with the uterus, as they are also distended, but the ovaries should be left.

The operation of making a vagina when none or virtually none exists is most unsatisfactory, practically all the cases reverting to their former condition and having to submit to further operative measures. If the blood can be evacuated from below some operators have indicated oöphorectomy as being the best treatment, but this is only sacrificing healthy genital glands for a deformed and useless uterus.

Hæmatometra of an Undeveloped Horn of the Uterus.—This is a rare condition sometimes found in connection with the malformation of a unicorn uterus. The distended undeveloped horn forms the outer half of the unicorn uterus, and has the appearance of a blood cyst of the broad ligament, which diagnosis is rectified when the relation of the round ligament to the tumour is confirmed. The distended horn may usually be removed, leaving the functional half of the uterus intact, by an operation similar to that of salpingectomy.

C. B.

THE SEXUAL FUNCTIONS IN WOMAN, NORMAL AND PATHOLOGICAL

Since the true biological existence of every individual is concerned equally with its own

life in the transit from the womb to the grave and with the reproduction of the species, the sexual functions which ensure the propagation of the race are of importance second to no other vital phenomenon. But with the advance of evolution, and the consequent "civilization" of the human species, we are brought face to face with complexities in sexual consummation not met with in the lower animals. If we believe in volition we must admit that no longer are the sexual functions controlled and swayed by the so-called "bodily needs"—that is to say, external and internal sensory stimuli—alone; but there is introduced into the delicate physiological reactions a psychical element of choice, often determined by social exigencies, which, as we shall see presently, has much to account for, not only in the pathology of the sexual function, but also in the supposed normal life of woman in regard to that part of her existence which is concerned with the reproduction of our species.

So, in spite of all the advance of material knowledge in regard to the physiological and pathological phenomena of the sexual functions, it is necessary that the physician should be more than merely an interpreter of such concrete details: he must often look beyond what are known as physical factors and endeavour to penetrate far into the psychical life of his patient if he would trace those subtle changes which are produced by the interaction of mind and body throughout the sexual life of the human female. Here, indeed, is almost virgin soil, which must be tilled by the gynæcologist of the future for the immediate benefit of his patient, and for the future welfare of the race. Such investigations appear at present to be ultra-microscopical to the mind's eye of the eugenicist and the practising physician; nevertheless I hope to show, at least from the gynæcologist's point of view, the importance and the direct scientific value of such considerations.

The Normal Sexual Functions in Woman

Every normal woman is, of course, predestined to become a female from the earliest stage of segmentation, and the germ plasm from which she is produced brings with it the necessary instincts and hereditary characteristics. Consequently every normal woman possesses the intuitions of her sex, and the hereditary tendencies of her ancestors, in respect to the functions we are discussing.

Normally the sexual potentialities remain dormant until puberty is reached. At this period there comes the awakening of the slumbering forces. It is true, no doubt, that each woman's introspection in regard to her sexual functions is dependent on her surroundings, training and mode of life. Even the

normal onset of puberty itself may be precocious or delayed according to the disposition of circumstances. These factors will be found discussed fully under *Puberty*. We are only concerned in drawing attention to them here because of their bearing on the subsequent sexual life of any particular woman.

In Great Britain the active sexual life of woman usually commences when she is between thirteen and fifteen years of age, and is continued until the menopause, some thirty-two to thirty-five years later, although in some cases sexuality continues for some time after the menopause.

What, then, are the sexual functions of woman which constitute her sexual life? I do not think that the sexual life can be confined to acts of coitus, for the full development of the sexual functions is so largely dependent upon the results of such intercourse. But I do not propose here to discuss *Conception*, except in view of the essential relation to the sexual life of woman, so that we may consider the normal sexual functions from the following standpoints:—

1. *The normal sexual functions from a physical point of view.*

2. *The normal sexual functions from a psychical point of view.*

The Physical Function.—It is not impossible for the human female to partake fully of the sexual act before puberty, although such precocity is probably not normal, since it never occurs in the lower animals of the female sex. But at puberty sexuality in woman becomes developed—more or less according to the force of circumstances already alluded to. In those circumstances in which the girl remains innocent—somewhat rare in these days—she may be completely ignorant of her potentialities, and be untouched by the internal stimuli emanating from her ovaries and other ductless glands, thus differing considerably from the young male.

The normal woman's first contact with the male is usually far from pleasant, and it is generally only after repeated intercourse that the sexual desire—the desire for physical pleasure, previously the attractions were more psychical—becomes established.

The normal sexual act in woman is concerned in the reception of the male organ into the vagina. This act leads to the ejaculation of secretion from the glands of Bartholin, the ducts of which are situated between the hymen and the nymphæ. There is, too, some stimulation of the clitoris and nymphæ which leads to a vascular turgescence in these parts, and also in the bulbus vestibuli surrounding the vagina. No doubt there is considerable stimulation also of the internal genital organs as the male organ moves to and fro in the vagina until the culmination of the act when the female experiences

the sexual orgasm—not necessarily at the same time as the male. Usually the whole body of the female takes part in the act in an endeavour to obtain, as it were, the uttermost limit of satisfaction. Then follows a period of absolute relaxation—almost temporary exhaustion—and the greater the excitement and satisfaction the greater the subsequent calm.

Thus ends the physical act. The subsequent occurrences that may follow—fertilization, implantation and development of the ovum—concern us only indirectly.

Women vary very much, as has already been stated, in their sexual desires. Many women only respond to the stimulus of actual contact, and, while they enjoy the act, do not appear to anticipate it in the way the male does. Other women are under the influence of stronger internal stimuli from their ductless glands, just as the male is. The latter class of women are really the more normal, yet, as we shall see presently, a serious abnormal (according to the standards of civilization) state of affairs may be associated with excessive desire.

The Psychical Function.—In the natural state birds and beasts acquire during the breeding seasons various external embellishments or other forms of attraction. In some a portion of the body—at other times almost colourless—assumes a vivid hue; the plumage of the bird or the coat of the animal may assume a particular degree of attraction to the opposite sex. As a rule these external changes occur in the male, whereas the female attracts the male by her insinuating habits or the peculiar odour emitted from the vulval glands.

It is commonly supposed that all the external changes that occur are the result of the activity of the gonads. Yet there is no doubt, as recent work has shown, that sexual developments and secondary sexual characteristics are absolutely dependent on the interrelation and interaction of all the ductless glands, which form normally a well-balanced combination in the regulation of the metabolism in general and in particular. For example of the latter, it is well known that overgrowth of the adrenal cortex in women leads to masculinity in regard to some of the secondary sexual characteristics, such as the growth of hair on the face.

Now these characteristics, which of themselves are thus produced by internal stimuli, act as external stimuli on the members of the opposite sex. And here it is that we must carefully watch the parting of the ways, by observing how from mere external stimuli in the lower animals the psychical phenomenon of choice in sexual matters has come to be an established factor in the sexual life of civilized woman.

In animals—and in some extremely sexual

human beings—the syndrome of external and internal stimuli is all that is required to complete the functional desire for sexual satisfaction. The influence of the secretion from her gonads and other ductless glands is sufficient to cause a female animal, and some abnormal women, to find all they require in any male—no matter what his appearance or other fascinations, or the absence of them.

But this is unusual in women; so unusual now that women are highly civilized that we consider—and rightly consider—such a condition abnormal. But we must not forget that in normal women, though to a less extent, exactly the same stimuli present themselves. But owing to the progress of evolution, with the demands of civilization and the claims of morality, such stimuli have become weakened, and are not strong enough to make all women prostitutes, or wanton in the desire to satisfy their sexual needs or instincts for motherhood. Something more is required before a virtuous woman submits herself to sexual satisfaction.

Although the complex problem of the relation of the sexual to the maternal instinct in woman is adumbrated in these remarks, it would serve no useful or practical purpose to follow the question further.

And here we enter the most intricate field of philosophy, and one which from the dawn of civilization has occupied the minds of many great thinkers. It is impossible in this article to trace the attitude of the majority of modern women in regard to sex matters, and the evolution of the psychical barrier that has arisen between the ordinary physical stimuli and their effect upon the human female. Is it the outcome of an unconscious eugenic effort on the part of mankind for the benefit of the race? Is it the effect of the rise of social and family life? Is it the result of the growth of intellect and religion, with the sanctification of carnal desire? Or is it that in this change from a lower and more natural state of affairs we are witnessing a disappearance of the race effected by Nature unseen, and driving us to our destruction, that the chain of evolution may not be broken?

These problems, deeply interesting though they are, are no concern of ours in what is intended to be a practical essay, beyond indicating the forces against which we have to contend, or with which perchance we have to side.

Since, however, a psychical element—hitherto unknown among animals or primitive human races—has been introduced, although we cannot discuss further the origin and reason of it, we must briefly consider its nature and its effect on woman.

In the first place, we may safely assume that in spite of all evolutionary refinements no nor-

mal woman is happily mated unless her sexual desires are fully satisfied. If she be happy without that satisfaction then certain it is that her sexual instincts are deficient, or else have never been aroused. If the latter, so much the greater is the danger to our social system which finds a safety outlet in the divorce court.

In the best circumstances—that is the best from a human point of view—a woman is sexually alive and sensitive to the stimuli arising from the cells in her body which provide the necessary secretions. She is healthily alive to the existence of man. She has no desire to earn her own living, possess a vote, or in any way hunt for her food or slay the enemies of her tribe. Yet she has had her mind carefully trained through generations of civilization, and throughout her own personal existence. She is fastidious; and an overwhelming repugnance to a pigmy of a man or a congenital idiot may master all internal sexual stimuli she may have—in other words she exerts a so-called choice. Perhaps, as we have already said, this is a divine inspiration of Nature to ensure the survival of the fittest. But if women are to retain their intuitions and their influence over man which are of such advantage to the race, they must remain women in the only true environment for a woman—the home.

Thus we have defined the actual sexual life of the best type of modern woman—the woman sexually alive, who is capable of sensing the psychical as well as the organic stimuli. Fortunately such women constitute the bulk of our race—the best of our race. And herein they are morally superior to men, for few there are of the latter who are not, or have not been, entirely at the mercy of their organic stimuli.

Undoubtedly, then, the organic sexual stimuli of those women we term normal are weak, at any rate until they are roused. Sometimes this leads them to marry any man for the sake of a home; sometimes to marry a man because they like him—psychical attraction; and fortunately not infrequently because they love him—psychical and sexual attraction.

If now we were to take into account the satisfaction of the maternal instincts and joys that fall to the normal woman, we should have to fill far more space than is at our disposal in an estimation of the enormous influence they exert in the life of woman—filling her life to the exclusion of all else. We cannot, nor is there need to do so. It is a natural corollary of what we have already said, and with civilized woman motherhood is as truly psychical as instinctive.

So we have it that a normal civilized woman in her sexual life and functions and their results fulfils the ideals and laws of Nature; and in doing so wins for herself peace and happiness,

and sexual and maternal satisfaction in its most animal, and at the same time in its most human form.

Abnormalities of the Sexual Function in Woman

Just as we divided the stimuli concerned in the sexual functions of the normal woman into those of physical and those of psychical origin, so we may divide the pathological conditions into abnormalities of the physical and psychical functions. And just as under normal circumstances these apparently separate faculties become blended and mutually interdependent, so, too, abnormalities of the physical functions may react upon the psychical and produce mental abnormalities; or psychoses may give rise to physical disabilities. The subject is so enormous and so far-reaching that it will be possible here only to give the barest outline for the guidance of those who are occasionally brought face to face with these difficult cases. And, after all, each case is almost a disease unto itself. So long as the practitioner is aware of the possibilities and principles underlying the conditions in question, his plan of action can be developed along the most suitable lines. For it is only complete ignorance or narrowed views on such a subject as this that leads us into unfathomable depths.

Physical Abnormalities.—When coitus is absolutely impossible owing to malformations of the female genital organs or other causes, the result may be called "*Apareunia*." When a woman suffers unduly during sexual intercourse, or the act is impeded without being prevented, the condition is known as "*Dyspareunia*." We shall for the sake of clearness consider each group of cases under these headings.

Apareunia. Impossibility of coitus is brought about by any condition which prevents the male organ from penetrating the vagina. Such obstruction may arise from:—

(a) *Impermeability of the vagina.*

This may be due to:—

1. Abnormalities of the hymen, which may be imperforate, cribriform or unusually tough.
2. Oclusions of the lower end of the vagina, either developmental or acquired. In the latter case inflammatory processes or growths are the commonest causes.
3. Absence of the vagina.
4. Senile atrophy of the vagina and vaginal orifice.

(b) *Impossibility of access to the vaginal orifice.*

This results from:—

1. Malformations which give rise to accessory lower limbs, united twins and the like.

2. Acquired deformities, such as bilateral ankylosis of the hip joints, or paralysis producing the "scissor-leg" deformity (spastic paraplegia).

Fortunately some of the conditions in the first group are curable, and the patient may, after suitable treatment, become normal. Thus abnormalities of the hymen can be effectively dealt with by excising this structure. Atresia of the lower end of the vagina usually can be dealt with surgically, whether the condition be developmental or acquired.

If there be absolute, that is incurable, *apareunia*, the woman is not marriageable in the ordinary sense of the word, although she may have the normal instincts and even suffer from psychoses, which we shall discuss presently, from the inability to fulfil the sexual obligations under which she labours. If a woman were to marry and to acquire a deformity such as that due to ankylosis of the hip joints, many interesting questions might arise if an heir were greatly desired. Such could only be obtained by artificial insemination and Cæsarean section.

Dyspareunia. Difficult coitus is usually, of course, associated with pain. There are two definite and distinct classes of patients: those in whom coitus has never been satisfactorily or painlessly accomplished, and those who, after perhaps many years of fertile married life, suddenly suffer great pain on connexion. And though sometimes there is no real pathological distinction between the conditions found, yet the practical differences are often so great that it will be best to mention each class separately.

(a) *Dyspareunia in the young married woman.*

This may be due to:—

1. Nervousness, and the fear of being hurt.
2. Tender carunculæ myrtiformes, or soreness from laceration of the hymen.
3. Disproportion in size between the male organ and the ostium vaginæ.
4. Inflammations of the vulva or vagina.
5. Growths of the vulva or vagina.
6. Prolapsed ovaries, with retroflexion of the uterus.
7. Salpingitis and pelvic peritonitis.

In such cases as those included in (6) and (7) the pain is of a different character from that which arises from difficulties at the outlet.

Only the first three causes are at all common in young married women.

(b) *In married women who have had children* the following are the commonest causes of *dyspareunia*:—

1. Prolapsed ovaries, with perhaps a very tender retroflexed fundus uteri.
2. Salpingitis and pelvic peritonitis.

3. Vulvitis, usually due to gonorrhœa. The swollen and inflamed labia are very tender.
4. Growths of the vulva and vagina.

All of these causes except the last are common, and it will be seen that they differ from the common causes in young married women, who but rarely suffer dyspareunia from such lesions.

It is most important that the pathological factor should be recognized, because, as we shall see directly, such physical disabilities are extremely liable to give rise to psychological troubles.

The *treatment* of these various conditions will be found detailed in connexion with the descriptions of the various lesions, and need not be discussed in this article. But it will not be out of place to emphasize the fact that *such conditions are curable*, and that it is of the very greatest importance that they should be discovered and cured. With natural modesty, especially if newly married, the patient rarely volunteers the information that she suffers from dyspareunia, so that it is absolutely essential that the medical attendant should discover or negative the presence of what may be at the bottom of many physical and mental ailments, and of much unhappiness in the home.

Psychical Abnormalities.—To detail closely the many psycho-pathological phenomena and their manifestations that may occur would be impossible here. But we must take a general survey of the main groups into which such conditions can naturally be arranged. These are:—

1. Deficient sexuality.
2. Limitation of the sexual functions.
3. Excessive sexuality.

Deficient Sexuality. While of course deficiency in regard to the sexual desires may be looked upon in many cases as a physical deficiency, and would be so considered in animals, in woman it is usually necessary to look upon it as a psychical phenomenon. In the normal woman, as we have seen, the natural desire is largely under the influence of the mind. That is to say, she exerts a choice in the matter, and while a very large proportion of women have full sexual desire and consummation with one man only—and it is interesting to note that some men seem to possess in a marked degree the power of exciting the sexual passions in women—yet any physically normal woman can conceive after coitus with practically any man who is potent. And herein lies the first psychical problem. Can a woman be considered normal because in her married life she has not shown a satisfactory degree of sexuality—even though she may be the mother of a family and possess apparently full maternal instincts? Strictly speaking, she may or may not be normal. In other words the particular man may be

unable to stimulate her sexual desire as another might have done. Such a condition of affairs is unfortunately common, and is due more to what we may describe as environment than to abnormality.

But, again, there is quite a different class of case: the woman who is absolutely deficient sexually. Such women frequently have no true mother-instinct. They are an anomaly; and their condition may be due either to deficient femininity, or to an excess of masculinity which balances the femininity and produces a being that is neuter in regard to sexual matters. This type is often found among the better balanced of female agitators.

It is somewhat difficult with our present knowledge to say much about the controlling factors in regard to deficiency of the sexual desires, which of course may amount to absolute asexuality. And the difficulty lies in the wide range of physical and mental abnormalities that may be met with. But, in so complicated a function as is the sexual in woman, this is not to be wondered at, for it is obvious that so long a chain of connexions may be broken in one link or another, with the production of the general phenomenon.

From the physical point of view we not infrequently find that the ductless glands are diseased, or that there is a certain infantilism of the genital organs; and in this connexion it is well to remember that excessive muscular exercise or mental concentration are common causes of menstrual suppression, sterility and sexual deficiency. This is of course unknown to, or ignored by, those who encourage women to seek to conquer other worlds than those in which they naturally reign supreme. In all these circumstances the physical stimuli that react on the brain are absent, and the chain of sequence that goes to establish full sexuality is interrupted.

But apart from this partially physical aspect there is the purely mental. And here, too, we meet with the asexual propensities in various grades, degrees and manifestations. The social surroundings, the education, the effect of religion, or the individual revulsion from anything partaking of the animal instincts may all lead to a condition of complete psychic apathy or even of disgust of everything appertaining to sexual matters. Yet in many of these cases under suitable conditions, and with romantic wooing (which appeals to the higher ideals), the suppressed natural functions may become aroused, especially through the instinct of motherhood; but usually, though by no means always, there is a certain coldness in actual sexual affairs. At least, such women are generally excessively feminine, gentle and “angelic.”

But from mere quiet apathy or revulsion one may find a further degree, and one that is

associated with more active manifestations. In these cases the woman is a misandrist to such an extent that sometimes her resentment becomes a manifestation of insanity.

Limitation of the Sexual Functions. In less civilized communities than ours no woman loses the chance of sexual satisfaction. With the advance of modern civilization polygamy and hetairism have been banished from our recognized social customs. The result has been rather injurious to our womankind, and possibly in some ways to the natural course of evolution. That it has conferred immediate benefits on men, and ensured social harmony none, of course, can deny. It is, however, our duty to realize any penalties there may be in the result concerning the subject under discussion. There can be no doubt that every normal woman has sexual desires, and the consummation of them makes for her physical and mental welfare. If these functions be not employed she has not only missed the whole object of her sex formation, but she is sure to pay the price in some way. True it is, as we have already seen, that some women are deficient in regard to sex sense; and these do not suffer so objectively as those who have the sense well developed but have not opportunities for the consummation of their desire. How common it is to see women over thirty-five years of age who are suffering psychically and physically owing to the fact that they have not had sexual and maternal satisfaction. They may have a physical disorder such as menorrhagia, or they may be subject to various neuroses and psychoses which make them a trouble to themselves and to every one else; especially when they become active public agitators in order to give vent to their suppressed and disordered feelings, which not infrequently lead them to harp upon the one topic—"woman's rights." There are many who deny this state of affairs; but surely it has the support of all observant gynæcologists.

It may be pointed out, however, that savage or primitive women as a rule have not shown great sexuality; but obviously this is because they are so early and so certainly sought out by the males and all their latent and potential desires satisfied and merged into motherhood. This can hardly be said to be the case in our country in the present day. And it is, therefore, interesting to note that manifestations of unsatisfied sexual or maternal desire are rarely seen before about thirty-five years of age, when the best chances of matrimony have passed. We have created the circumstances, but we have not yet provided the real cure for the disabilities they give rise to. Allowing our women-folk to enter into competition with men will merely perpetuate and accentuate the abnormal state of affairs.

There is one other interesting class of pheno-

mena in connexion with the limitation of the sexual functions which will not infrequently be met with by those who take a practical view of the subject. If a woman receive sexual stimulation without full consummation she may suffer in several ways. This may perhaps be most often observed, but whether observed or not frequently occurs, in the young woman who is "engaged." The limited sexual excitement caused by kissing and the other forms of endearment usual in the circumstances may give rise to menorrhagia or too frequent menstruation. From an unmarried patient who seeks advice concerning these symptoms inquiries should always be made as to the possibility of an engagement. Such a woman does not suffer in health unless the engagement be protracted and her fiancé always with her. The condition exactly resembles what takes place in lower animals in which, in the presence of the male, repeated oestral cycles occur until pregnancy supervenes.

But akin to this condition is a very much more important one, that is to say, important in its results. And it is one for which the practitioner should ever be on the look out in the present day when the limitation of families is so common. Reference is made, of course, to the incomplete or non-performance of the sexual act, either because of impotency on the part of the husband, or the desire to avoid the responsibilities of parentage.

The prolonged practice of such an unnatural proceeding as the interruption of coitus before the culmination of the act may affect very deleteriously both the husband and wife—most often the wife, who never experiences satisfaction after the preliminary sexual stimulation. In these circumstances women become neurotic, thin and ailing. They are liable to suffer from menorrhagia and dysmenorrhœa, with various neuralgias. If, however, the prevention of conception with full completion of the sexual act be employed, then the woman merely suffers the penalties of thwarted motherhood, and these penalties are directly proportional to her maternal instincts. In any case such practices are strongly to be condemned. It is sufficient to mention that a similar train of symptoms might arise if for any reason—such as hip disease—apareunia exist.

Excessive Sexuality. Finally, we have to consider the results of excessive sexuality, and this is not a very common condition in woman, for, as already mentioned, although a woman, if normal and suitably mated, will be extremely sexual with the man of her choice, she is usually absolutely antipathetic to all others. Even prostitutes often experience sexual gratification with one man only, and he is frequently her "bully," or a man of her own class.

Strictly speaking, we may divide the mani-

festations of excessive sexuality into three groups: those caused by excessive sexual indulgence without sexual insanity; those due to masturbation or sexual perversion; and those seen in the sexually insane, with or without excessive sexual indulgence.

(a) *Excessive sexual indulgence* may perhaps be noted most frequently in the newly married, in whom, as a rule, the routine of ordinary life teaches moderation, or in whom satiety checks the sexual passions. Sexual excess in those not living in the bonds of matrimony is rarely seen in women, although it may be encountered in prostitutes, who, however, are usually, as already pointed out, untouched by the ordinary sexual feelings. In the young married woman, whom the practitioner would be most likely to have under his care, menorrhagia and lassitude, with headache and neuralgia, are most frequently noted. In such cases one should always advise the husband and wife to occupy separate beds, or even separate bedrooms—the obvious effect of which is to lead to moderation.

(b) *Masturbation and sexual perversion* are usually manifestations of excessive sexuality. If we except the masturbation commonly seen in various forms of insanity, this vice is, of course, not nearly so common in women as men. For during adolescence the sexual appetites of girls are very much more passive or latent than are the equivalent functions in the male. Masturbation not infrequently arises in the first instance from irritation about the vulva, which leads to the child or girl rubbing the parts in all innocence. Since the sensation produced is pleasant the bad habit is continued, and may, when full sexual maturity is reached, be continued as a means of sexual satisfaction. This practice leads to much ill-health, neurasthenia and mental instability in girls, and should be strenuously checked. It may be necessary to remove enlarged nymphæ and even the clitoris in very bad cases. However, if the habit be detected early, moral persuasion is frequently all that is necessary in healthily minded girls. If it be a manifestation of insanity the patient will require suitable treatment for her mental condition.

Sexual perversion may occur in the sexually insane, or merely in women with excessive and unsatisfied sexual desires. It may be taken for granted that if a married woman with full opportunities for gratification prefers perverted methods such as Sapphism to the exclusion of ordinary marital relations, she is really sexually insane. It is doubtful how far moderate perversion with the full enjoyment of the natural sexual relations can be considered more than indicative of great sexuality. As a rule true sexual insanity in woman is concerned in attempting promiscuity with any and every man by natural methods. It is, however,

probable that most of the sexual perversion that occurs among women is of the Sapphic type, and is found in women who have not full sexual gratification either because they are not married, or because they do not live in harmony with their husbands. Such women are hardly normal.

(c) *Sexual Insanity*. This dreadful condition is unfortunately not very rare in girls. And it is difficult to say how far it arises from primary mental instability, from mental instability produced by excessive internal secretions in relation to the genital phenomena, or from actual disease in the genital organs; for we know primary insanity often produces animalism in regard to sexual instincts and functions, as though the psychic restraint evolved by a long period of civilization had been removed. But we know further that, although the child may have been precocious, the insane manifestations in this form of mental disease rarely become evident till puberty, when the girl comes under the influence of the sexual stimuli.

In the absence of actual disease in the genital organs, which may be curable, such cases are a terrible anxiety to all concerned, and no case is properly treated unless the patient be placed under complete restraint, for such a woman will stop at nothing in her attempts to inveigle any and every male into satisfying her desires. In addition to this she may be a confirmed masturbator. So far the only attempt actually to cure these obscurer cases have consisted in the removal of the ovaries—a most injudicious form of treatment, which may convert the condition into one of incurable melancholia.

It seems probable that such cases might be more suitably dealt with by the removal of *one* ovary, on the hypothesis that there existed a condition of hyperoöphorism. Or again, removal of the uterus would prevent the possibility of conception, and according to our present knowledge lead to diminished activity of the ovaries. These are merely suggestions, for as far as I know they have never been put into practice. Needless to say if the origin of the malady were clearly due to mental instability, and not definitely connected with the onset of puberty or the menopause, then no such treatment should be contemplated.

From the foregoing remarks, which are necessarily brief and incomplete, it will be obvious how intricate is the sexual function in woman, both in normal circumstances and in the pathological manifestations which the physician may be called upon to recognize and control.

W. B. B.

DISEASES OF THE VULVA

The vulva or external genitals of the female comprise all the structures external to the

hymen, having the navicular fossa and perineum behind, the urethral orifice, vestibule, clitoris and mons veneris in front, and at the two sides the nymphæ (labia minora) and labia majora.

Atresia.—Superficial atresia of the vulva is a condition which results from inflammation occurring in infancy or childhood, leading to adhesion of the posterior portions of the labia majora and the greater part of the labia minora. The hymen is concealed, the vulval aperture being nearly occluded. A narrow channel exists behind the clitoris, passing downwards and backwards into the vagina. Through this channel menstrual fluid may escape. Occasionally, however, the occlusion is complete and the menstrual fluid is retained.

Treatment. The adherent portions should be divided in the middle line and the edges over-stitched with catgut. When the occlusion is complete and an intact hymen found behind it, the septum should be dissected out and the raw edges stitched.

In young children the adhesion may be separated by means of a probe.

Injuries.—The vulva is liable to injury from falls on pointed objects, cuts, kicks and violence as a result of criminal assaults. It may also be injured by forceps and other instruments used in obstetric practice. Free bleeding may ensue, especially when the wounds are deep.

Treatment. Bleeding points should be secured with forceps and tied, followed by the application of a firm gauze pad and bandage.

Varicose Veins.—The vulva being plentifully supplied with veins, marked varicosity may be encountered in the later months of pregnancy. In the absence of pregnancy the cause is usually some obstruction to the venous circulation in the pelvis, abdomen or thorax, although isolated examples are met with where no such obstruction is present. The dilated and tortuous veins can be seen through the skin, and the veins of the thigh are generally involved, as well as those under the vaginal mucosa.

There is considerable risk of injury as well as spontaneous rupture; free bleeding occurring from the superficial veins or subcutaneous rupture giving rise to the formation of a hæmatoma.

Treatment. The enlargement of the veins during pregnancy may be so extreme that premature labour may require to be induced. Rest in the horizontal position and careful regulation of the bowels may suffice when the varicosity is not so pronounced. When the varix results from some venous obstruction in the pelvis or abdomen, the treatment must be directed to the cause of this obstruction. When no such cause exists and the veins from their size cause inconvenience excision may be

practised. Should the veins become thrombosed they must be treated on similar lines to thrombosed veins in the limbs. A hæmatoma should not be disturbed unless increasing rapidly in size. Rapid increase in size demands a free incision, followed by evacuation of the clots and ligation of the bleeding points. A hæmatoma may suppurate, and then incision and drainage is requisite.

Inflammation of the Vulva (Vulvitis) is due to infection either by the gonococcus or by organisms from the bowel. It is usual to give as causes "dirt, worms and chronic irritation," but infection is the real cause. The acute cases are probably all gonococcal and are met with both in children and adults, whilst the chronic cases are examples of a milder type of infection in which various organisms play a part. Exception must, however, be made for those examples of acute puerperal vulvitis whose origin is due to a virulent local infection. Irritating vaginal discharges or irritating urine tend to maintain the chronicity, whilst scratching and rubbing, employed to relieve the local irritation, lead to abrasions, cracks and fissures.

A mild form of vulvitis arises as a result of the accumulation of smegma in those of uncleanly habits and is readily cured.

Acute vulvitis is characterized by the presence of pain, redness, purulent discharge and œdema of the labia. The urethra and the ducts of the Bartholinian glands are involved in gonorrhœal cases. The involvement of the urethra causes scalding pain on micturition. In the chronic cases the symptoms are of a milder type and œdema of the labia is not observed.

Treatment. Acute gonorrhœal vulvitis in the adult should be treated by rest in bed, diluent drinks, such as barley water, and saline purgatives and avoidance of alcohol. Hot hip baths to which boric acid (1 in 40) has been added, frequently repeated, ensure cleanliness and relieve pain. No douching or syringing should be employed, as both tend to cause ascent of the infection. Unfortunately in many instances a syringe is used as soon as the disease is detected, and through this treatment the local condition is aggravated. A diaper of sal alembroth wool and gauze should be worn and frequently changed. The patient should be cautioned concerning the infective nature of the discharge, and all gauze, wool or lint should be burned after use.

After the labial swelling has subsided the vagina should be swabbed out through a speculum with wool dipped in strong carbolic acid and held by a pair of long forceps. The surface should be seared by the acid and care taken that any excess of acid is mopped up. This application should not be made more than

twice weekly, and only once if there be much subsequent swelling. Usually four to six applications will suffice, and no syringing or douching is permitted. This treatment will stamp out the disease in its early stages and does much to prevent suffering both to the patient and those with whom she comes in contact.

Nitrate of silver, five to ten per cent. solution, employed in like manner is also efficacious, but it causes more pain. The disease in its early stages is much more accessible to direct treatment in the female, and sufficient advantage is not taken of this important fact by those who are called upon to treat these cases.

The urethritis proceeds to a natural cure and no local treatment is necessary. Internally acetate and bicarbonate of potassium dissolved in camphor water and urotropin (5 gr. three times daily) will be found of benefit. In children syringing should not be employed for fear of ascending infection. Hot boracic hip baths and local cleanliness will suffice. A dusting powder composed of equal parts of carbonate of bismuth and starch is useful in the later stages.

Chronic Vulvitis.—When the disease is due to chronic irritating discharges these must receive attention, but in addition there results pruritus, often associated with an eczematous condition produced by scratching. The treatment will be considered under the heading *Pruritus*.

Abscess of the Vulva most commonly results from infection of the ducts of Bartholin's glands, one side only being affected, more rarely both sides. The cause is most frequently gonorrhœa, but injury followed by subsequent infection is also a cause.

Treatment. In the acute cases incise freely and plug with gauze. Pus may, however, be discharged at intervals through the duct or through a small sinus, and again collect at a later date. In such cases the sac should be dissected out and the cavity brought together by deep and superficial sutures. In neglected gonorrhœal cases two or three sinuses may form in the labium, the orifices of which are surrounded by flattened granulation tissue looking like a condyloma. The sinuses should be excised, followed by accurate sutures.

Abscesses arise in the sebaceous glands of the labia and amongst the hairs on the mons veneris, and infection may be carried to the male.

Gangrene of the Vulva.—Apart from the results of injury and subsequent infection in obstetric practice, gangrene of the vulva, or noma, occurs in ill-nourished children or after the exanthemata. It is seen as a black patch on the labium which gradually increases in size and is associated with profound constitutional disturbance. It is frequently fatal.

The *treatment* which the writer has found

most satisfactory is to remove the gangrenous patch with a sharp spoon and then to apply strong carbolic acid, followed subsequently by fomentation.

Pruritus Vulvæ.—This is not a disease, but a symptom of many different morbid states affecting the vulva. The patient seeks advice because of the intolerable itching, and hence it is convenient to enumerate the conditions which give rise to this symptom and the appropriate treatment for each. It often leads to masturbation or it may even follow masturbation.

Irritating uterine or vaginal discharges, especially chronic gonorrhœa and hyperacidity of the urine, are frequent causes. The occurrence of sugar in the urine may lead to an intense form of vulval pruritus. More frequently, however, some local change in the vulva is the cause. Various forms of skin disease may produce itching, but eczema is the most common, and as a result of scratching and rubbing various appearances are produced. The accumulation of smegma as well as pediculi explain certain cases. In others localised tender spots and patches may be detected on careful examination.

During pregnancy pruritus is not uncommon, and probably depends on increased local congestion, as well as on the presence of discharge.

Kraurosis vulvæ and leukoplakia are associated with pruritus, and in elderly women a *long-continued history of pruritus usually precedes the development of carcinoma*. In another group of cases no local cause can be detected, and then it is called "a neurosis."

To sum up, in all cases of pruritus examine (1) the vulva, to ascertain if there be any local cause; (2) the vagina, to note the extent of the disease or the presence of discharge; (3) the cervix, noting the amount and character of any discharge; (4) the rectum, to exclude the possibility of the presence of thread-worms, or cracks or fissures; (5) the urine, for sugar or hyperacidity.

Treatment. The cause must be sought for, and when discovered appropriate treatment should be applied.

Tender spots and patches are best treated by the application of pure carbolic acid, tincture of iodine, or the galvano-cautery. Irritating cervical and vaginal discharges are treated by local applications to the cervical canal and non-irritating vaginal douches. Permanganate of potassium (five grains to a pint of warm water) and sodii biboratis (one drachm to a pint of water) can be recommended for general use.

Hyperacidity of the urine is treated by the administration of potassium bicarbonate and potassium acetate dissolved in camphor water.

Climacteric glycosuria, with which severe pruritus is so often associated, is best combated by the administration of opium, in pill one grain

three times daily and three grains at bedtime continued for a month or two, varying the dose at intervals. Sulphuret of potassium (ten grains to the ounce of simple ointment) is the best local remedy.

As a local remedy for the majority of cases of pruritus carbolic acid is most effectual. It is necessary to use it in strong solution and to see that it is applied not only to the vulva but to the lower half of the vagina.

For this purpose strips of lint three inches long and two inches wide are steeped in the solution and the lint is inserted into the vagina for about one inch and the remainder spread out like a fan between the labia. A solution of the strength of 1 in 40 is first used and, if necessary, 1 in 20.

During this treatment the patient should be kept in bed, as for all severe cases of pruritus rest is an essential adjunct to the local treatment. Instead of carbolic acid, nitrate of silver (five to ten per cent.) solution may be used, but its application causes pain. A large pad of boracic wool is worn on the vulva and fixed by a T-bandage.

After removal of the plugs, which are kept in over night, the vulva and lower portion of the vagina should be anointed with carbonate of bismuth (bismuthi carbonatis \bar{z} i, lanoline \bar{z} i), or a paste made of the bismuth combined with glycerine or castor oil. Ung. conii \bar{z} i, with or without thirty minims of purified creosote, is also a useful local application.

All local remedies should be applied to the lower half of the vagina as well as to the vulva.

New Growths of the Vulva—

Lipomata,	Squamous-celled carcinoma,
Fibromata,	Melanoma,
Papillomata,	Sarcoma,
Angiomata,	Adeno-carcinoma.

Lipomata and **Fibromata** arise in the fatty and connective tissue of the labia, and are either sessile or pedunculated. They are usually small, but they attain considerable size and thus cause inconvenience, or the skin over them may ulcerate.

Papillomata or **Warts** are seen in association with gonorrhœal or, rarely, some irritating vaginal discharge.

Angiomata.—Nævi occur on the labia of children.

Treatment. Lipomata and fibromata should be excised. Papillomata are best removed with scissors, followed, if necessary, by suturing or the application of the cautery.

Squamous-Celled Carcinoma.—Squamous carcinoma arises most frequently on the inner aspect of the labium majus, and less frequently from the clitoris and vestibule, in women between fifty and sixty. It begins as a small

papule or a hard nodule, which is soon followed by ulceration from the surface inwards. At first pruritus is the only symptom until a sanious discharge prompts the patient to seek medical advice. In the later stages extensive ulceration and destruction of the labia may result. Leukoplakial patches are frequently seen in association with carcinoma and may precede its development. The inguinal glands, and later the iliac glands, become the seat of secondary deposits.

Treatment. Preventive treatment consists in prompt attention to the pruritus of elderly women and free excision of leukoplakial patches.

The radical treatment consists in complete excision of the vulva and the glands in both groins.

Melanoma, sarcoma and adeno-carcinoma are rare. The latter arises in Bartholin's gland.

Cysts.—On the inner surface of the labia minora cysts are found, small in size, which are spoken of as *mucous cysts*. Their origin is obscure. Some probably arise from dilated lymphatics.

Sebaceous Cysts similar to those found in other regions are met with on the labia. They are usually small, but may enlarge to the size of a hen's egg. Their contents are the characteristic sebaceous material. They may become infected and abscess formation result. They should be treated by excision.

Cysts of Bartholin.—These cysts usually arise in the duct, but less frequently the gland may enlarge. The duct may become dilated and the fluid suddenly discharged, and it accumulates at a later date, so that when an examination is made no swelling can be detected. Usually a characteristic tense fluctuating ovoid swelling is felt occupying the labium majus in its posterior third. Unless the cyst is infected, leading to abscess formation, the symptoms produced are those due to inconvenience in sitting, walking and during sexual congress.

Treatment. The cyst should be dissected out, and after arresting all bleeding the resulting cavity should be obliterated by deep and superficial sutures.

Elephantiasis.—This affection is rare in this country, although not uncommon in the tropics. A form of elephantiasis is, however, seen, due to tertiary syphilis, where growths of considerable size hang down from the labia. Ulceration is present at points of contact.

Treatment. The hypertrophied masses should be excised, followed by a course of antisyphilitic treatment.

Syphilis.—Primary, secondary and tertiary lesions are found affecting the vulva.

Primary Sores are met with in the fourchette and inner surface of the labia as shallow rounded or irregularly ovoid ulcers with a bright red margin and a greyish white base. There is less

induration than in the male, and for this reason they are often overlooked. The inguinal glands present the characteristic amygdaloid enlargement. Multiple primary sores are occasionally seen occurring on opposing surfaces.

Secondary Manifestations are met with as mucous plaques and tubercles.

Tertiary Lesions.—Gummata and hypertrophies (pseudo-elephantiasis) are seen in the tertiary stages. A recent example was seen by the writer in which the greater part of both labia was destroyed by ulceration in a woman aged twenty-five years. In elderly women such ulcerations have been mistaken for cancer.

Treatment. See *Syphilis*.

Tuberculous Ulceration is rarely met with in the vulva.

Hypertrophy of the Labia Minora, which is seen in Hottentot women to a marked degree, may be met with in young women and requires to be treated by removal.

Kraurosis Vulvæ.—This term is applied to a progressive atrophy of the nymphæ and vestibule occurring in women who have passed middle life, and in younger women may follow on an artificial menopause produced by removal of the ovaries.

The orifice of the urethra presents a reddened appearance and numerous dull red patches are observed on the labia. In the later stages the nymphæ atrophy; and considerable contraction of the ostium vaginæ results. The reddened patches are tender and bleed readily. Finally the affected parts become pale and greatly retracted. Micturition is frequent and painful and dyspareunia results from the contraction. Pruritus is also a distressing symptom.

Treatment. The tender spots should be touched with pure carbolic acid or the cautery and a sedative ointment used subsequently.

The Hymen. Imperforate Hymen.—The hymen may exist as a complete diaphragm obstructing the entrance to the vagina and preventing the egress of the menstrual fluid. To this condition the term imperforate hymen is applied. It is usually discovered owing to the non-appearance of the menstrual flow. As a result menstrual blood may accumulate in the vagina (hæmatocolpos), in the uterus (hæmatometra) or in the Fallopian tubes (hæmatosalpinx). The vagina may become greatly distended, forming a rounded fluctuating swelling with the uterus perched on its summit. It is detected by abdomino-rectal examination and there may be bulging forwards of the hymeneal septum.

Treatment. The hymeneal septum should be freely divided and the retained fluid permitted to run out slowly. It is necessary to carry out this operation under strict aseptic precautions to prevent the fluid becoming infected. In the majority of cases it is not necessary or desirable

to syringe out the fluid, but if there be difficulty in its removal a douche of normal saline solution may be used. The vulva must be kept scrupulously clean and an antiseptic diaper worn during the after-treatment. To prevent closure of the vulvar outlet a small tubular speculum may be passed, or if necessary retained in situ for a few hours.

Normally the hymen possesses a central aperture nearer the anterior than the posterior margin, but considerable variations may be encountered. It may be thin and easily torn or dense and unyielding. Coitus may occur without causing rupture where the hymen is unusually distensible, therefore an unruptured hymen is not always proof of virginity. A rigid hymen may require division to permit coitus. This is best accomplished by a crucial incision, followed by the wearing of a glass vaginal dilator for twelve to twenty-four hours, or the hymen may be dissected out and the raw edges accurately stitched with fine catgut to prevent scar formation. Rupture of the hymen may be attended by free bleeding, necessitating the use of a gauze plug.

Carunculæ myrtiformes is the term applied to the isolated nodular remains of the hymen seen in parous women. These nodules may become congested and extremely sensitive, causing dyspareunia. Reddened congested nodules are often seen in conjunction with urethral caruncles in elderly women.

Cysts.—Small cysts possessing an epithelial lining may occasionally form in the tissues of the hymen.

The Clitoris.—This organ may be the seat of inflammation either localised or part of a general vulvitis. One of the commonest causes of localised inflammation is the accumulation of smegma in those of uncleanly habits. Phagedenic and syphilitic ulceration are also observed.

Carcinoma may originate in the clitoris, causing considerable enlargement of the organ, with ulceration at points of contact. The treatment is the same as for vulvar carcinoma.

Elephantiasis may also be localised to the clitoris or occur in association with a similar affection of the vulva.

Urethra.—**Urethral Caruncles** occur as small bright red or pale red sessile or pedunculated growths, varying in size from a pea to a bean, growing from within the urinary meatus. Some are exceedingly sensitive, especially the smaller varieties; others are painless. In certain examples glandular structures can be demonstrated. Painful and frequent micturition are the chief symptoms produced. Hyperacidity of the urine increases the pain.

Treatment. The growth should be excised with small curved scissors, care being taken to remove that portion within the urinary meatus,

otherwise the growth will recur. The raw surface should then be stitched with fine catgut. A cautery should not be used, as this leads to scar formation, and actual meatal stricture has followed.

Prolapse of the Urethra.—Slight degrees of urethral prolapse may be mistaken for an urethral caruncle. It is usually associated with a patulous urethral meatus.

The prolapse may be sudden and owing to its bulk become strangulated in the meatal ring. In a recent case observed by the writer in a woman aged fifty-six years the prolapsed portion had become gangrenous. It was greenish-black in colour and through its centre the aperture of the urethra was noted.

Treatment. The prolapsed portion should be excised and the edges united with fine catgut sutures. In milder cases it may be possible to reduce the prolapse.

Carcinoma.—Primary carcinoma of the urethra is very rare.

Perineum. This term is applied to the cutaneous and subcutaneous structures which intervene between the fourchette and anterior margin of the anus. The perineum is subjected to injury during parturition. Such injury not involving the rectal wall and anal sphincter is spoken of as a "partial tear," in contradistinction to a "complete tear," where the sphincter ani and rectal wall participate.

The *treatment* consists in accurately repairing such injuries after parturition, in order to prevent the disastrous after-results which may ensue.

F. J. McC.

AMENORRHOEA

By the term "amenorrhœa" we understand absence of those definite changes already described under the term "menstruation." According to whether menstruation has never taken place or, having occurred, does not return at the proper time, so the disorder of amenorrhœa can be divided into two classes, primary and secondary.

Primary Amenorrhœa.—Primary amenorrhœa may be temporary or permanent, and in both the reason will be found to be due either to some local or general cause.

Temporary Primary Amenorrhœa—

Local Cause. *Delayed Development of the Uterus and Ovaries.* In certain females the uterus, ovaries or both are still somewhat undeveloped when the normal time for puberty arrives, and consequently menstruation is delayed. Such a condition is sometimes associated with that known as "delayed puberty."

General Causes. *Delayed Puberty.* In delayed puberty the external changes associated

with puberty, such as the development of the mammae, of the vulva, and the appearance of hair on the mons veneris is delayed, as is also the menstrual function, rarely as late even as the twenty-fifth year. Delayed puberty is at times also accompanied by some diminution in the size or abnormal shape (infantile) of the uterus and ovaries. Rarely no definite cause can be established, but generally the patient is living amidst insanitary surroundings, is ill-nourished, has some definite disease, such as anæmia or tubercle, or has a deficient thyroid activity. Exactly at what age "delayed puberty" may be diagnosed is open to question. From observations made by Giles, it would appear that up to the age of eighteen delayed puberty is a misnomer, and the term should only be applied to those cases in which menstruation fails to appear between the ages of eighteen and twenty-five. In an analysis of the age of puberty in 1000 cases by Giles the following results bearing upon this point were obtained—

2·8 % of girls do not menstruate before the age of 16					
13·7	"	"	"	"	17
6·1	"	"	"	"	18
3·3	"	"	"	"	19
1·5	"	"	"	"	20
0·9	"	"	"	"	21
0·6	"	"	"	"	22

In the absence of some congenital deformity of the uterus or ovaries, primary amenorrhœa cannot be classified as permanent until the patient has passed the age of twenty-five.

Permanent Primary Amenorrhœa—

Local Causes. *Absence of, or Marked Mal-development of the Uterus or Ovaries.* The uterus may be absent and simply replaced by a fibrous cord, or the relative size of the body and cervix may be reversed (infantile uterus). The ovaries may be absent or they may be devoid of Graafian follicles. Such congenital deficiency is, in either case, very rare.

General Causes. Apart from those just mentioned, the pathological conditions associated with permanent primary amenorrhœa may be attributable to the thyroid gland (cretins), the pituitary gland (tumours), to anæmia, tubercle, albuminuria or some other serious constitutional disease.

Secondary Amenorrhœa.—Secondary amenorrhœa may be either temporary or permanent, and in either case the cause will have some local or general origin.

Temporary Secondary Amenorrhœa—

Local Cause. *Deficient ovarian secretion,* it is supposed, may be responsible for a temporary amenorrhœa.

General Causes. *Physiological causes of a*

temporary secondary amenorrhœa are pregnancy, lactation and hyper-lactation.

Pathological causes are any serious illness; anæmia; chill; the acute specific fevers; pernicious anæmia; chronic alcoholism; drug habits, especially morphinomania; altered surroundings; nervous disturbances, such as shock, the desire or fear of pregnancy; surgical operations; overwork, and insanity.

Permanent Secondary Amenorrhœa—

Local Causes. Atrophy of the uterus as a result of childbirth (superinvolution).

Ovarian tumours or destruction of the ovaries from inflammation.

Removal of the ovaries. In this case amenorrhœa does not always result, at any rate at first. Many cases of menstruation after removal of the ovaries are due to the fact that some small portion has been overlooked, and this is more especially liable to occur in cases of inflammatory disease. Nevertheless, even after their entire removal a periodic hæmorrhagic discharge has been known to occur for some time.

Total hysterectomy. Supra-vaginal hysterectomy, although in these cases there is at times for a short while periodic hæmorrhage from the cervix.

General Causes. A *physiological* cause is the menopause, and before menstruation entirely ceases a relative amenorrhœa often occurs in that the periods become less frequent and decrease in amount.

The *pathological* causes may be most of those mentioned under the corresponding heading in temporary secondary amenorrhœa, and, in addition, advanced cases of albuminuria, diabetes, cancer, and cerebral tumours.

Diagnosis. There is no need to discuss the differential diagnosis of the various causes of amenorrhœa just enumerated, but the practitioner, having elicited the fact that the amenorrhœa is either primary or secondary, can proceed on the following lines.

Primary Amenorrhœa.—In these cases the patient should be carefully examined for one of the general causes mentioned and for the signs of puberty. A failure to elicit either of these necessitates a local pelvic examination, which is best carried out when the patient is under the influence of an anæsthetic. It is important to remember that a patient may become pregnant without ever having menstruated.

Secondary Amenorrhœa.—The first thing to determine in a patient who comes complaining that she has amenorrhœa is whether she is pregnant or not. The neglect of this rule has often led to unfortunate results, both to the doctor and the patient.

The practitioner must not be put off his

guard because of the civil state or social position of the patient, for pregnancy is apt to occur in women of the highest as well as the lowest social position, be they single, married or widows; in the religious or irreligious.

The amenorrhœa due to pregnancy as a rule ensues suddenly, that is to say, menstruation up to the "period" that was missed has been regular and normal. Amenorrhœa due to a chill is sudden in its onset. If the chill is caught just at the commencement of menstruation, the flow may cease and the patient experience severe abdominal and pelvic pain.

A sudden onset of amenorrhœa is also found in cases due to the acute specific fevers. On the other hand, if anæmia is the cause, the periods become gradually less in quantity and very often irregular, whilst the appearance of the patient, her breathlessness and inability to exert herself to any extent, complete the diagnosis.

Treatment. The cause may be ascertained and the appropriate treatment applied. For the anæmia which is so commonly associated with amenorrhœa, large doses of iron are required to be given over a long period, combined perhaps with arsenic, and the bowels must be kept very regular during its administration.

If the periods are suddenly stopped by a chill, the patient should be ordered a hot hip-bath, and afterwards given hot fomentations and hot non-alcoholic drinks. If when the period is next due it does not come on, this treatment can be repeated.

The administration of thyroid extract is especially indicated in cases of myxœdema, and ovarian extract has also proved useful at times in cases presumably due to deficient ovarian activity.

There are certain drugs known as "emmenagogues" from their supposed local action in stimulating menstruation. The best known of these are permanganate of potash, manganese dioxide, apiol and aloes. They are probably all of them useless for the object under discussion, and so rarely do they act that a resulting menstruation may be regarded as a coincidence and not as a consequence of their administration.

Change of air and surroundings is at times successful when other means have failed

C. B.

DYSMENORRHŒA

Pain is associated with the menstrual period in seventy per cent. of women, but only in about ten per cent. is it seriously complained of or does it handicap the sufferer in her daily avocations. Tolerance of pain varies within wide limits in different individuals, and although

doubtless one woman may be able to withstand an amount of dysmenorrhœa under which another would collapse we have unfortunately no means of adequately measuring this resistance to pain or of estimating the real severity of any particular attack of dysmenorrhœa. It thus results that although we may suspect that some patient is making more of her complaint than the occasion demands we have no proof and each case must be treated on its own merits.

As the result of experience one finds that dysmenorrhœa is less often complained of and apparently more easily tolerated in women who have to earn their own living than in those whose life is spent in a round of idleness, luxury or amusement.

To the patient dysmenorrhœa is a troublesome complaint since in many cases an absolute cure cannot be obtained. To the practitioner it is just as unsatisfactory because it is impossible in all cases to give any adequate explanation of the pain; there are almost as many different classifications of dysmenorrhœa as there are text-books, and none of them are entirely appropriate.

When we come to question a large number of women who complain seriously of dysmenorrhœa, we can divide them into three classes—

1. In which the pain is intermittent and colicky in character.
2. In which the pain is continuous and dull-aching in character.
3. In which, with a dull-aching pain, there are intermittent periods of sharp intensity.

The third class is merely a combination of the first and second, and the kind of pain first appearing varies in different cases, so that the dysmenorrhœa may commence as in the first class and after a time have the pain of the second complicating it, or vice versa. There will, therefore, be no need to discuss the third separately.

We will consider the cases of dysmenorrhœa according to the sensations of the patient, under the headings of "colicky and congestive," as a distinct clinical classification, rather than a perfect classification.

Colicky Dysmenorrhœa.—The pain is due to the fact that the normally painless or only slightly painful contractions of the uterus during menstruation come to be of a very sharp and painful character.

The cause of these painful contractions can in the majority of cases be easily identified, there is something in the cavity of the uterus which it is trying to expel.

In a minority of cases no cause can be found, and it is regarded as a neurosis, or as due to the fact that the uterus is not so well developed as it should be; but although it is impossible to

affirm that in some cases these are not causes, still the clinical fact remains that in by far the greater number of such cases the uterus is apparently perfectly formed and the sufferers are free from neuroses in any other aspect.

We may therefore divide the women who suffer from "colicky dysmenorrhœa" into two classes, one in which some pathological cause can be determined, the other in which it cannot.

Pathological Cause Present.—The foreign body which the uterus is trying to expel is either blood clot, mucous membrane, or a tumour.

Blood Clot (Obstructive Dysmenorrhœa of some authors). The amount of blood lost at a normal menstruation is not sufficient to prevent it flowing easily away from the uterine cavity when it escapes from the vessels, but if for some reason the hæmorrhage is excessive or the cervical canal is narrowed, then the blood is "held up" in the uterus and clots, and as these clots have to be expelled, the uterus has to contract harder than usual and colicky dysmenorrhœa results and continues until all the clots are expelled.

Any condition, therefore, in which more blood than normal is lost at the menstrual period will cause colicky dysmenorrhœa; or any condition which obstructs the flow of blood from the cavity such as cancer of the cervix, or an atresia of the cervical canal resulting from inflammation following childbirth; some plastic operations, or the application of a strong chemical will produce the same result.

Mucous Membrane (Membranous Dysmenorrhœa of some authors). A reference to the description of normal menstruation will remind the reader that during this function but very little mucous membrane is shed. There is, however, a disease of the mucous membrane known as "exfoliative endometritis" in which the superficial layers of the mucous membrane are shed in pieces of varying size from small strips up to an entire cast of the uterus. This shedding is thought by Blair Bell to be partly due to the fact that the superficial layers of stroma are so compact that they will not allow the blood to exude through the endometrium (a microscopical examination of the shed endometrium will show that the stroma is more condensed than usual) and partly due to excessive hæmorrhage tearing up the endometrium (clinically these cases are usually associated with menorrhagia), but what exactly causes the stroma to be more compact or the bleeding to be excessive in these cases no one knows.

Dysmenorrhœa is not present in all cases of "exfoliative endometritis." It is only when the membrane is passed in large pieces and rolled up to form the so-called solid casts that the severity of the pain is complained of.

Tumours. If the uterus is the seat of a

sub-mucous fibroid or fibroid polypus it will try to expel it, and its efforts to accomplish this will be associated from time to time with abdominal pain, more particularly at menstruation when "colicky dysmenorrhœa" may become very marked.

Pathological Cause Absent. (*Spasmodic Dysmenorrhœa* of some authors.) One common cause of the uterine colic in these cases is unknown. The diagnosis of a neurosis is inadequate. The suggestion that because the uterus is not properly shaped therefore it is functionally deficient is unsatisfactory, since this variety of dysmenorrhœa may commonly be found in girls with apparently normal uteri and marked ante flexion in a uterus with a conical cervix, and a pin-hole os may be present in a girl who has no menstrual pain. The surmise that there is some interference with the "polarity" of the uterus, that the "wave of muscular contraction is stopped by a ring or area of noncontractile tissue" (Blair Bell) is only a surmise, for the ring or area has never been demonstrated. It may be that some cases are due to a neurosis, some to a malformed uterus, some to a ring of non-contractile tissue.

Congestive Dysmenorrhœa.—This variety of dysmenorrhœa can also be divided into two classes, one in which a pathological cause is present and one in which it is not.

Pathological Cause Present. This variety of dysmenorrhœa is nearly always associated with some local disease of the pelvic organs, in many cases already the seat of chronic congestion such as perimetritis, parametritis, salpingitis, ovaritis, endometritis, fibroid tumour of the uterus, fibro-adenomata of the uterus, fibrosis of the uterus, subinvolution, or with some backward displacement of the uterus, misplacement of the tubes or ovaries, or a combination of these factors.

The pain is partly due to the fact that the normal premenstrual flushing of the pelvic blood-vessels, added to the already congested condition of these parts, causes pressure on the nerves in the immediate neighbourhood, and partly to the fact that the pelvic organs are not able to accommodate this extra amount of blood as they normally do, either because of their malposition and inability to right themselves or because the normal elasticity of their tissues is depreciated by inflammatory exudation, the nerves being unduly pressed upon in either case.

Pathological Cause Absent.—In a certain number of patients no pelvic disease can be detected. This variety of congestive dysmenorrhœa is common in young people. For want of a better explanation it has been supposed that the nerves associated with the pelvic organs in these patients are unable to withstand this

premenstrual flushing without originating a dysmenorrhœa.

Differential Diagnosis. With regard to the variety there is no difficulty in deciding whether the dysmenorrhœa is colicky or congestive, since in the first the pain supervenes with menstruation and tends to become worse for a time, whereas in the second the pain declares itself in the week preceding menstruation and is relieved by the onset of the discharge. The pain of colicky dysmenorrhœa is as a rule very sharp and of short duration, though at times the spasms are prolonged, whereas congestive dysmenorrhœa is of a dull aching character and more or less continuous. Certain remedies which will relieve one form fail to do so or increase the intensity in the other. Thus rest is sought and is found to alleviate the congestive variety, whereas in the colicky form it does no good. Alcohol, though to be deprecated as a method of treatment, certainly increases the congestion and may relieve the colic. With regard to the exact cause of the dysmenorrhœa, a local examination will often decide the question, but since it is not generally advisable to make a local examination in girls or single women, and since certain causes of dysmenorrhœa are commoner in this class, these must be considered a little more fully.

Colicky Dysmenorrhœa due to the Expulsion of Exfoliated Endometrium.—This form is diagnosed when the membrane is discovered, and it is thought that if the menstrual discharge in cases of dysmenorrhœa was always carefully washed through muslin, it would be found from the pieces of membrane retained by the meshes that this is more common as a cause of dysmenorrhœa than might be supposed. As a rule, however, the membrane is not discovered unless it is passed in rather large pieces, when it may form a most valuable aid to diagnosis.

Membranes may be passed from the uterus when the patient is seriously ill from sepsis or one of the acute specific fevers, or when there is no indication of such a serious condition. It is only necessary to deal with the latter, in which case the membrane may be part of a monthly abortion, it may the decidual cast of an extra-uterine gestation, or it may be, as in these cases of dysmenorrhœa, the endometrium.

Microscopical Character of a Complete Cast.—

Endometrial Cast. In size it corresponds to that of the uterus, *i. e.* $1\frac{1}{2}$ in. \times 1 in. \times $\frac{1}{2}$ in. In shape it is triangular, and has three openings, one at the apex for the internal os, and two at the base for the Fallopian tubes. It is rough on one surface where it has been separated from the uterus, and smooth on the other which lines the uterine cavity, on which surface also can be seen the mouths of the uterine glands.

Monthly Abortion. The embryo may be found within the cast.

The size of the membrane is distinctly larger than that of the unimpregnated uterus. Its shape more nearly approximates to that of the egg, and there are no openings corresponding to the internal os or Fallopian tubes. Its outer surface is rough from chorionic villi, its inner surface is quite smooth from the amnion.

Decidual Cast in Extra-Uterine Gestation. In appearance it partly resembles the endometrial cast, inasmuch as it has three openings, and its inner side is smooth and shows the mouths of the uterine glands; it also partly resembles a monthly abortion in being larger, thicker and less triangular in shape.

Blood Clots. A blood clot takes the shape of the uterus, has no openings, can easily be broken, is almost black in colour, and is generally solid.

But after all, the expulsion of a perfect cast, or even one nearly perfect, is of rare occurrence, so that the practitioner can only make a reliable diagnosis after examining a portion of the membrane under a microscope.

Microscopical Characters of the Membranes under Discussion.—

Endometrial Cast. The surface columnar epithelium is absent or only badly developed.

The stroma is rendered more compact than normal by a small round-celled infiltration, and the uterine glands are either entirely absent or simply represented by a few scattered tubules.

Monthly Abortion. The membrane is much thicker than in the variety of cast just described and consists of two layers, a superficial compact layer in which a vast number of decidual cells can easily be identified, and a deep cavernous layer in which there are a large number of dilated glands. Interstitial hæmorrhages can also be seen. In addition, well-marked chorionic villi will be easily identified.

Decidual Cast in Extra-Uterine Gestation. The microscopical characters of the membranes resemble very much those of a monthly abortion with this important difference, that the chorionic villi are absent in the cast of extra-uterine gestation.

Blood clots have the microscopical appearance of blood clot only. As a further help in diagnosis it must be remembered that a monthly abortion cannot occur in one leading a single life, and that as a rule by the time the decidual cast of an extra-uterine gestation is expelled, other symptoms and signs of a serious nature will be present, and the case will not be very difficult of diagnosis.

Colicky Dysmenorrhœa without any apparent Pathological Cause.—This is the most frequent variety of dysmenorrhœa in young women, it is also the most painful of all, the patient

at times rolling about in agony, sweating profusely, vomiting and even fainting. This form usually comes on with the flow or more rarely a few hours before and seldom lasts longer than twenty-four hours, often much less. The amount of blood lost varies, at the commencement of menstruation it is always scanty and the flow only becomes properly established as the pain disappears.

The pain is felt in the lower abdomen, thighs and sacral region, and whilst most often the spasm is of short duration in a certain number of cases it may be very prolonged.

Many patients are sterile, especially when this variety of dysmenorrhœa is associated with the abnormal shape of the uterus already referred to.

Treatment. Dysmenorrhœa being a symptom only, will be cured or relieved according to the result of the treatment of the disease to which it owes its origin; this treatment will be found fully discussed under its appropriate headings elsewhere.

In most cases the better the state of the patient's health the less troublesome will be the dysmenorrhœa.

There are, however, two examples of the "colicky" dysmenorrhœa and one of the "congestive" dysmenorrhœa the treatment of which must be dealt with here.

Colicky Dysmenorrhœa due to the Expulsion of Exfoliated Endometrium.—The treatment of this condition is most unsatisfactory. Such as it is, it aims at the substitution of a normal endometrium for the diseased one, and this may be essayed either by drugs or operation. In many cases short of arresting menstruation the disease appears to be incurable.

Drugs. Some practitioners have thought that they obtained good results from the administration of sulphur and guaiacum, of ammonium chloride and liquor ammoniæ acetatis or of mercury and iodide of potassium. Others have been disappointed.

Ionization has at times been stated to give relief.

Operation. The diseased endometrium can be removed by a thorough curetting followed by swabbing the uterine cavity with iodized phenol. Unfortunately the new endometrium may be no better than the old.

If these methods fail to relieve the condition and the dysmenorrhœa is so severe that the patient is laid up every month and prevented from earning her living, then it may be necessary to arrest menstruation. The best way to achieve this end is to remove the uterus and leave the ovaries. Before proceeding to such a radical treatment the greatest consideration would have to be given to the case.

Colicky Dysmenorrhœa in which there is no

immediate indication for a local examination, or in which on a local examination being made no apparent cause can be detected.—This may be treated by drugs and operation.

Drugs. For the immediate relief of pain various drugs may be tried, but what will give a good result in one patient will have no effect on another, and it is therefore only by trying a number of them that success may be achieved. Thus phenazone, phenacetin, phenalgin, pyramidon, aspirin, or ammonol in ten-grain doses may prove successful. Hot fomentations or hip baths will at times relieve the acute pain.

Operation. When treatment by drugs fails to give relief, a large number of these patients are improved and may even be cured by dilatation of the cervix. The dilatation should be carried out during the week prior to the expected period. The dilatation may also have to be done twice or even three times before a cure results.

The best dilator is the child's head, therefore in the newly married an opportunity for pregnancy to occur may be given before the cervix is dilated artificially, but inasmuch as many of these cases of dysmenorrhœa are associated with sterility, the patient may wait in vain for a natural dilatation and the practitioner may have to undertake the artificial one with this additional advantage that the dilatation may also cure the sterility.

It occasionally happens that a practitioner will meet with a patient upon whom all these remedies have been tried in vain, and whose pain is so bad that she takes some form of opium to ease it, or is prevented from earning her living because each month the pain keeps her away from her work. In this case, sooner than the patient should develop into a morphomaniac, drift into the workhouse or become a drag on her friends, menstruation had better be arrested. The proper method is to remove the uterus. These cases are few and far between. I have met two, both hospital nurses, who suffered so severely that for a week every month they were useless. Removal of their ovaries cured them and made them useful members of society. This was some years ago; I should now remove the uterus as I know that the operation is not more risky, whilst it is certainly more scientific.

Congestive Dysmenorrhœa without any Obvious Cause.—In these cases the state of health of the patient must be inquired into and any gouty or rheumatic tendency dealt with. Anæmia should be treated, and it is most important that the bowels should be kept regular, and with a view to lessening the premenstrual congestion saline aperients should be prescribed for the week preceding the onset of menstruation. The pain will be relieved by resting, and it is

best to encourage the patient to be satisfied with such measures as these. If the pain demands some further treatment the bromides of ammonium and sodium will be found to be most useful.

Local Treatment. As a rule these cases do not require local treatment. Rarely when the treatment as already outlined fails, the introduction of glycerine and ichthyol (ten per cent.) tampons into the vagina will, by reducing the local congestion, afford relief. C. B.

THE DISEASES OF THE VAGINA

The vagina is frequently involved secondarily in the morbid processes affecting the uterus and neighbouring organs. It is often, however, the seat of independent diseases which will now be considered.

Atresia.—Imperforate vagina is met with as a congenital malformation, or it may be acquired as a result of sloughing, injury, ulceration or repeated application of strong caustics.

Congenital Atresia may occur alone, or be complicated with absence, imperfect development or closure of the orifice of the uterus. Occasionally the vagina is bifid and the atresia affects only one side in which the menstrual fluid of the corresponding horn of the uterus may accumulate, producing the condition termed *hæmatokolpos lateralis*. The occlusion may affect the entire vagina or only for a half or a third of its length, most frequently towards the lower extremity, or a membranous septum may form a complete hymen. The congenital atresia is usually complete with total occlusion of the passage to and from the uterus.

Although most examples are described as congenital, there is an increasing body of evidence to show that inflammation and ulceration occurring in early life are important factors in causation.

Symptoms and Diagnosis. A diagnosis is usually not made until after puberty, when the patient has the usual indications of monthly menses without any menstrual discharge, the extravasated blood being detained above the seat of obstruction. In other instances the difficulty or impossibility of sexual intercourse leads to a local examination being made. Whilst in the acquired form resistance during childbirth owing to constriction of the vaginal canal may lead to its discovery.

Physical examination may discover a definite tumour in the hypogastric region, tense, fluctuating and rising out of the pelvis, and the uterus may sometimes be felt as a firm pear-shaped body perched on the summit of the tumour. The finger is soon arrested within the labia, or a bulging, fluctuating pouch is

felt. A further investigation can be made by recto-abdominal examination, aided if necessary by a sound in the bladder.

Treatment. A free incision should be made, and the retained fluid permitted to run out slowly, care being taken to avoid pressure from above. If necessary, gentle irrigation by means of warm, sterile, normal salt solution can be used to facilitate the removal of the sticky fluid. To prevent subsequent closure of the orifice the obstructing membrane may be required to be dissected out, and a glass dilator worn for a few hours at intervals until patency is permanently established.

Strict antiseptic precautions should be observed during the performance of this operation, and an antiseptic diaper, frequently changed, should be worn to collect the discharge.

Foreign Bodies.—Pessaries have been left in the vagina for years, being forgotten until foul discharge or ulceration has called attention to their presence. The writer has removed a Zwack pessary retained in the vagina four years, one limb of which had penetrated into the bladder. In another woman aged seventy years, when her pessary was removed, an annular carcinomatous growth was found on the vaginal wall. A miscellaneous collection of foreign bodies has been described as being found in the vagina. Corks, pieces of wood, pomade pots, portions of glass syringes, pieces of sponge, and various appliances used for preventing conception. Worms are occasionally detected having made their way into the vagina from the anus.

A persistent foul discharge in an otherwise healthy young woman should suggest a foreign body.

There is usually no difficulty in the removal of foreign bodies, but anæsthesia may be required where ulceration exists, and where they are partially embedded in the vaginal walls.

Vaginitis.—Inflammation of the vagina, like that of the vulva, is due to infection, the gonococcus being the most frequent cause.

The existence of gonorrhœal vaginitis has even been disputed, for it is not so often seen where the epithelium is thickened. In young women and children it is of frequent occurrence because the epithelium is less resistant, and the writer has seen it subsequent to total hysterectomy, where the possibility of contamination from cervical discharge could be excluded. A secondary vaginitis frequently accompanies chronic cervical gonorrhœa.

Septic infection and tubercle are important causes of vaginitis, whilst the congestion during pregnancy favours the development of vaginitis. Injury, foreign bodies, neoplasms, caustics and immoderate coitus may also cause vaginitis. Lastly, some of the exanthema

ta cause vaginitis, the consequences of which may have an important bearing on many so-called "congenital" abnormalities.

A special form of vaginitis—**Senile Vaginitis**—is seen in women after the menopause, or in younger women where menstruation has been arrested by operation. The mucosa, especially in the upper part of the canal, sheds its epithelium in patches, becomes studded here and there with papillary granulations, and shows a tendency to cicatricial contractions.

The discharge is thin, purulent and occasionally blood tinged.

It is supposed that the atrophic changes in the mucosa interfering with the normal protective power of the vaginal secretion render the tissues less able to resist bacterial invasion.

Gonorrhœal Vaginitis is characterized by pain, dyspareunia and discharge, and is usually complicated by vulvitis. The vaginal walls are red, tender to the touch and bathed in a yellow or greenish-yellow purulent discharge, which is quite distinct from the yellowish mucoid discharge seen associated with endocervicitis. In the chronic forms of vaginitis the discharge becomes more creamy with exfoliation of the epithelium, the surface exhibiting numerous red papillæ.

The *diagnosis* is made by exposure with the speculum, and examination of the discharge. Specimens of the pus should be examined for gonococci in all doubtful cases.

Treatment of Vaginitis. In the acute gonorrhœal cases injections should not be used, the same treatment being applied as has been recommended for acute gonorrhœal vulvitis.

For the more chronic cases, swabbing the vagina with five per cent. silver nitrate gives excellent results, followed later by the use of oxychloride of bismuth pessaries (oxychloride of bismuth gr. x., ol. theobromatis ʒ ii).

Senile vaginitis is best treated by wiping away all the purulent secretion with absorbent wool soaked in 1 in 2000 biniodide of mercury, and then applying carbonate of bismuth over the entire surface of the vagina. In the later stages a douche of liq. plumbi subacetatis (ʒ i to O i of warm water) will complete the cure.

It will be found much more efficacious to adopt treatment by swabbing instead of ordering patients with vaginitis to use a douche.

During the wearing of a pessary, daily douching is required in order to prevent the development of a discharge. For this purpose either bichlorate of soda (ʒ i to O i of warm water) or permanganate of potassium (grs. 5–10 to O i) are most useful.

Douching may be required to assist in disinfecting necrotic growths from the cervix or

vagina. R. Iodi (5 i to O i), creolin (5 ss to O i) and hydrogen peroxide (10 vols.) are the best solutions. Here, also, the direct application of strong disinfectants to the surface of the growth is more effectual.

Injuries. It is principally in connection with labour that the vaginal walls are liable to be injured. The injury may be followed by sloughing and a fistulous opening develop between the bladder and the vagina or between the rectum and the vagina. The mucosa is frequently torn more or less deeply, especially at its lower extremity. Such lacerations are important because of their liability to become channels of infection during the puerperium. For this reason they should be sutured after labour, as they are in addition the cause of relaxation of the vaginal outlet.

Injuries from instruments used for inducing abortion, brutal assaults, falls on pointed objects, or injury during sexual intercourse, are not infrequently encountered, and may be associated with serious or even fatal hæmorrhage.

New Growths.—*Myomata* and *fibromata* are rare. They are most frequently on the anterior wall, being either sessile or pedunculated. The symptoms produced depend on their size and position. They should be enucleated, and care taken that the bladder is not injured during the operation.

Sarcomata are very rare. They have been described in children and adults from puberty to extreme old age. In children grape-like sarcomata and in adults diffuse and circumscribed types have been noted. The treatment is early and complete removal of the vagina.

Carcinomata.—Cancer is much more frequently a secondary affection of the vagina; the primary growth being uterine or rectal. Rarely, however, the growth is primarily vaginal in origin. It may be circumscribed, diffuse or rarely form a series of warty growths, which ultimately coalesce. It occurs both in young and elderly women. The symptoms are those of discharge and bleeding, and later special symptoms develop from involvement of neighbouring organs.

The best treatment is complete removal of the uterus and vagina when practicable. In the presence of advanced disease, palliative treatment is required.

Cystomata.—Cystic tumours are most frequently found on the anterior vaginal wall. They are usually small in size and appear as thin-walled, translucent tumours bulging into the vaginal canal. The contents are pale, watery or viscid, and occasionally brownish from extravasated blood. They are best treated by complete excision and subsequent suture of the vaginal wall.

Vaginismus.—This term is applied to spasmodic contraction of the bulbo-cavernosus and anterior fibres of the levator ani which is excited by the slightest contact with the vulval mucous membrane. It should be differentiated from another condition, hyperæsthesia of the vulva in which such contractions are not produced.

In marked examples of vaginismus a vaginal examination is impossible owing to muscular contraction, and the patient may even exhibit opisthotonos.

The sufferers are usually recently married women, in whom although the hymen is unruptured, excoriations at its base towards the navicular fossa may be observed. Painful fissures may be noted in the hymen attended by a certain amount of chronic inflammation, whilst in other instances no local cause is discoverable.

Treatment. Under anæsthesia a search should be made for local lesions. Inflamed tages may be excised and fissures treated by the application of pure carbolic acid. A five per cent. solution of cocaine may be subsequently required, or a soluble pessary containing two grains of cocaine as well as the wearing of a glass dilator for half an hour or longer twice daily. Incision of the mucosa and subjacent muscle may be necessary in those cases which resist palliative treatment.

Dyspareunia (Painful Coitus) is another condition resulting from vaginismus, but it is also met with as a consequence of inflammation of the vulva or vagina; inflammation of the Bartholinian glands, fissures and ulcers of the labia and ostium vaginae, tender carunculae myrtiformes and occasionally painful urethral caruncles. In another group of cases the cause must be sought for in the uterus appendages or pelvic peritoneum. The treatment must be directed to a removal of the cause.

Displacements of the Vagina.—The vagina may be displaced apart from the uterus, the two chief types of displacement being cystocele and rectocele.

Cystocele is really a hernia of a portion of the bladder into the vagina, the vaginal mucosa forming its outer covering. In the same manner a bulging of the floor of the urethra may occur, forming a *urethrocele*.

Rectocele is a hernia of a portion of the rectum into the vagina, the posterior vaginal wall forming its outer covering.

During coughing or straining these hernial pouches increase in size and protrude at the vulva. They may occur singly or both are found together, two swellings are then seen to protrude at the vulva.

Treatment. The palliative treatment consists in the wearing of a pessary, but as this only

affords temporary relief operative treatment should be recommended in the majority of the cases. F. J. McC.

PROLAPSE OF THE UTERUS AND ITS COMPLICATIONS

The uterus normally lies in a sagittal mesial plane, its anterior surface in contact with the bladder, and the tip of the cervix on a level with

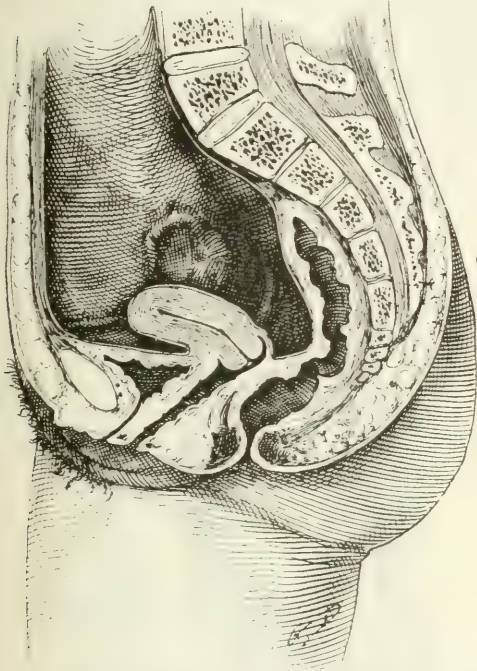


FIG. 1.—Sagittal section of the normal female pelvis, showing the position of the round and the utero-sacral ligaments on the left side.

the lines joining the ischiatic spines. When the bladder is empty the axis of the cervix is almost horizontal, with the fundus in front, and the axis of the body is inclined slightly in front of the cervical axis, so that the fundus rests on the empty bladder. That is to say the uterus is in a position of marked anteversion and slight anteflexion (Fig. 1). When, on the other hand, the bladder is full the uterus lies in an almost vertical position, and, if there is bladder over-distension associated with rectal over-distension, the uterus may be pushed upwards.

A prolapsed uterus is one which, as a whole, lies at a lower level than normal in the pelvis. The amount of descent may be slight, or, on the other hand, the entire uterus may have passed below the vulvar orifice. Sometimes the term prolapse is used in a more limited sense and is confined to cases in which the uterus lies lower than normal but has not, even in part,

passed through the vulvar orifice (Fig. 4). While to the more marked condition, in which part or the whole uterus has passed below this orifice, the term *procidentia* is applied (Figs. 2 and 3).

Etiology. The chief factors which maintain the uterus at its normal level are the uterine ligaments and the pelvic floor. The ligaments either directly support the uterus, as in the case of the utero-sacral ligaments and the ligaments of Mackenrodt, or indirectly support it by keeping it at right angles to the axis of the vagina and parallel to the pelvic floor, so that the maximum resistance is offered to its descent. When the utero-sacral ligaments are markedly lengthened, the cervix depends for its support on its vaginal attachments and on the so-called ligaments of Mackenrodt, neither of which remains efficient for long. When the utero-sacral ligaments are slightly lengthened, and when there is an accompanying elongation of the round ligaments, backward displacement occurs, and the

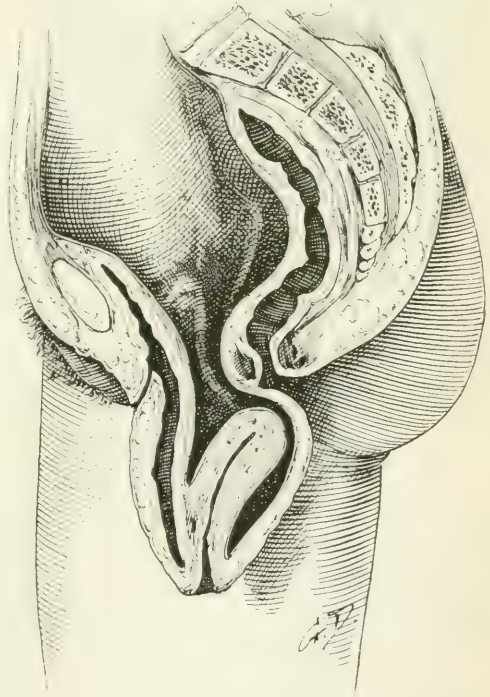


FIG. 2.—Sagittal section of the pelvis in a case of complete prolapse (after Schultze).

axis of the uterus more directly corresponds with the vaginal axis. In consequence, descent through the vaginal canal becomes possible. The pelvic floor directly supports the uterus and resists descent. The amount of support the floor affords depends on its strength and on the extent of uterine surface which is in apposition with it. If the integrity of the floor

is destroyed, and its different component parts are either torn or overstretched or themselves prolapse, then it can no longer support the uterus; and, if the long axis of the uterus, instead of lying parallel with the floor and so offering a large surface for support, becomes vertical, then the uterus can drop wedge-like through the opening in the floor made by the vaginal canal.

There are other factors which, though not of so great importance in maintaining the normal position of the uterus, are occasionally potent in causing or assisting prolapse. The first of these is the weight of the uterus and the second the intra-abdominal pressure. So long as these remain normal their effect on the uterus is in equilibrium with the support afforded by the ligaments and pelvic floor. If either of them, and particularly if the latter, is greatly increased, the two together may overcome the support given to the uterus and the latter may gradually descend. As it does so lengthening of the ligaments, and sometimes yielding of the pelvic floor, necessarily follows.

The foregoing are the general factors which, when normal, aid in maintaining the normal position of the uterus, and which, when altered by disease or injury, tend to permit or to cause prolapse. We must now see how this alteration is caused in individual cases.

Elongation of the ligaments may be a primary or a secondary factor in the production of prolapse. It is a primary factor when, as a result of subinvolution, it is present after the puerperium and allows the uterus to fall backwards and come into and descend along the axis of the vagina (*vide* Fig. 5). As the uterus descends it draws down the vault of the vagina with it, with consequent elongation of the lateral vaginal ligamentous attachments. Descent continues until the uterus reaches the levator muscles, and is then temporarily arrested if these are intact, while, if they are torn or over-stretched, descent continues uninterruptedly. In each case the result is similar, as the pressure of the uterus will gradually stretch the muscles, even if they are intact, sufficiently to allow further descent. Primary elongation of the ligaments is also sometimes a so-called congenital condition, that is to say it is present to a marked extent in women who have never borne children and in whom there is no obvious evidence of any other primary cause of prolapse such as increased intra-abdominal pressure or increased uterine weight. Sometimes this condition is actually congenital and is present in infants at birth. This, however, is very rare, and more usually the prolapse does not appear until after puberty. In such cases there may also be "congenital" hypertrophy of the cervix.

Elongation of the ligaments is a secondary factor under two different conditions. First,

when the weight of the uterus or the intra-abdominal pressure is markedly increased and is directly transmitted to the ligaments, which in turn yield under the strain; and, secondly, where the pelvic floor has been so torn or stretched that it fails to give a normal support, so that the entire weight of the uterus comes on the ligaments. In such cases there is frequently accompanying prolapse of the vagina, and then not only has the uterus lost the support of the pelvic floor, but there is direct downward traction on the cervix at the cervico-vaginal junction. When this occurs there is a direct conflict between the down-pull exerted by the vaginal walls and the up-pull exerted by the utero-sacral ligaments. If the ligaments

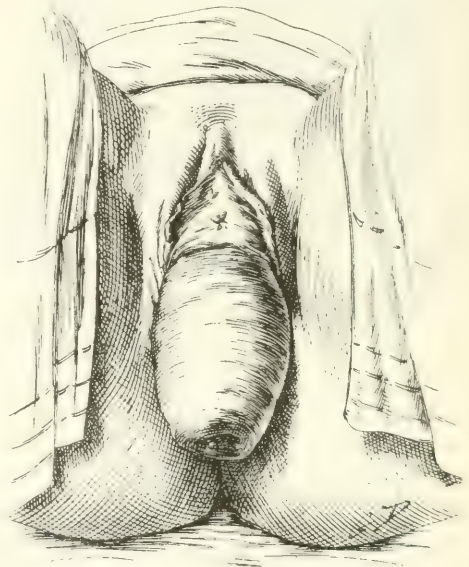


FIG. 3.—Complete prolapse, as seen from below.

yield and stretch, prolapse continues and the uterus soon reaches the vulvar orifice. If, on the other hand, the ligaments are strong and maintain their original length, there is marked elongation of the tissues of the cervix between the attachments of the vaginal vault and the attachments of the utero-sacral ligaments (Fig. 6). This condition is usually spoken of as supravaginal hypertrophy of the cervix, and we shall subsequently see that its occurrence has an important bearing on the operative treatment of the case.

Loss of support from the pelvic floor is the result of injury to the floor, and this in almost every case occurs during labour. Very rarely indeed it may be the result of operative interference, as when a deep para-vaginal incision has been made and has failed to unite properly. The essential lesion is tearing of the levator ani muscles, structures which constitute the

most important part of the pelvic floor. When they are torn the lower part of the vaginal canal loses its support, and the canal itself, which normally makes an angle of sixty degrees with the horizon, becomes almost vertical. As a result the anterior vaginal wall, which normally rests on the posterior wall, becomes practically unsupported, and intra-abdominal pressure tends to drive it downwards through the vulva. As a further result of the tearing of the muscle the anterior rectal wall loses its support, and, pressing directly on the lower part of the posterior vaginal wall, gradually stretches it, and both together protrude through the vulvar orifice. Prolapse of the lower part of the vagina thus begins, dragging with it in almost every case the posterior wall of the bladder and in some cases an extensive rectal pouch (*vide* Fig. 4). The downward pull is quickly transmitted to the upper part of the vagina, and, if the attachments of the latter to the pelvic wall yield, is transmitted to the uterine cervix. Then, as we have seen, either supravaginal elongation occurs, or else the utero-sacral ligaments also yield and the uterus prolapses.

Increased weight of the uterus of a kind that favours or causes prolapse is generally the result of subinvolution, since we have then in association other factors favourable to prolapse, such

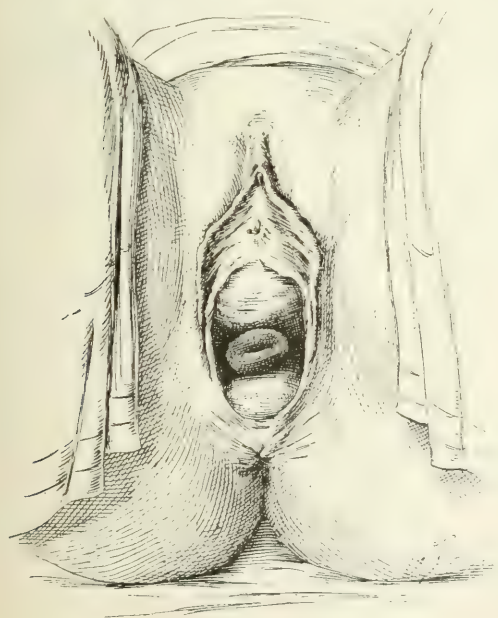


FIG. 4.—Partial prolapse, with rectocele and cystocele.

as subinvolution of the ligaments and softening of the vaginal attachments. Increased weight due to tumour formation more rarely causes prolapse, since in the first place there is usually no accompanying ligamentous softening, and

in the second the tumour itself often grows in such a manner as to fix the uterus in its normal position or even to draw it upwards. Sometimes, however, tumours grow in such a manner as to guide the uterus into a position in which its

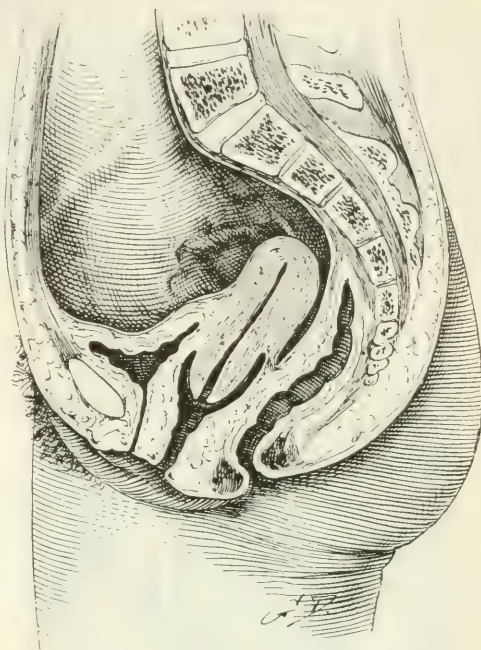


FIG. 5.—Sagittal section of the pelvis, showing the uterus in a position of retroversion and the first stage of prolapse.

long axis corresponds with the vaginal axis, and then, if the tumour is small, the vagina patulous, and the support of the pelvic floor deficient, prolapse occurs.

Increased intra-abdominal pressure, when it acts uniformly over the whole pelvic floor and when it persists for a considerable time, tends to drive the floor down. The first result of this is usually an increased projection of the floor below the level of outlet of the bony pelvis, very similar to the increased projection that occurs during pregnancy. If the vulvar orifice is patulous and its vaginal support deficient, prolapse of the vaginal walls may occur, and, later, uterine prolapse. Or, if the uterus is very small and its ligaments weak, it may be driven down through the vagina, even though the latter is uninjured. Instances of this are sometimes met in stout women who have to stand a great deal, and such cases are usually very difficult to treat or cure.

From the foregoing it will be seen that there are many causes which, either singly or in association, may produce uterine prolapse, and that while the latter is most usually the result of the injuries of childbirth, it may occur in

women who have never been pregnant. It will also be seen that the associated lesions of prolapse are varied. If the radical treatment of prolapse is to be successful, we must be able to recognize the actual causes and lesions which are present in each case, and so we shall now proceed to consider the methods of examining the patient with a view to their diagnosis.

Diagnosis. In examining a patient with the object of ascertaining the position of the uterus and the condition of the other pelvic organs and structures, it is advisable, and indeed almost essential, that she should be placed in the dorsal gynæcological position, so that a thorough bimanual examination may be made. As a preliminary to this examination the external genitals

occurs when the patient walks about, the uterus may have gone up again into position and may only descend when some driving or pulling force is applied to it.

Assuming that a prolapse occurs, the next step is to ascertain what part of it is formed by the uterus and what part by the vaginal wall. This is readily done by trying to pass the finger into the vagina. If the vagina is completely inverted this will be impossible, and, if the vagina is partly inverted, it will be possible to introduce the finger for a short distance corresponding to the length of the part of the vaginal canal still in its proper position. It is obvious that in all cases of descent of the uterus as a whole there must be some descent of the upper part of the vagina also, and where this does not occur the prolapsed part will be found to consist of an elongated vaginal portion of the cervix alone.

When the vagina is prolapsed we must determine what part of it is chiefly involved. In many cases this will be the entire canal, in others the anterior and posterior walls, and in some one of these walls only. When the anterior wall prolapses the condition is spoken of as "cystocele," and invariably the bladder is carried down beneath the vaginal mucous membrane. When the posterior wall prolapses the condition is spoken of loosely as "rectocele," and in some cases the term is correct, inasmuch as a pouch formed by the anterior rectal wall also prolapses. In the majority of cases, however, it is probable that the rectum does not share in the descent, and that the vaginal mucous membrane has been peeled off the rectum. In these cases the position of the bladder is readily ascertained by passing a catheter or sound into it, and of the rectum by passing the finger into it.

While this examination is being made one must also ascertain the condition of the levator ani muscles. This can be done by estimating the thickness of the tissue lying between the vaginal mucous membrane and the tuberosities of the ischium. Where no perineal laceration has occurred the anterior edges of the muscles approach one another in the depth of the perineum and blend with the superficial perineal muscles, while anterior to the point of blending they form a definite band which can readily be felt. If the muscles have been deeply torn this band is absent, but the mass of the muscle can be felt between the mucous membrane and the tuberosity, its distance from the central line of the perineum being proportionate to the extent to which it has been torn. If the muscles are atrophied by over-distension and retracted altogether from the perineal region owing to extensive tearing, then the surfaces of the tuberosities as felt from the vagina are

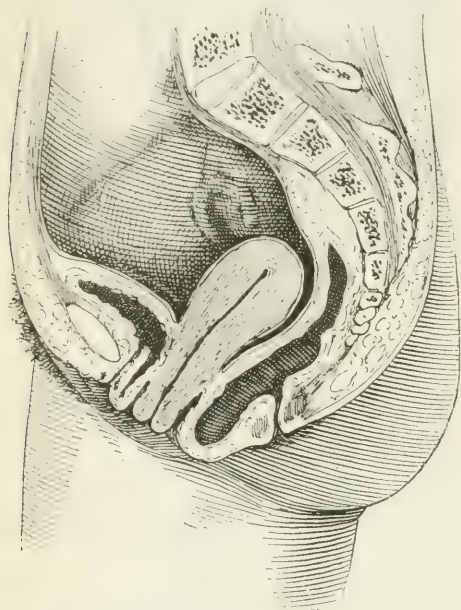


FIG. 6.—Sagittal section of the pelvis, showing the uterus in a position of partial prolapse with considerable supravaginal and slight vaginal hyperthrophy of the cervix.

should be inspected, in order to ascertain whether there is any visible prolapse of the vagina or of the uterus, and any lesion of the vulvar orifice. The patient should then be told to cough several times, during which a prolapse may occur owing to the increased abdominal pressure. Next, the cervix should be caught with a vulsellum forceps and drawn down in order to see if it can be brought outside the vulva, and, if so, how far. During this the patient should again cough, so as to bring the uterus down as far as its ligaments will allow it. In many cases the prolapse may be so complete that it is visible without any straining efforts or traction, but, in other cases, where prolapse

abnormally distinct, and suggest that nothing lies over them except vaginal mucous membrane.

The examination of the uterus comes next. We have already ascertained whether the cervix prolapses, and, if so, how far, and we must now learn what other changes have occurred, and what is the condition of the utero-sacral ligaments. Descent of the cervix may be caused in one of three ways. First, the vaginal portion may be hypertrophied and elongated, the supravaginal portion and body remaining normal. As a result the cervix may protrude through the vulva, although the body of the uterus remains in its normal position. Secondly, the supravaginal portion may be hypertrophied and elongated, the body still remaining in its normal position. As a result the cervix and the upper part of the vagina prolapse, while the body may remain in its proper place or perhaps may also descend. In the third place the uterus as a whole may descend. Accurate diagnosis between these three conditions is essential for correct treatment, and is as a rule quite easy. Simple hypertrophy of the vaginal portion is readily recognized by vaginal examination, while a bimanual examination shows that the body remains at its proper level. The condition of the supravaginal portion can be ascertained by noting the distance between the vaginal attachment and the insertions of the utero-sacral ligaments, as, when supravaginal hypertrophy exists, this distance is markedly increased. The utero-sacral ligaments can usually be felt from the vagina, and, if present, can always be felt from the rectum. They run an almost vertical course from the second piece of the sacrum downwards to be inserted into the lower part of the body of the uterus, and form the lateral boundaries of the pouch of Douglas. If the finger is placed against them and at the same time the cervix is drawn down, they will be found to tighten and become string-like. Descent of the uterus as a whole is recognized by palpating the body of the uterus and noting its position relative to the pelvic outlet. In such cases examination of the utero-sacral ligaments shows that they are elongated, while in supravaginal or vaginal hypertrophy of the cervix existing without uterine prolapse these ligaments preserve their normal length.

In addition to determining the length of the cervix one must also determine whether there is any "erosion," true ulceration or laceration present. This is readily done after the cervix has been drawn down externally.

The last step consists in the examination of the appendages of the uterus and the abdominal contents generally, with the object of eliminating any cause of increased intra-abdominal pressure such as tumours, ascites, marked and

constant intestinal distension, and excessive fat.

Treatment. The treatment of prolapse falls under one or other of two headings:—palliative by means of pessaries; and radical by operative measures. Each of these must be considered separately.

The pessary treatment of prolapse can be carried out satisfactorily as a temporary measure in a considerable number of cases, and in a smaller number of cases it can be carried out satisfactorily for years. In a very considerable number, however, it is altogether inapplicable. The advantages of this line of treatment are that it does not necessitate operation and so that it is preferable in the case of aged or enfeebled patients, and that it does not necessitate hospital

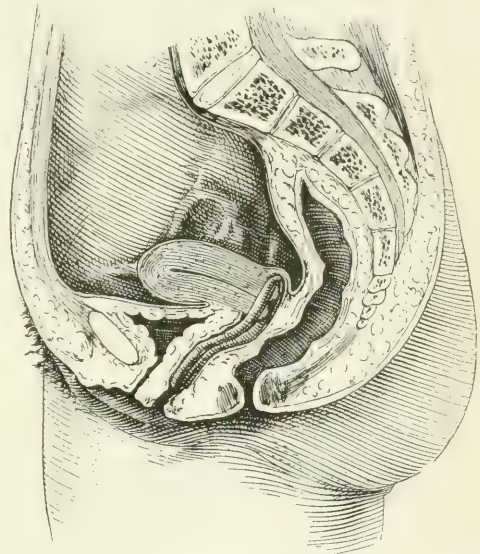


FIG. 7.—The uterus maintained in position by a Smith-Hodge pessary.

treatment. Its disadvantages are that it necessitates regular medical assistance for the purpose of removing and cleansing the pessary and of seeing that the latter does not cause inflammation or ulceration; that it is very prone to cause inflammation, when it becomes difficult or almost inadmissible; that when the vagina is small in proportion to the size of the vulvar orifice the retention of a pessary is impossible; that the pessary sometimes fails to keep the displacement reduced even though it remains in position in the vagina; and that it does nothing for accompanying complications such as cervical erosion or hypertrophy or perineal lacerations.

A pessary must be removed for cleaning and examining at least every three months in cases in which the vaginal and cervical mucous membranes are healthy, and where there are even

slight erosions or vaginitis it must be removed more frequently. Many gynæcologists consider it permissible to allow the patient to remove and replace the pessary herself, but, in the case of certain forms of pessary, such as a Smith-Hodge, this is impossible, and in almost all forms it is a most objectionable practice, and one which the medical adviser should not allow. At the time of removal the vagina should be douched and the mucous membrane carefully examined with a speculum to see that there is no ulceration and irritation. Whenever the latter occur, or when they are present in a patient who comes under treatment for the first time, they must be cured before the pessary is replaced or inserted, and this is frequently a most difficult matter, requiring prolonged treatment, during which the patient may have to remain in bed or, if up, to refrain from active exercise. The difficulty of treating such cases is that the pessary cannot be inserted because it will increase the ulceration, while, if the patient walks about much without it, the prolapse will recur and the healing process will be delayed. The usual method of treating the irritation or ulceration is by the insertion of vaginal tampons which have been soaked in some healing solution. For this purpose glycerine nine parts and ichthyol one part, or a mixture of glycerine and compound tincture of benzoin of the same strength, are useful. The plugs must be changed daily, and, while the patient may herself remove them if a piece of tape has been tied to them, they must be inserted by the medical adviser. The simplest way of doing this is to prepare a plug of suitable size tied round the middle by a tape six inches long. The plug is soaked in the selected solution and placed in a cylindrical speculum of large size. The speculum is then passed into the vagina, and withdrawn while the end of a forceps or other suitable instrument is held against the plug so as to prevent it being also brought down. In this way any friction or discomfort that would be caused by pushing the plug through the vulvar orifice is avoided. As soon as the ulceration or inflammation is cured the pessary may be introduced, but it will probably be found that in a short time it has again caused the same trouble.

When the vulvar orifice is larger than the vaginal canal, it is impossible to keep a pessary in position satisfactorily. It is obvious that in such cases the pessary can only be retained by virtue of the distensile pressure it exerts on the vaginal walls, and such pressure is bound sooner or later to cause deep ulceration. The cause of the disproportion between the vulvar orifice and the vagina may be atrophy of the latter or old unsutured lacerations of the former. In each case the result is similar. These are the cases in which vaginal stem pessaries of various types

have been used, but, as we do not consider them permissible, we do not describe them. Radical treatment in such cases is essential.

When prolapse of the vaginal wall persists, even though the pessary remains in position, relief may sometimes be given by means of another type of pessary. Thus, if a Smith-Hodge pessary fails, a ring pessary may succeed, or, if this fails, a pessary of the Gehrung type. But as a rule operative treatment will be required.

The most suitable types of pessary for use in prolapse are the Smith-Hodge, the solid vulcanite ring, the hollow vulcanite ring, the solid rubber ring, and the watch-spring. The Smith-Hodge

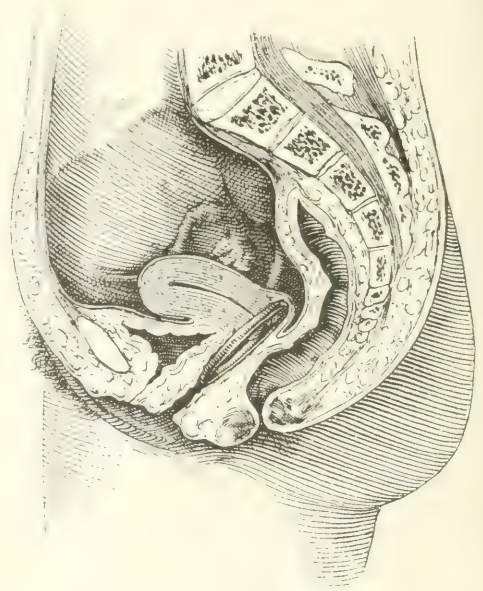


FIG. 8.—The uterus maintained in position by a vulcanite ring pessary.

pessary is most useful where there is also a backward displacement of the uterus and where the perineum is intact (*vide* Fig. 7). Before inserting it the backward displacement must be replaced, and the patient must be examined again in a few days to see if the uterus remains in its normal position. If the fundus again falls back it will probably pass below the upper bar of the pessary and marked discomfort will result. If, on the other hand, the uterus remains in position it is probable that we shall be able to keep up the prolapse with a smaller-sized pessary than would be possible if one of the other types was used, and this is a considerable advantage. When the uterus is very small, so that it does not much matter whether it lies in a position of ante- or of retro-version, and when there is enlargement of the vulvar orifice, a ring pessary of one or other of the types mentioned above will be

found best (*vide* Fig. 8). An elastic pessary is most easily introduced, a hollow vulcanite pessary will be worn without resultant irritation in cases where other forms may cause trouble, while the solid vulcanite ring may be retained where others will slip out. The Gehrung pessary is principally of use in cases of cystocele, and is said sometimes to be of service where all other types fail (*vide* Fig. 9).

There are several types of pessary which must be rigidly avoided. The principal of these are the stem pessary, and the so-called butterfly or Zwanke's pessary, both of which introduce infection and cause ulceration from pressure, and the box-wood ball pessary, which is both dirty and liable to become incarcerated in the vagina.

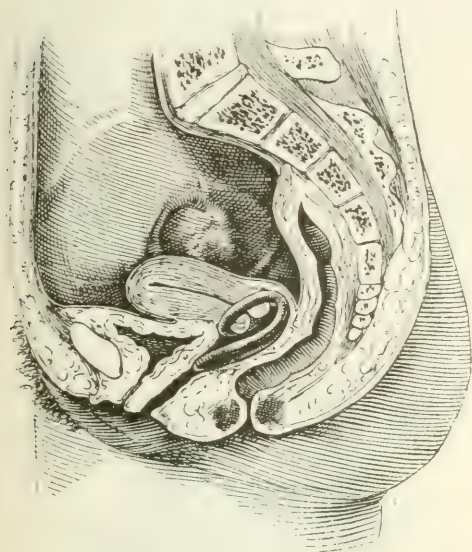


FIG. 9.—The uterus maintained in position by Gehrung's pessary.

The radical or operative treatment of prolapse is preferably directed to the removal of all complications and the adoption of such measures as will permanently prevent the recurrence of the prolapse. In some cases, however, owing to the age or state of health of the patient, lengthy operations are impossible, and then the measures adopted may be directed solely to the removal or cure of such conditions as prevent the wearing of a pessary. Thus, if a patient has a large erosion of the cervix causing much leucorrhœa which is intensified by a pessary, amputation of the cervix may enable the latter to be worn satisfactorily. Or, if a deep laceration of the perineum prevents the retention of a pessary or necessitates the wearing of one too large for the vaginal canal, a perineorrhaphy will enable a pessary of suitable size to

be worn. Such operations are, however, at best only palliative, and, wherever possible, a true radical cure, which will prevent the necessity of again wearing a pessary, is preferable.

As we have seen, the different lesions which may be associated with prolapse, either as causal factors or as complications, are numerous, and a correct diagnosis of the extent of each and all of them is necessary before one can decide on the most suitable operative treatment. It is the neglect of this somewhat obvious step that has led to the so frequent failure of operative treatment. Thus, ventral fixation has been done with the object of preventing the descent of the fundus, while at the same time the condition of the utero-sacral ligaments has been neglected, with the result that in a short time the prolapse is in a worse condition than it was before the operation. Vaginal fixation has been done and the condition of the pelvic floor neglected, with a very similar result. Perineorrhaphy has been done and the condition of the cervix and the position of the uterus neglected, with again a similar result. And so on. Where deficiency of the uterine supports once begins to manifest itself, it quickly brings in its train other lesions, which in turn are capable of aggravating the original one, and even of reproducing the latter, if, after its removal, they are allowed to persist.

If we take, for example, a typical case of complete prolapse associated with the usual complications and discuss its treatment, it will give perhaps the best idea of the different operative procedures that are usually necessary. In such a case the uterus will be enlarged and completely prolapsed outside the vulva, and if it is pushed back to its normal level it will fall into a position of retroversion and retroflexion. The entire vagina will be inverted. The bladder will have followed the anterior wall and so will be in great part outside the vulva, and the rectum may similarly have followed the posterior wall. The utero-sacral ligaments will be markedly lengthened, and so will be the round ligaments. The cervix will be hypertrophied supravaginally, and the vaginal portion will probably be ulcerated. The levator ani muscles will be torn and the vulvar orifice considerably enlarged.

For the cure of such a case it will be necessary, first, to adopt measures that will ultimately effect a reduction in size of the uterus; secondly, to fix the uterus at its normal level and the fundus in a position of anteversion; thirdly, to remove the hypertrophied cervix; fourthly, to restore the bladder and the rectum to their proper positions, or at any rate to a position in which they cannot again bulge downwards through the vulva; fifthly, to remove superfluous vaginal mucous membrane; and, sixthly, to restore the muscles of the pelvic floor. All these will be effected somewhat as follows:—Curetting

of the uterine mucous membrane will tend to bring about ultimately a healthier state of the uterus and so a reduction in size in cases where the enlargement is due to a chronic inflammatory process. Where tumours are present,

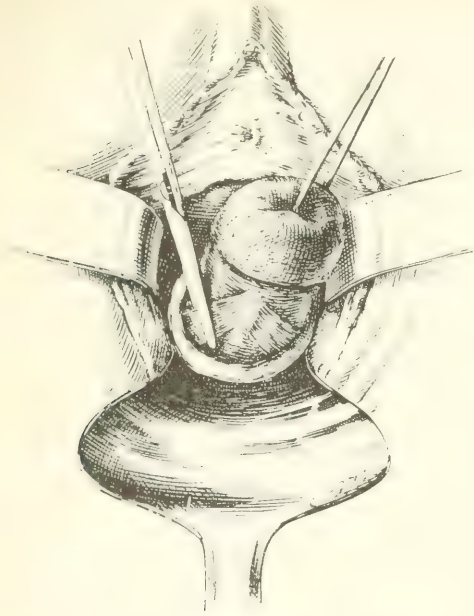


FIG. 10.—Shortening the utero-sacral ligaments. The ligaments exposed after the detachment of the vaginal mucous membrane from the cervix.

such as small myomata, they must be removed by enucleation or myomectomy. Shortening of the utero-sacral ligaments will bring the cervix again to a normal level in the pelvis. Shortening of the round ligaments or ventral suspension will keep the uterus in a position of anteversion. Interposition of the uterus between the bladder and the anterior vaginal wall will support both the vaginal wall itself and the bladder, and, by fixing the uterus in a position of aggravated anteversion, will render any other step to accomplish that end unnecessary. Supravaginal amputation of the cervix will remove the hypertrophied portion. Anterior colporrhaphy, when the interposition operation is not performed, will remove superfluous mucous membrane from the anterior vaginal wall, and at the same time will give some support to the bladder. Where the interposition operation is performed it is unnecessary. Finally, a posterior colpo-perineorrhaphy, associated with suture of the levator ani muscles, will remove any excess of the mucous membrane of the posterior vaginal wall and restore again the torn muscles and the perineum.

Some of these procedures call for special description, and then we shall see how they

may be satisfactorily associated with one another.

Shortening of the utero-sacral ligaments by the vaginal route can be carried out either by the intraperitoneal method described by Wertheim, or by the extraperitoneal method which we have described ourselves. Perhaps naturally, we prefer the latter method. It consists in exposing the ligaments at their point of insertion into the uterus by means of a circular incision round the cervix at the cervico-vaginal junction, similar to the incision made as a preliminary to vaginal hysterectomy. Each ligament is then caught with a small forceps and cut off the uterus. It is then drawn down and carried round in front of the cervix, where it is secured with sutures (*vide* Figs. 10 and 11). At the same time it is shortened to the necessary extent to bring the cervix back to its normal level in the pelvis. It is by no means a difficult procedure, and, in cases in which supravaginal amputation of the cervix is necessary, it adds on little to the length of the operation.

Interposition of the uterus between the anterior vaginal wall and the bladder was

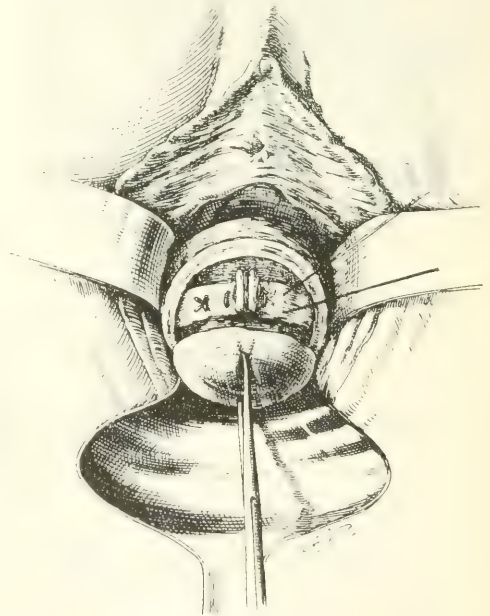


FIG. 11.—Shortening the utero-sacral ligaments. The ligaments brought forward in front of the cervix.

introduced by Wertheim, and, when associated with shortening of the utero-sacral ligaments if they are lengthened, is one of the best methods of maintaining the uterus at a proper level in the pelvis. At the same time it supports the bladder and takes up the excess of vaginal mucous membrane. It thus renders any other

procedure to keep the uterus in a state of anteversion unnecessary, or any such procedure as anterior colporrhaphy. Essentially, it consists in dissecting up a flap of the anterior vaginal wall, and then opening into the peritoneal cavity through the utero-vesical pouch after first pushing the bladder upwards out of the way. The body of the uterus is then brought out through the opening thus made and drawn forcibly down. The peritoneum, forming the anterior edge of the opening in the utero-vesical pouch, is then sutured carefully to the back of the uterus in the region of the insertion of the utero-sacral ligaments, thus making the uterine body extra-peritoneal. The fundus of the uterus is then sutured to the vaginal wall as close as convenient to the

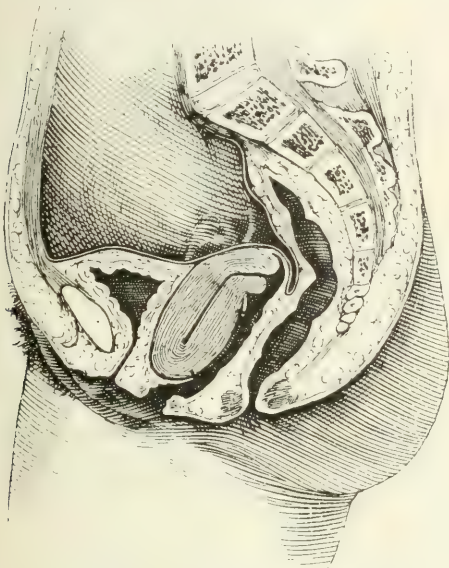


FIG. 12.—Sagittal section of the pelvis after the performance of Wertheim's interposition operation.

urethral orifice, and, finally, the vaginal flap is brought back into place so as to cover over the uterine body. As a result the uterus lies below the bladder, for which and for the anterior vaginal wall it forms a firm support (*vide* Fig. 12). It is, in fact, a form of living pessary which acts in a manner very similar to the old spherical pessary formerly used in such cases. The only objection to this operation is that it cannot safely be followed by pregnancy, and that therefore it may only be performed after the child-bearing period is passed, unless it is accompanied by division of the tubes so as to prevent the passage of an ovum into the uterus.

Where interposition is not performed, shortening of the round ligaments at the external abdominal ring—Alexander's operation, or Kelly's ventral suspension, or suspension of

the uterus to the abdominal wall by the round ligaments—Gilliam's operation, must be substituted, since, if the fundus is left free again to become retroverted, prolapse is bound to recur, as we have already tried to show.

Supravaginal, or vaginal amputation of the cervix (*vide* Fig. 13) and anterior colporrhaphy do not call for any special remarks. The first-named can be satisfactorily combined with extra-peritoneal shortening of the utero-sacral ligaments. The last is not required when interposition is done.

Posterior colpo-perineorrhaphy consists of three steps—the removal of a triangular piece of superfluous mucous membrane from the posterior vaginal wall, the suture of the torn edges of the levator ani muscle, and the restoration of the skin perineum (*vide* Figs. 14 and 15). It is a simple procedure which can be carried out very rapidly.

The association of the different steps of the complete prolapse operation is a matter which calls for careful consideration, as on it depends greatly the length of the operation and its ultimate success. After the usual dilatation of the cervix and curetting, the first step consists in dividing the vaginal mucous membrane round the cervix, as if for a vaginal hysterectomy. The mucous membrane is then pushed upwards all round, so as to expose the entire length of the cervix. If the cervix is now drawn forcibly forwards, the insertion of the utero-sacral ligaments can be easily seen.

The second step consists in catching each ligament separately with an artery forceps quite close to the uterus, and then in dividing the ligament with scissors between the forceps and the uterus. It is unnecessary to open the peritoneum to do this, but, if one has any doubt as to whether one has actually caught the ligament, it is perhaps better to open into Douglas' pouch. A finger passed into the pouch can then easily palpate the ligaments, and, if at the same time one pulls the forceps gently downwards, it is easy to tell by the transmission of the pull to the finger in Douglas' pouch whether the forceps has caught the ligament or not. Each ligament is then drawn gently downwards and freed from its attachment to the peritoneum, so as to allow it to be pulled down still farther.

The third step consists in the amputation of the hypertrophied cervix at the level which seems best. The vaginal cuff is then brought back into position over the stump posteriorly and laterally, leaving the anterior portion still unfastened and taking care that the ends of the ligaments have been drawn forwards so as to project through the anterior opening.

The fourth step consists in defining and raising a flap of the mucous membrane of the

anterior vaginal wall, and during it the cervix is drawn strongly down, so as to expose and make taut the anterior vaginal wall. The flap is defined by making two vertical incisions through the mucous membrane, starting a little above the level of the urethral orifice and running upwards to meet the circular incision round the cervix. They lie each at one side of the middle line, and enclose between them a flap of an inch or an inch and a half wide, according to the size of the vaginal wall. When the flap is lifted it remains attached in the region of the urethra. This step may be associated with the first step, or may be left until this stage, as is found most convenient.

The bladder is thus exposed, and is pushed upwards off the uterus until the peritoneal reflection is reached. Care must be taken to push up also the lateral portions of the bladder. The peritoneum of the utero-vesical pouch is then opened by a transverse incision.

As soon as this has been done the utero-sacral ligaments are drawn tightly out through the opening remaining in front of the cervix, which is now pushed up to its normal level in the vagina. Each ligament is then sutured in turn to the anterior surface of the cervix in such a manner as to keep the cervix at the level to which it has been pushed, or they may be

and the edge of the vesical peritoneum, forming the anterior margin of the opening in the utero-vesical pouch, is sutured to this wall in the region of the internal os, thus mooring the bladder

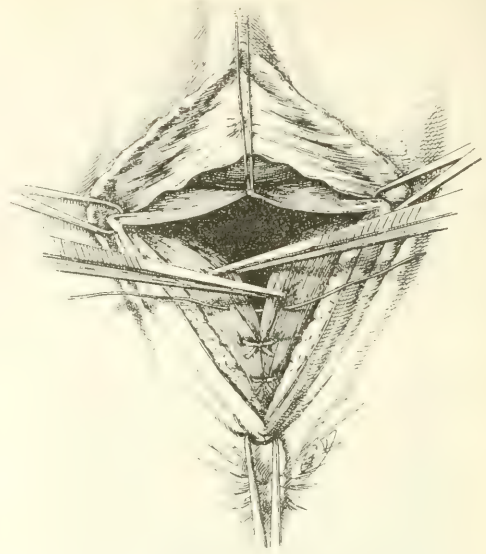


FIG. 14.—Perineorrhaphy. The levator ani muscles exposed and in process of being brought together in the middle line.

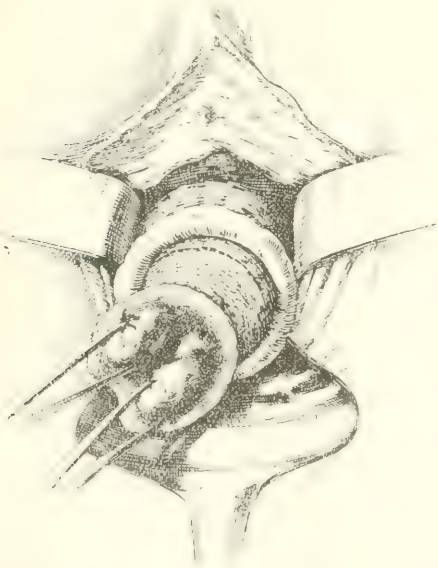


FIG. 13.—Supravaginal amputation of the cervix. The dotted line shows the site of the incision.

sutured to one another below the cervix. Any excess of ligament is removed. The uterine body is next brought out into the vagina through the opening in the peritoneum, in such a manner as to expose the entire posterior uterine wall,

above the uterus. The fundus of the uterus is then in turn moored to the vaginal mucous membrane as near the urethral orifice as possible, and, lastly, the flap of vaginal mucous membrane is brought back again into place in such a manner as to cover over the uterine body. If the uterine body is large the entire flap will be required to cover it, and, if it is small, any excess of flap may be cut away.

As a result of the fixation of the cervix by the shortening of the utero-sacral ligaments, and of the interposition of the body of the uterus between the bladder and the anterior vaginal wall, it is almost impossible for prolapse of either the uterus or the vagina again to occur. The last step of the operation is the performance of colpo-perineorrhaphy.

In conclusion, a few words may be written on the considerations which should influence us in advising or adopting palliative or radical treatment. We have seen already in general terms the advantages and disadvantages of each method, and from them we may arrive at certain conclusions. The first and most important of these is that prolapse in a young or middle-aged and healthy woman should always receive operative treatment. No matter how satisfactory pessary treatment may appear for a time, its tendencies are always in an unsatisfactory direction, and, in the majority

of cases, a time will come when its continuance is impossible or at best wholly unsatisfactory. In old women, on the other hand, whose expectation of life is less, and who do not live a very active life, pessary treatment may be satisfactorily carried out if due care is exerted, and if there are no complications present

Endometritis, adenomatous disease, tubercle, carcinoma and sarcoma.

Endometritis.—Endometritis signifies inflammation of the endometrium, and as such it occurs in two forms—the acute and chronic. The term endometritis has been used until recent years in a very loose way; we now know that many of the so-called cases of endometritis are definite diseases not necessarily inflammatory, and they therefore should be and will be treated of separately.

Acute Endometritis is due to infection by the staphylococcus, streptococcus, bacillus coli communis, either alone or mixed, or to the gonococcus. It is most commonly associated with a septic labour or abortion, at times with the introduction of an infected uterine sound, and rarely with an acute attack of gonorrhœa or a sloughing fibroid.

The inflammation quickly spreads to the muscle, and the uterus becomes enlarged, soft, tender and the seat of multiple small abscesses. The peritoneal coat is also involved, and perimetritis, and not uncommonly general peritonitis, follows in its wake.

The veins of the uterus may become thrombosed and septic emboli leading to pyæmia result.

Symptoms and Signs. As a rule the general symptoms and signs mask those of a more local character, so that in puerperal cases the picture is one of septicæmia and in gonococcal cases one of peritonitis.

When the illness is of a more localised character it will often be found to commence with a rigor and the temperature rises to a considerable height.

The patient will probably complain of pelvic pain, the uterus will have the characters already described, and there may be an abundant discharge of offensive pus. If the patient recovers, she will very likely be sterile, as the inflammation commonly spreads to the Fallopian tubes, giving rise to salpingitis and pyosalpinx.

Treatment. The treatment of acute endometritis necessitates careful judgment; if associated with septicæmia or general peritonitis, these conditions must be treated by the recognized methods.

Hysterectomy, when the uterus is the seat of multiple abscesses and the patient suffering from septicæmia, is doubtfully beneficial.

In the rarer cases when the inflammation stops short of the peritoneum or there is no generalized infection, local treatment is indicated and consists in removing any portions of placenta or membrane that have been retained in puerperal cases, in irrigating the uterus with 1 in 4000 biniodide of mercury, following this up with an irrigation of sterile water and afterwards well swabbing the interior with carbolic acid four parts and iodine one part (iodised phenol).

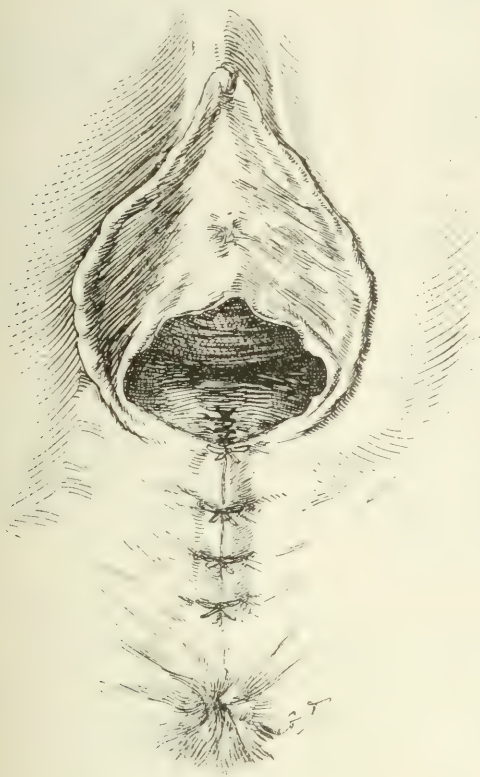


FIG. 15.—Perineorrhaphy. The operation finished.

that forbid the use of a pessary. Where such complications are present there is very little choice between operation and a life of semi-invalidism. Again, where an old woman is robust and wishes to live or has to live an active life, operative treatment will usually be found to be the most satisfactory. In short, operative treatment is always the treatment of choice, and pessary treatment the treatment of necessity. H. J.

DISEASES OF THE UTERUS

The coats of the uterus consist of mucous membrane, muscle and peritoneum, and there are diseases which originate in each of these structures or involve them.

Diseases originating in the Mucous Membrane.—The endometrium of the uterus may be the seat of the following pathological conditions:—

The uterus should on no account be curetted, as this will only favour reinfection by making a fresh raw surface.

If on intra-uterine examination the uterine wall is found to be breaking down, then the best treatment would be a hysterectomy, allowing free drainage afterwards.

Chronic Endometritis—

Causes. Chronic endometritis may follow on an acute attack or may be primary, arising either in the puerperium or apart from it, and due to the same organisms mentioned as causing the acute form. It may also be associated with atrophy of the uterus.

Symptoms. Leucorrhœal discharge, menorrhagia, dysmenorrhœa and pelvic aching.

Signs. The cervical discharge will be altered; from being transparent like unboiled white of egg, and with this consistency, it becomes opaque and white or yellow. Other symptoms will be due to associated complications—for instance, chronic endometritis is often combined with salpingo-oöphoritis, adenomatous disease of the cervix and chronic vaginitis.

Treatment. If the menorrhagia cannot be controlled by some of the drugs mentioned on page 963, if the leucorrhœal discharge cannot be relieved by douching, and the health suffers, the patient may be curetted. In a certain number of patients relief may be obtained, in most the result will probably be unsatisfactory, because in these cases the disease has penetrated deep to the endometrium and curetting will not touch this part. Ionization is said at times to do good.

Chronic Endometritis associated with Uterine Atrophy.—After the menopause the vaginal secretion loses its bactericidal properties and the entrance to the vagina gapes. Microbes will therefore enter more easily, and having gained entrance may not be destroyed. The secretions are consequently more likely to become infected and chronic endometritis result (Eden).

This is generally known as “senile endometritis.” Its exact nature has long given rise to discussion, some authorities even contending that the disease is in reality an example of primary cancer of the endometrium.

Symptoms. At a varying period, even up to some years after the menopause, the patient will complain of a slight hæmorrhagic discharge, a leucorrhœa which is at times offensive and profuse, and occasionally of pain.

Signs. The presence of senile vaginitis would suggest endometritis, since the two frequently coexist, and with a speculum pus can be seen exuding from the external os. The uterus is generally smaller than normal.

Diagnosis. It is very important not to confound senile endometritis with carcinoma of

the body, and therefore in all cases before the diagnosis is completed the cervix should be dilated and a digital examination made, when if the case be one of “senile endometritis” ulceration will not be detected, whereas in cancer of the body the ulcerated endometrium may be felt.

There is, however, a variety of carcinoma occurring in an atrophic uterus in which there is diffuse ulceration of the endometrium and which may at first be difficult to diagnose. It is better therefore in doubtful cases to procure a specimen of the endometrium for microscopical purposes by careful curetting.

Treatment. The disease is a difficult one to cure, repeated curettage often failing to give the requisite relief. This, together with the fact that the case may really be one of very early carcinoma, is in my opinion an indication that the best treatment is hysterectomy, failing which the uterus should be curetted and swabbed with iodised phenol.

Adenomatous Disease of the Endometrium.—

There are two varieties of this condition: one is *diffuse* and when it affects the body of the uterus often mis-called fungous, villous, hæmorrhagic, glandular or hypertrophic endometritis; when it affects the cervix and spreads beyond the limits of the external os it is known as an “erosion.”

The other is the *polypoid* form and is known as mucous polypus of the body or cervix according to the part to which the polypus is attached.

Diffuse Adenoma of the Body.—In this condition the endometrium is much thickened, there being a marked increase in the number of glands in some cases and of the size of the glands in others, whilst here and there where the glands are fewer the amount of stroma is increased by a marked round-celled infiltration.

Symptoms. The patient suffers from menorrhagia, leucorrhœa and dysmenorrhœa.

Signs. The uterine cavity is considerably enlarged, the sound passing in some cases four to five inches, and if signs of other disease such as salpingo-oöphoritis, tumours or misplacements of the uterus are absent, this makes the diagnosis more certain. The diagnosis, however, may only be confirmed on a digital examination of the uterine cavity after dilatation of the cervix.

Treatment. The best treatment in these cases is curettage, and if the endometrium is entirely removed the result may be quite satisfactory; on the contrary, however, the result is at times rather disappointing, since in many cases the operation has to be repeated a second and even a third or fourth time. This is partly due to the fact that the diseased endometrium has not been entirely removed, and so to make the operation more complete the uterus is often

swabbed with pure carbolic or iodised phenol after curetting. I have had successful results through applying pure nitric acid after curetting. This has to be done carefully and is even then not devoid of risk. The vagina and vulva are protected by passing the cervix through a hole made in a piece of lint about six inches square, the lint having been soaked in a saline solution and not wrung out. Directly the nitric acid has been applied the uterine cavity is douched with sterile water and the vagina well flushed. Such treatment may, however, lead to atresia of the cervical canal and retained menstruation, of an example of which complication I have knowledge.

Diffuse Adenoma of the Cervix (Erosion of the Cervix; Cervical Cysts).—Erosion of the cervix is an extension of the mucous membrane lining this canal beyond its normal limits of the external os.

Such a name as "erosion" for this disease is an unfortunate and bad one, since there is no loss of tissue, but rather an excess due to overgrowth. Sections of an adenoma of the cervix show that the squamous epithelial covering of the vaginal cervix has disappeared, that its place has been taken by columnar epithelioma, that there are numerous glands, the mouths of which open into the vaginal cervix, and that there is increased vascularity of the tissues involved.

Associated with adenoma of the cervix may be found a cystic condition in which the mouths of many of the cervical glands become obstructed, their mucous secretion is retained, and the cervix becomes riddled with mucous cysts. When one or two glands only become obstructed the cysts are known as ovula Nabothi.

Symptoms. Adenoma of the cervix occurs in the single as well as the married, but more often in the latter. The patient complains of backache and leucorrhœa, or these symptoms may be absent.

Signs. If the cervix has not been split the adenoma can be easily identified as a bright red patch on the vaginal cervix which is velvety to the touch and which scarcely bleeds, or does not bleed at all, on manipulation.

If the cervix has been split on both sides by childbirth and not healed, ectropion is the result, the two halves of the cervix often becoming markedly hypertrophied. The exposed mucous membrane has the same appearance as an adenoma of the vaginal cervix, and if this latter condition is present in addition it will be necessary to bring the two halves of the cervix together before the limits of the "erosion" can be determined.

Diagnosis. The diagnosis of an "erosion" may be a matter of much importance, since an

early carcinoma of the cervix has often been mistaken for it. This mistake need never be made, for the practitioner has only to cut a V-shaped piece out of the edge of the diseased area, including the subjacent muscle, and examine it with the microscope. Apart from this an "erosion" feels soft and velvety, a carcinoma hard and slippery, and whilst the cervix is not friable and will bleed little or not at all, carcinoma is friable, bleeding readily on being touched, and a sound can often be pushed into it without any effort.

Treatment. The best treatment for adenoma of the cervix is thoroughly to curette the uterus and the erosion, and for the latter one should use a sharp curette, as the glands are deeply situated in the cervix. After the curettage the erosion should be cauterized.

If an ectropion is present a trachelorrhaphy should be performed in addition.

Ovula Nabothi should be punctured, and marked cystic disease of the cervix will require amputation of that structure.

Polypoid Adenoma of the Uterus.—Mucous polypi are most often situated in the cervix, less frequently in the body, and at times in both situations. As a rule more than one polypus will be found. They vary in size from a pea to a bantam's egg or larger, and when large they are generally single and should be carefully examined for evidence of malignancy. In structure they correspond to the mucous membrane from which they spring.

Symptoms. The symptoms of polypoid adenomata are similar to those of the diffuse variety, and in addition, a mucous polypus of the cervix may cause metrorrhagia.

Signs. Mucous polypi of the cervix can often be detected by the finger as small soft tumours projecting through the external os, and can also be seen with Ferguson's speculum. Mucous polypi of the body will escape detection till the cervix is dilated and a digital examination made of the uterine cavity, and even then they are sometimes missed altogether or their presence only disclosed by the use of the curette.

Treatment. The polypus should be twisted off with ovum forceps and the uterus should be curetted, as not uncommonly the diffuse variety of adenoma is present in addition, or another polypus may have escaped notice.

Tuberculous Disease of the Endometrium.—Occurring primarily in the endometrium, tubercle is a rare disease. In the body it is generally secondary to tubercular salpingitis, whilst in the cervix it is found in conjunction with tubercle of the vagina.

Symptoms and Signs. When primary, this disease from its symptoms and signs is likely to be mistaken for carcinoma, and very probably

the true nature of the disease will only be recognized on microscopical examination.

In tuberculosis the uterine tissues do not bleed so much or so readily as in carcinoma.

Sarcoma.—Sarcoma of the endometrium arises from the connective tissue of this membrane and varies in type according to its situation. Thus in the body it soon becomes diffuse; if, however, it starts in the cervix, it is more likely to form large polypoid masses difficult to distinguish from mucous polypi.

Symptoms and Signs. The symptoms and signs are those enumerated under carcinoma and the diagnosis will be settled on microscopical examination.

It is a much rarer disease than carcinoma, occurs in young or old, and more sterile women are affected. It also more commonly affects the body than the cervix.

Treatment. Complete extirpation of the uterus directly it is detected.

Carcinoma of the Uterus.—Carcinoma of the uterus occurs in two situations, either in the body or the cervix. The striking clinical differences between these two may be summarised as follows—

<i>Carcinoma of the Cervix.</i>	<i>Carcinoma of the Body.</i>
Common . . . 95 %	Rare . . . 5 %
Average age . . . 43	Average age . . . 53
Sterility in . . . 6 %	Sterility in . . . 50 %
Greater number of children, greater frequency of cancer.	Greater number of children, less frequency of cancer.
Spreads by infiltration and permeation rapidly.	Spreads by infiltration and permeation slowly when compared with cancer of the cervix.
Prognosis after vaginal hysterectomy bad, much more hopeful after Wertheim's operation.	Prognosis after hysterectomy good.

Symptoms. The symptoms of the two varieties are the same, being hæmorrhage, leucorrhœa, pain, wasting and cachexia.

Hæmorrhage. The first symptom of carcinoma in either the body or the cervix is bleeding. There are four facts in connection with this bleeding that the practitioner must always bear in mind. (1) It is a comparatively late symptom. (2) It is small in amount at first. (3) It is intermenstrual. (4) It occurs commonly at or about, a little before or a little after, the menopause.

1. Time of Occurrence. The cancer may be somewhat advanced when the first bleeding occurs, or may even be found very advanced without any bleeding at all. The bleeding in cancer of the cervix occurs somewhat earlier than that of the body, a reason for this being partly due to the fact that the first bleeding is often the result of trauma, such as after coitus, due to rupture of small vessels in the friable growth.

2. Quantity. The patients, and even their medical attendants, may attach slight importance to the bleeding because it is small in amount, at first perhaps only a show. The bleeding does not become marked till the growth is advanced and some of the larger vessels have been ulcerated.

3. Metrorrhagia. The fact that the bleeding is intermenstrual in type, taken in consideration with the age at which it occurs, is very apt to lead the patients to think that the irregular bleeding is a sign of the approaching menopause.

4. Age. A large number of patients are attacked between the ages of forty-three and fifty-three. This is particularly unfortunate, since in the large majority of women the menopause supervenes between these dates. As irregular bleeding has from time immemorial been associated with the menopause, women fail to seek early advice, and even if they do the practitioner may fail to insist upon a local examination.

Leucorrhœa. There may be a slight watery discharge fairly early, but being without fœtor it passes unnoticed or disregarded. The horribly offensive discharge associated in the minds of the laity and profession with cancer of the uterus is a late symptom and occurs only when the growth is breaking down and has become septic.

Pain. Pain is a late symptom, later in cancer of the cervix than in cancer of the body. It does not occur in the cervix until the growth has spread into the surrounding structure. At times pain is absent. I have known patients in the cancer wards of the Middlesex Hospital to die of the disease without having complained of pain.

Cachexia and Wasting. These are late signs. In the early stages the patient will often appear to be in very good health.

Signs. When cancer of the uterus is advanced it can be so easily identified that it would be waste of time to discuss its diagnosis further.

Early Cancer of the Uterus.—The difficulties in the diagnosis of cancer are concerned with its early stages and its position.

Carcinoma commencing on the Vaginal Portion of the Cervix.—Early carcinoma of the cervix may have to be distinguished from an erosion, syphilis, tubercle, lacerated cervix.

Erosion.—To the touch an erosion of the cervix is soft and velvety, the tissue is not friable, it does not bleed easily, there is no induration in its neighbourhood. In appearance it is bright red in colour, the colour is uniform and there are no ecchymotic or yellow patches on it. Its edge is not well defined. It is a raised growth.

Carcinoma.—To the touch carcinoma of the

cervix is firm and somewhat rough or nodular, it is friable, so that it can be easily perforated with a sound, it bleeds easily on manipulation, it has the feeling of passing the finger over wet india-rubber, there is induration in its neighbourhood, its edges are somewhat defined, and it soon ulcerates, so that there is often a loss of tissue, a shallow ulcer. In appearance it is not nearly so red as an erosion, it is rather a yellowish-red, with often small darker red spots of hæmorrhage or yellow spots of suppuration.

Tubercle of the Cervix.—Tubercle of the cervix is most often associated with tubercular disease elsewhere; it is very rare as a primary affection.

To the touch there is no induration, the tissue is not friable, and it does not bleed easily on manipulation. Where it is ulcerated the edges of the ulcer are undermined. In appearance a tubercular ulcer may resemble carcinoma, and as a rule the correct diagnosis is made only after microscopical examination. The uterus has generally been removed for cancer and the diagnosis revealed afterwards.

Syphilis of the Cervix.—A chancre may occur on the cervix, as also may syphilitic ulceration, a rare condition. The growth is not friable, does not bleed easily and is not indurated. There will probably be other signs of syphilis, and the condition will quickly improve on treatment.

Lacerated Cervix.—When the cervix has been lacerated on both sides and has not healed, a condition known as "ectropion" may result in which the two halves of the cervix become everted and the cervical endometrium takes on the characters of an erosion. This condition is associated with a certain amount of inflammatory induration and overgrowth. The induration, hypertrophy, and cervical endometritis may suggest carcinoma. The condition can be easily identified by reducing the eversion by means of forceps, when the cervix will assume an appearance more or less normal.

Carcinoma of the Cervix commencing on the Cervical Canal of an Atrophic Uterus.—These cases are very likely to be overlooked. The vaginal cervix has atrophied, so that the external os is almost flush with the vaginal roof. The patient complains of a little bleeding and later of a slightly offensive discharge. The case is regarded as one of senile endometritis.

On making firm pressure over the external os with the index finger the os will often suddenly give and the finger passes into the supravaginal cervix, which is ulcerating and hollowed out by carcinoma extending up into the body. The disease is often only discovered on dilating the cervix for diagnostic purposes, and the operator is surprised to find the disease so far advanced.

Carcinoma commencing on the Body of the

Uterus.—In early cases, before the uterus is enlarged, this condition may be mistaken for senile endometritis, especially if the uterus is atrophied, or for a mucous polypus.

Carcinoma of the Cervix commencing on the Cervical Canal.—This variety of cancer—in which the growth commences in the glands of the cervix or in the epithelium lining the cervical canal—spreads into the adjacent tissues and not at first down through the external os. Such a condition has been mistaken for a cervical fibroid or a fibroid polypus.

Cervical Fibroid.—A cervical fibroid does not cause hæmorrhage, it is hard, smooth, not friable, does not bleed on pressure, there is no induration in its neighbourhood, and it does not invade the adjacent tissues.

Fibroid Polypus.—A carcinoma commencing high up in the cervix may resemble a polypus dilating the cervical canal, and if it is sloughing the resemblance becomes more marked. The polypus, however, is hard, not friable, does not bleed easily on pressure, and on dilating the canal its stalk will be felt.

Dilatation of the cervix will be the only means of determining the nature of the disease. In early cases, when the uterus is enlarged by a fibroid, carcinoma may escape detection. This complication is not a particularly rare one and is very dangerous because the bleeding may be attributed to the fibroid. The average age of a patient with carcinoma of the body is fifty-three, and this, together with the fact that fibroids at times postpone the menopause, leads to a diagnosis of postponed menopause due to the fibroid.

Causes of Death in Carcinoma of the Uterus.—*Exhaustion.* The majority of patients die of exhaustion brought about by the hæmorrhage, septic absorption, pain and deficient nourishment.

Uræmia. Death from uræmia is also a very common termination, being induced by the gradual involvement of the ureters or an ascending infection from the bladder.

Other causes are septic absorption, septic thrombosis with embolism, secondary growths on the various vital organs, intestinal obstruction, peritonitis and hæmorrhage. But all of these are uncommon fatalities when compared with exhaustion and uræmia.

It will be seen, therefore, that the diagnosis of early cancer of the uterus is a very unlikely clinical feat, and is in fact nearly always accidental.

Cancer detected sufficiently early is curable by operation, and even if not discovered until bleeding has declared itself, the prognosis is in a large number of cases, especially with the radical abdominal operation, good. Unfortunately, general experience shows that warnings

have been unheeded and the diagnosis not made until the growth has far advanced.

On the Continent and also in this country the profession is now waking up to the importance of early diagnosis of cancer, and knowledge of its symptoms is being disseminated through the medium of nurses and midwives.

Treatment of Cancer of the Uterus. The treatment of cancer of the uterus divides itself into palliative and medical.

Palliative Treatment of Cancer of the Uterus. When the disease has advanced too far for radical treatment, there only remains to treat the symptoms of hæmorrhage, discharge, pain and the various complications that occur.

Hæmorrhage. Hæmorrhage can be kept somewhat under control with ergot, but when it is due to deep ulceration and the involvement of large vessels, some further measures must be taken to arrest it.

Serious bleeding is often preceded by an increase in the severity of the pain and restlessness, and generally begins with the passage of several small clots; it sometimes follows severe vomiting. When the bleeding ensues the best remedy is a douche of hot water, commencing at a temperature of 110° F. and gradually raising this till it is 115° F. Copious bleeding can often be arrested by the addition of the tincture of perchloride of iron, a teaspoonful to a quart, but as this invariably causes sloughing, it is not a particularly good remedy to use. Ice-cold douches are just as useful, and if the bleeding is troublesome hot and cold douches may be alternated. A douche containing an infusion of matico leaves will sometimes stop the bleeding. Failing these remedies, the only remaining immediate treatment is to plug the vagina. After-treatment consists in elevating the foot of the bed, hot blankets, hot bottles, drinks of hot milk and an injection of morphia, and later the cervix, if this is the part of the uterus involved, can be thoroughly curetted and cauterized, which will often arrest the bleeding for some time.

Discharge. Some cases of uterine cancer tend to fungate and break down more than others and so lead to copious and most offensive discharges. These are the patients who get hectic temperatures, have marked cachexia, and suffer from gradual septic absorption. If the case is one of cancer of the cervix, much benefit may result from a curettage followed by a thorough cauterization with the actual cautery or solid zinc chloride, repeated if necessary. The benefit is often maintained for several months.

The emptying of a pyometra will also bring marked temporary improvement in these symptoms.

The discharge will, unless it is absorbed by

pads, and even sometimes in spite of them, cause a good deal of soreness and pruritus in the vulval region. The best treatment for this is perfect cleanliness. Pads should be used rather larger than those generally sold, should be very soft and absorbent, and may be made at home with cellulose covered with muslin. They should at least be changed three times a day, and more often if the patient asks for them.

The odour is best kept down by free ventilation and perfect cleanliness, both of the patient and the bed-clothes. It may be necessary to change the draw sheet five or six times a day.

Pain. The symptom which one has almost constantly to treat in these advanced cases is pain. It is remarkable how this diminishes after the patients have been properly nursed and douched for a day or two.

The pain varies a good deal in different people. If the patient keeps tolerably contented she seems to suffer less than if discontented and grumbling. Various drugs are used, but the most popular is some preparation of opium or morphia. This drug has certain marked disadvantages. Pain is relieved, it is true, but owing to the moral perversion induced the patient's resistance is lowered and a craving for the drug follows, which has to be given more frequently or in larger doses until appetite is lost and anæmia and emaciation hastened. As cancer is a wasting disease, and as one of the points in treatment is to encourage the patient to take as much nourishment as possible, the fact that opium interferes with the digestion is in itself a contra-indication to its use; and the constipating effect of opium is particularly troublesome in patients with uterine cancer, as the pain is worse when the patient is constipated, due to pressure in the lower bowel and to the extra congestion caused, and the pain will be much relieved if the bowels are kept acting regularly. In the cancer wards of the Middlesex Hospital opium is very seldom used. In some patients also it has a tendency to cause nausea and vomiting, and as there is a good deal of reflex vomiting in uterine cases this is a contra-indication of its use. One of the best ways to give opium is as follows—

Liquor Opii. Sed. ℥ x
Sodii Bicarb. gr. x
Sp. Ammon. Aromat. ℥ xx
Sp. Chloroformi ℥ x
Infus. Caryophylli ʒ i.

Such a mixture in some degree counteracts the bad effects of opium on the stomach, and warming the patient apparently increases the relief obtained. There does, however, come a time with many cases when morphia has to be given, and then it is best to commence with very small doses.

Before resorting to opium heroin should be given a trial.

Papine, a preparation of opium which is stated not to cause congestion or upset the digestion, one teaspoonful three times a day has been used with some success in place of opium.

We used in the cancer wards for a long time a mixture containing phenacetin (ten grains) and caffeine (five grains), twice a day. This certainly was more satisfactory than opium and for the time being gave marked relief, but after the patient had been taking it for about a month it was noticed that bad effects arose. For instance, in many cases it caused palpitation, with blueness of the lips and increase of hæmorrhage, also severe perspiration.

We have obtained the best results from aspirin, which as a rule is given twice daily, but if necessary three times a day and once in the night. It has no depressing action and as far as we can discover no bad effects; it is about half an hour slower in its action than phenacetin. It is not given unless the patient complains of pain, and as a matter of experience it is found that a dose at eight in the morning and eight at night is for a long time sufficient. Methylene blue, two to six grains daily, combined in a pill with extract belladonna $\frac{3}{4}$ gr. or arsenious acid $\frac{1}{40}$ gr. or strychnine $\frac{1}{60}$ gr., sometimes relieves pain and improves the general health. This drug at times causes nausea or vomiting, slow pulse and headache.

The effect of X-rays with regard to pain is very variable. In some cases there is undoubtedly increased pain, but in the majority of cases much relief is obtained, though at present there are no means of telling which cases will be relieved and which not.

The patient generally experiences more pain before hæmorrhage, and for this reason alone if a patient complains of very much pain it is better to keep her in bed for a day or two. Then, again, the pain of cystitis is very greatly relieved when the vesico-vaginal fistula is formed.

Alcohol rather tends to increase the pain, especially when it is of an inflammatory character.

Food. It is best to avoid a rich stimulating diet. Most patients have ordinary appetites and take an ordinary amount of food till towards the end, when their stomachs become upset. A large number of patients with advanced cancer will have ulcerated mouths, and therefore in anticipation of this it is most important that the teeth should be cleansed and the mouth washed out thoroughly. If in spite of these precautions the mouth becomes ulcerated, glycerine and borax or borax and honey may be used, and of course the nature of the food must be altered so that Benger's food, egg and milk, arrowroot, Plasmon and milk, cocoa made with milk, eggs

beaten up in tea, jelly, oysters, barley water, sweetbread, stewed eel, sheeps' tongues, ox palate, are found to be the articles of diet most satisfactory to patients.

Alcohol. Patients who are unable to take any food at all from loss of appetite will often be able to take and enjoy a glass of stout, or a little brandy, and regain some appetite.

Sleep. Most patients sleep fairly well, but at times their sleep may be interrupted, more especially if suffering from frequency of micturition. If the patient is troubled very much for want of sleep, nepenthe (thirty minims) will be found useful; some cases do better on bromide of potassium. Veronal in ten-grain doses in milk may be tried, but its action is very slow and it is not free from danger.

Trional in ten-grain doses or more will at times succeed in inducing sleep.

Paraldehyde is efficacious but very nauseous.

Vomiting. Sickness is a very trying complication in advanced cases of uterine cancer. The vomiting in these cases is either reflex or due to the gastritis. It is noticed that the reflex cases are much worse when constipation is present, and that it is more retching than actual vomiting. This variety very often is worse in the early morning, when a cup of warm milk or tea will be found in many cases to give relief.

Sickness is very difficult to treat, and in the majority of cases nothing will entirely arrest it when it has become at all severe, and patients are often hurried to their end by the onset of this complication. The treatment is that of vomiting from other causes.

Cystitis. The best treatment for cystitis is urotropin, ten grains given in an ounce of chloroform water twice daily. This condition is much relieved when a vesico-vaginal fistula is formed.

Sore Backs. In cases where there is incontinence of urine and fæces sore backs are very likely to occur, and the greatest care and cleanliness are necessary to prevent this.

For this reason it is found best to keep the patient quite flat and not to use any contrivance, such as a ring pillow, which tends to dam back the discharges. The draw sheets should be frequently changed, so that in a bad case it is not uncommon to change them three or four times during the night.

Delusions. A large number of patients suffer from delusions, which generally take the form that the nurse is not attending to them properly, or that she is doing something which she should not, so that a nurse may be wrongfully accused.

Radical Treatment of Cancer of the Cervix. The radical operation for cancer of the cervix consists in removing, through an abdominal incision, the uterus and its appendages and, by means of clamps, sufficient vagina to form

a bag in which the diseased cervix can be encapsuled. In addition, the parametrium and as much connective tissue of the pelvis as possible are dissected out, together with as many regional glands as the operator may deem advisable.

It is to Wertheim that we owe the present position of this operation, which he has performed as a routine one for a much longer period and in far greater numbers than any other surgeon, and his results are the most interesting we have.

What Advantages has Wertheim's Operation Over Simple Vaginal Hysterectomy? I must discuss this question under four headings—

1. The operation from the pathological standpoint.

2. Primary mortality.

3. Percentage operability.

4. Percentage of cures.

The Operation from a Pathological Standpoint. Carcinoma, as has been insisted upon by Sampson Handley, grows by "infiltration" and "permeation." By infiltration is meant destruction of the tissues surrounding the growth, and this can be seen microscopically as a sharp line between the carcinoma and the surrounding structures. By permeation the growth advances along the trunk lymphatic channels and is seen in the carcinomatous lymphatic glands and secondary nodules quite apart from the primary growth. Supposing carcinoma grew by infiltration alone, an incision external to its growing margin would permanently cure it, but as it also extends by permeation, the operation, to be successful, should remove the entire lymphatic tract. In carcinoma of the cervix these two methods of growth are well distinguished, since infiltration is taking place round the whole edge of the carcinoma, so that the bladder, rectum and vagina are in the end involved, although this may take some year or two, whilst permeation is involving the lymphatic glands at a much faster rate, so that the growth may spread in this way some distance in a few weeks. The lymphatics of the cervix are few, and run outwards through the parametrium to the external iliac glands. If, therefore, the operation area includes this tract and at the same time keeps well outside the infiltration area, the operation from a pathological standpoint is fulfilled.

Primary Mortality. The primary mortality of Wertheim's operation is undoubtedly high. With increased experience it can be lowered. Wertheim's results are an example of this. In his first 200 cases there were fifty deaths; in his next 258 cases thirty-five deaths. Döderlein publishes a list of 715 operations with a mortality of 14·8 per cent.; he gives his own primary mortality for sixty-five cases as 18·7

per cent. The mortality of 313 cases of the radical abdominal operation performed in the British Isles that I collected was 18·5 per cent.

The mortality for simple vaginal hysterectomy is naturally lower. Döderlein reports 4368 vaginal hysterectomies with a mortality of 9·1 per cent.

In England the experience of some of those who have performed vaginal hysterectomy to a large extent has been more favourable than this, but the operability rate in this country is lower than that on the Continent. The fact that the radical abdominal operation has a higher primary mortality should not of itself deprive any patient of the chance of cure. Moreover, this increased mortality is mostly because cases of a much more advanced or serious nature can be and are treated by this method. It is, therefore, really unfair to compare the primary mortality of the radical abdominal operation with that of vaginal hysterectomy, which can only be performed in early cases. If the percentage mortality is reckoned according to whether the case is one of an early, moderate or advanced nature, I find in 238 of the "Wertheim's" which I collected the following results—

In 186 advanced cases, 23·1 per cent.

In nineteen moderate cases, 5·2 per cent.

In thirty-three early cases, 6·3 per cent.

If, therefore, cases of a similar nature are chosen, the mortality of Wertheim's operation will be found to be but very little higher than that of vaginal hysterectomy.

Although every effort must be made to reduce the primary mortality of Wertheim's operation, still in a comparison of the merits of these two operations I am distinctly of the opinion that too much should not be made of the greater mortality. If after a period of five years there are appreciably more patients alive out of every hundred operated upon by this method than out of every hundred operated upon by simple vaginal hysterectomy, then, in spite of the primary mortality, the end justifies the means.

Percentage Operability. The percentage operability is greatly increased by the radical abdominal operation, because the bladder, rectum and ureter can be separated from the growth without much risk of injury, whereas in simple vaginal hysterectomy in a large number of cases this is impossible.

It has been argued that the percentage operability can be made as large as any operator chooses if he operates upon cases in which there is no chance of cure. Up to a certain point no doubt this criticism is just, but I do not think it entirely meets the case. It is, as we shall see, difficult to determine beforehand in which patients there is a chance of cure. All are

agreed that if only early cases are chosen the percentage of cures will be much greater and the mortality much less. Still, it is evident that most operators have not limited themselves in this way, with the result that many women have been cured whose chances from a clinical examination might have been thought to be hopeless. According to Döderlein and Krönig, the average percentage operability of ten operators by the radical abdominal method was sixty-eight. The average percentage operability for vaginal hysterectomy is much smaller, according to the experience of English operators about twelve per cent., and on the Continent a little higher than this.

Percentage of Cures. If the uterus is removed by simple vaginal hysterectomy, practically all the parametrium is left behind; if by Wertheim's method, all the parametrium and a large portion of the cellular tissue of the pelvis are taken away. The results of the pathological investigation of the parametrium extending over a large number of cases, and including the microscopical examination of some thousands of sections, prove conclusively to my mind that this structure should always be removed, since in at least fifty per cent. of the cases the parametrium is found infected. In at least half the cases, therefore, simple vaginal hysterectomy is useless, because cancerous tissue is left behind.

These facts do not carry much weight with those who favour vaginal hysterectomy, because they argue that if on clinical examination the parametrium is found to be involved, no method of removal is satisfactory; whereas, if the uterus is quite mobile and the parametrium is felt to be soft, vaginal hysterectomy holds out as good a chance of cure as any other operation. The pathological findings have proved this opinion to be untenable. It is impossible to diagnose clinically the real condition of the parametrium. A hard parametrium may contain no cancer, the induration being due to inflammation; a soft one may be full of cancer. It is almost impossible to estimate accurately the percentage of cures in this country, because of the difficulty in tracing hospital patients. The German method of estimating cures is a very strict one, including as it does by Winter's method the number of cases per hundred operated upon, added to the number of patients per hundred remaining well, the result divided by one hundred being called the "absolute cure" for the number of cases taken. Five years seem to be the period chosen by most authorities, after which the patient may be said to be cured as far as her original disease goes. Wertheim has one hundred and thirty-eight women alive operated upon more than five years ago, which equals a percentage of sixty-

two, and others have made equally good returns. On comparing this with the percentage of cures by vaginal hysterectomy, a very great diminution is at once noticeable. With cases of carcinoma of the cervix results prove that apparently not one-tenth of the cases operated upon by vaginal hysterectomy are alive after five years. In comparison with vaginal hysterectomy, therefore, the percentage of cures by Wertheim's and other radical abdominal operations show a remarkable improvement.

This increase in the number of cures by the radical abdominal operation is due entirely to two factors. One I have already discussed, namely, the thorough removal of the parametrium and the adjacent connective tissue. The other is due to the means taken for preventing any part of the wound from being contaminated by the growth—that part of the operation, in fact, with which Wertheim's name is particularly associated, *i. e.* clamping the vagina well below any growth before dividing it, so that the diseased cervix is removed in a bag of vagina and the risk of local implantation of cancer cells on the cut edges of this canal is practically eliminated.

In the past the recurrence of cancer after the removal of the diseased cervix has nearly always been local, due to cell-implantation on the cut edges of the wound or from an imperfect removal of the parametrium. On the other hand, with Wertheim's operation local recurrence is a rarity.

The standpoint from which any operation must be gauged is its ultimate result with regard to the cure of the greatest number of patients. Even if, therefore, the percentage of cures with Wertheim's operation were not greater than that by the simple vaginal method, nevertheless it would be the better operation because of the increased operability, since a greater number of patients would be saved. But, further, the percentage of cures by vaginal hysterectomy is a very low one, whereas that by the radical abdominal methods may, I think, in comparison be called high.

Archibald Leitch found from an investigation of 900 cases of carcinoma of the cervix that had not been operated upon that the average duration of the disease from the earliest symptoms to death was one year and nine months.

About six months may be taken as the average period between the first appearance of the symptoms and the report of the patient to her medical man, so that one year and three months is the average life-expectation of these patients if not operated upon.

The only point in favour of simple vaginal hysterectomy is its low mortality, although, as I have pointed out, if we take similar cases the difference is not appreciable.

Radical Operation for Cancer of the Body of the Uterus. The operation that will prove successful and satisfactory in the case of cancer of the body is pan-hysterectomy. The results of this operation are very good in these cases, because the disease is usually discovered before it has spread beyond the confines of the uterus.

Diseases Originating in the Muscular Coat.—The following diseases will next be considered—

Fibroids; adeno-fibroma; sarcoma; subinvolution; superinvolution; fibrosis.

Fibroids.—It is estimated that new growths are three times as common in women as in men. Twenty-five per cent. of the new growths that affect women originate in the uterus, and of these fibroids are by far the commonest.

Their frequency has been variously estimated, but reliable statistics show that in one hundred women between the ages of thirty-five and fifty there will be twenty thus afflicted, and if the lower age limit is raised to fifty this percentage will be doubled.

Between twenty-five and thirty fibroids are not particularly common, between twenty and twenty-five they are rare, and under twenty almost unknown.

The majority of fibroids do not give rise to any symptoms in their owners; they are quite small.

In the textbooks fibroids are classified as innocent or simple tumours of the uterus, but their innocency and simplicity is somewhat fictitious.

Up to comparatively recent times it was the custom to minimize the perils of fibroids, since the majority did not cause symptoms, and women were encouraged to believe that good feeding, rest, ergot and the menopause would severally relieve them of their trouble. This optimism was hardly justified by the facts.

In most women fibroids fail to cause any inconvenience because they stop growing when quite small and their presence is unrecognized. The false sense of security concerning fibroids held by so many in the past was partly due to the condition of the uterus found at the routine post-mortem examinations, partly due to the infrequency of abdominal operations, and partly to the lack of pathological knowledge.

For, in the first place, fibroids were discovered so often, and in comparison the times they had caused any trouble were so few, that these tumours were not regarded at all seriously, whilst the lack of experience due to the second and third factors still further tended to convey an erroneous impression as to their dangers.

During recent years the life-history of fibroids has been carefully investigated by many competent observers, with the result that they are to-day recognized by all well-informed prac-

titioners as really serious tumours, and their efficient treatment is now an everyday occurrence. In this connection I mean such fibroids as give rise to some recognizable symptom. Fibroids which, from their situation and size, fail to cause any trouble cannot be considered, since their presence cannot be determined.

It has been computed that in every hundred women seeking advice for disease peculiar to their sex, there will be twelve who do so because their trouble is due to a fibroid, and a large amount of suffering and ill-health and many deaths are due to these tumours, so that their efficient treatment is of primary importance.

Noble, in a study of 2274 cases of fibroids as seen in practice, patients who sought advice because of some symptom due to the tumour, found that in 1553, *i. e.* in sixty-eight per cent. of them, complications and degenerations were present. Let us therefore now consider how fibroids may endanger the life of the woman. They may do so in one of the following ways :— (1) By causing hæmorrhage; (2) by undergoing some secondary change; (3) by causing pressure; (4) by complicating pregnancy, labour or the puerperium; (5) by giving rise to mistakes in diagnosis.

The Maiming of Menorrhagia.—Bleeding due to fibroids may be either intraperitoneal or intra-uterine. The former is very rare; the latter is very common, and we will deal with it first.

Intra-Uterine Bleeding.—By this I mean bleeding from the endometrium into the cavity of the uterus, escaping per vias naturales. The size of the tumour is no criterion of the amount of hæmorrhage it will cause. This depends upon the situation of the tumour. So long as the uterine cavity is not invaded by the tumour no abnormal bleeding will occur; thus menstruation is not increased with subperitoneal fibroids. On the other hand, when the uterine cavity is invaded, as by a submucous fibroid or a fibroid polypus, menorrhagia, often of a severe type, is present, and at times also metrorrhagia.

If the uterus contains a submucous fibroid or a fibroid polypus its cavity is enlarged, and consequently there is a greater surface of endometrium. In these cases, also, the endometrium is not healthy, the glandular tissue being hypertrophied and the amount of stroma and number of blood-vessels appreciably increased. It therefore results that with the onset of menstruation more vessels are ruptured and more blood lost, and because of the fibroid in the uterus this organ does not contract efficiently, so that the bleeding from the vessels is not controlled so well as it is in normal menstruation.

Death from hæmorrhage directly due to fibroids is now-a-days a rare occurrence; on the

other hand, the protracted hæmorrhage caused by these tumours indirectly causes death in many cases through shock and exhaustion. It is as well to remember that fibroids which cause bleeding delay the menopause, a fact that must be taken carefully into consideration when anticipating relief from this phenomenon.

The amount of hæmorrhage due to fibroids varies, of course, in different women. It may be that the amount lost at menstruation is only a shade in excess of the normal, or the bleeding may be so profuse that the term "flooding" as applied to it is entirely appropriate. In these latter cases great difficulty may be experienced in arresting the flow, and even then the patient will hover between life and death for many days. Fortunately, these excessive losses are rare; but fairly profuse losses are not at all uncommon, and when to this menorrhagia is superadded the additional loss due to greater frequency of the periods, the patient's position is a serious one. There is one point about the bleeding associated with fibroids which it is well to remember, viz. that if a woman has a fibroid and suffers from menorrhagia, any sudden increase in the amount lost has in most cases a serious significance, for the usual history of menorrhagia due to fibroids is that it gradually becomes more marked or less marked as the case may be; there is no sudden increase; if there is, in many cases it will be found that some serious change is taking place in the tumour. Increased loss occurs when a fibroid becomes septic (this is particularly noticeable when a fibroid polypus becomes gangrenous), when it undergoes sarcomatous degeneration, or when necrobiotic changes are taking place. Increased loss at the menopause is suspicious, indicating as it sometimes does that carcinoma has arisen in the endometrium.

Many authors have laid great stress on the cardiac disease due to the anæmia produced by fibroids, which may take the form of fatty degeneration, brown atrophy and dilatation, and the condition is certainly expedited in these cases by the prolonged course of ergot which the patients have been through.

Intraperitoneal Bleeding.—Bleeding from a subperitoneal fibroid is a very rare complication, but several cases have been reported. In these, either from pressure of the tumour against the sacrum causing ulceration or from congestion, a large vein coursing over the surface of the tumour has been opened and a very serious hæmorrhage, ending fatally on more than one occasion, has resulted. A similar complication has been caused by a subperitoneal fibroid being partly torn off the uterus during an examination. The cause of the hæmorrhage has rarely been diagnosed before the abdominal cavity was opened, the condition being usually mistaken

for a ruptured tubal gestation, or the perforation of a gastric or duodenal ulcer.

The Disasters of Degeneration.—Uterine fibroids are very slow-growing tumours; a rapid increase in size therefore at once suggests some complication such as pregnancy or the various degenerations about to be mentioned.

Secondary changes are commoner in fibroids than in any other form of tumour, and they occurred in twenty-nine per cent. of the cases studied by Noble. Christopher Martin finds that hyaline, fatty, calcareous, myxomatous, red degeneration or œdema occur in fourteen per cent., infection occurs in four per cent., and malignant degeneration in four per cent.

Septic Infection.—A septic fibroid is a very serious danger, threatening hæmorrhage, peritonitis or septicæmia, giving rise to peritoneal adhesions which may involve the intestine and give rise to intestinal distension or obstruction. Salpingitis and pyosalpinx, with all their attendant evils, may follow on a septic fibroid. These in themselves may bring about a fatal result or greatly increase the risk of a subsequent operation. A striking example of a septic fibroid is the gangrenous fibroid polypus. During the process of extrusion the tumour has been expelled through the cervix, which then contracts on its pedicle, nips the vessels in the stalk, and causes congestion. The endometrium being thus injured, micro-organisms in the vagina infect the tumour, which becomes gangrenous and horribly offensive. Sepsis most commonly infects fibroids through the endometrium, either by the agency of some septic discharge, by sounds or dilators which have not been sterilized, or it may supervene on a septic miscarriage or labour.

Transperitoneal septic infection is much rarer, but it does occur, as, for instance, when a subperitoneal fibroid becomes infected by a pyosalpinx or diseased appendix, by a suppurating ovarian cyst, or by inflamed bowel, or when the tumour is pedunculated and undergoes axial rotation. Very rarely the sepsis may be blood-borne. At times the inflamed fibroid may suppurate, in which case the pus and disintegrated portion of the tumour may escape into the cavity of the uterus and be expelled, or the abscess may burst into the peritoneal cavity, or some portion of the bowel having first become adherent to the tumour, the abscess then bursts through into its lumen and the pus is discharged per anum.

Calcareous Degeneration.—The deposition of lime salts in fibroids is due to a diminished blood supply, and is most likely to occur, therefore, in subperitoneal fibroids, more especially at or after the menopause. The calcareous matter may either infiltrate the tumour or form a shell-like covering to it. Whilst as a rule

this change causes no inconvenience, it has occasionally happened that infection has taken place, and the "womb-stone," as it has been fancifully called, has sloughed out. Calcareous tumours are also rather frequently concerned with the rare complication of intestinal obstruction.

Necrobiosis.—Necrobiosis, or red degeneration as it is termed, is an interesting and peculiar change to which fibroids, more particularly those of the intestinal variety, are liable. This change, which has only been recognized of recent years, was supposed to be intimately connected with child-bearing, since most of the recorded examples have complicated pregnancy, labour or the puerperium. Nevertheless, since attention has been particularly drawn to it, fibroids undergoing this change have been found, though much more rarely, in the unimpregnated uterus. Necrobiosis, which commences in the centre of the tumour, consists of a degeneration of the fibres, an extravasation of the blood and thrombosis of the vessels, so that the tumour on section has a reddish appearance approximating that of raw beef-steak; it has also a peculiarly fishy odour. As the result of this change the tumour increases in size, becomes softer and also tender, whilst there is frequently fever and always pain, the latter often of great severity, which has led sometimes to a mistaken diagnosis of appendicitis, and more often to one of an ovarian cyst with a twisted pedicle.

Myxomatous Degeneration.—This is a common degeneration, but as a rule it is only very slight, so that it would usually escape detection, except on careful examination of the whole tumour. It most frequently takes place in subperitoneal tumours. It commences as a hyaline degeneration initiated by a limited blood supply, and is associated with cedema. The cells, of the fibrous tissues more especially, subsequently undergo liquefaction, and spaces are found containing a yellowish gelatinous fluid. When this change is very marked the tumour becomes cystic, and in this way cystic fibroids are formed. The largest fibroids are generally of this type, and clinically this degeneration may be diagnosed from the rapid increase in size of the tumour. The diagnosis of ovarian cyst and pregnancy has not infrequently been applied to such a condition.

Sarcomatous Degeneration.—The question of sarcomatous degeneration of a fibroid has long been a vexed question. Many reported cases proved, on re-examination of the specimen, to be really septic—the sarcoma was really an infected fibroid. Owing to the similarity of the appearance of sarcoma and the infected tumour sarcomatous degeneration was looked upon with great suspicion. Several authorities, however,

now contend that sarcomatous degeneration is not particularly uncommon if a very careful examination is made of the whole tumour.

Clinically, sarcomatous degeneration declares itself in a rapid increase in size of the tumour and hæmorrhage, more especially after the menopause; other signs may be wasting, an offensive discharge, pain and recurrence after removal of a supposed submucous fibroid or fibroid polypus.

Axial Rotation of a Pedunculated Subperitoneal Fibroid.—The stalk of a subperitoneal fibroid is more likely to be twisted if fairly long, and if the tumour is small and freely movable above the rim of the pelvis. As subperitoneal fibroids rarely have long stalks, axial rotation in them is rare. Two varieties of axial rotation are met with, acute and chronic.

In the acute variety the venous circulation in the stalk is hindered, the tumour becomes congested and hæmorrhage takes place into it. This gives rise to great abdominal pain and tenderness of the tumour, the patient may vomit, and her temperature and pulse-rate are raised. The tumour soon becomes infected from the bowel in its neighbourhood.

In the chronic variety the obstruction to the flow of blood is not so marked, and beyond the pain the patient has no complaint. There is, however, in these cases a certain amount of congestion, which leads to adhesions being formed between the tumour and the omentum and intestine, which may later be a source of danger. Cases have been reported in which, during torsion of the pedicle, a piece of bowel has been included, thus giving rise to acute intestinal obstruction.

Very rarely the arterial as well as the venous blood supply becomes obstructed, in which case the fibroid may become altogether detached from the uterus, and either fall free, or, if adhesions have formed, may be nourished by the vessels in these and become attached to some neighbouring structure.

At times a fibroid has not only caused torsion of its pedicle, but also the uterus, pregnant and non-pregnant, together with its appendages, has been twisted through nearly half a circle.

The Perils of Pressure.—Some of the most dangerous complications caused by fibroids are due to pressure. The reason for this is not far to seek. As a rule the fibroids most likely to cause pressure are least likely to cause hæmorrhage, so that in the first place the patient is not for a long time likely to have her attention drawn to the condition, and, secondly, it has so long been the custom for medical men to minimize the dangers of fibroids, especially those which are not causing hæmorrhage, that serious trouble frequently arises before they discover that the "innocent" tumour is directly threatening the life of their patient. The most dangerous form

of pressure is that known as impaction, and I will deal with this first.

An impacted fibroid is one that is located in the cavity of the pelvis and is large enough to fill it, sometimes so tightly that the tumour on removal is found to be more or less a cast of the pelvis. A cervical fibroid is particularly liable to become impacted, because in its growth it cannot rise above the brim of the pelvis. Impaction may occur in other ways: for instance, a pedunculated subperitoneal fibroid may slip down behind the uterus into the pelvic cavity; a fibroid may retrovert the uterus and on further growth be caught by the promontory of the sacrum, simulating in this respect a retroverted and incarcerated gravid uterus. A subperitoneal fibroid may arise low down on the posterior surface of the uterus and in its growth be caught by the promontory. A rare but dangerous form of impaction is due to atrophy of a fibroid at the menopause. Up to this time, resting above the brim, it may have been causing no trouble; then, as shrinking gradually takes place, it settles down into the pelvic cavity quietly but firmly and becomes a source of the greatest danger. I have seen two patients die of this variety of impaction.

When a fibroid becomes impacted or partially impacted, there are various structures in its neighbourhood pressure on which will cause serious trouble.

Urethra. In front, the urethra may be pressed against the symphysis pubis and retention of urine results, with, perhaps, cystitis and its attendant evils.

Rectum. Behind, pressure on the rectum may cause constipation, hæmorrhoids, and even intestinal obstruction. This latter complication is a rare one, but deaths have been reported from it, generally due to peritonitis from ulceration of the bowel above the point of pressure and escape of its contents into the peritoneal cavity.

Ureters. Important structures at the sides of the pelvis are the ureters. These may be nipped where they are passing over the brim of the pelvis, or they may be displaced by the tumour and subjected to pressure in this way. Thus one or both kidneys may become atrophied, or hydronephrosis or pyonephrosis may supervene and uræmia may be the immediate cause of death. As the ureters may be compressed for some considerable time before any symptoms arise therefrom, the danger of this complication will be apparent.

Veins. Pressure on the veins may give rise to marked œdema of the legs, varicose veins, and even thrombosis. This last complication is a dangerous one, as the thrombosis may become detached and cause a pulmonary embolism and so death.

Nerves. Pressure on the nerves may set up sacral neuralgia, sciatica or cramp.

There is an interesting form of impaction known as temporary impaction, in which, owing to the increased flow of blood to the uterus and fibroid just preceding menstruation, the size of the affected organ becomes somewhat increased, so that an impaction results which was previously absent. With the onset of menstruation the impaction passes off. The clinical sign of this condition is retention of urine just before menstruation and relieved with its onset. It is a sign of the greatest importance, signifying as it does that no time should be lost in removing the tumour.

Other Forms of Pressure. Fibroids may also cause injurious pressure without becoming impacted. Danger from this form of pressure is much rarer and is due to the size of the tumour. As a rule the most that is complained of is discomfort; nevertheless, if the tumour becomes very large—and tumours up to 195 lb. in weight have been removed—dangerous symptoms may arise from pressure on the heart and diaphragm. Cullen removed a fibroid weighing 89 lb. Owing to the upward pressure exerted by the tumour the patient was unable to lie down, and on one or two occasions when she inadvertently did so she was nearly suffocated.

A very heavy fibroid resting on the brim of the pelvis may seriously compress the ureters or pelvic colon. Complications may likewise result from pressure on the veins.

The Incidence of Impregnation.—The percentage of fibroids is higher in married women than in those who live single lives. It has been calculated that two-thirds of the married women with fibroids causing symptoms are sterile. The sterility is most often due to disease of the Fallopian tubes, the frequency of which has already been insisted upon, or to the diseased condition of the endometrium.

If the tumour is interstitial or submucous, whatever its size the chances of fertilization are diminished, but the subperitoneal variety is *per se* no bar to conception, however large it may be, as long as the Fallopian tubes are not so displaced that ova cannot enter them. Nevertheless the association of fibroids and pregnancy is not particularly uncommon. Should fecundation occur, the woman is unlikely to suffer any harm supposing the fibroid is small and occupies a position not inimical to the normal progress of pregnancy or labour, yet, either from the position of the tumour, its size or its degeneration, conception may be fraught with the greatest peril.

Having thus premised that fibroids, although a cause of sterility, are not as a rule a source of peril should the woman conceive, since most of them are quite small and situated in the body

of the uterus, the various dangers that may await the woman during her pregnancy, her labour and her puerperium must now be dealt with. We can divide these complications into two classes: the effect of the tumour on pregnancy, labour or the puerperium, or the effect of these on the tumour.

Pregnancy. Most children are born between the twenty-fifth and thirty-fifth years of their mothers' lives. Fibroids become increasingly common after the woman has passed thirty. The combination of fibroids and pregnancy should therefore be most evident between thirty and thirty-five, and so it is.

The diagnosis of pregnancy in a uterus containing one or more fibroid tumours is often a most difficult matter, especially when one remembers that the uterine cavity, with its contained ovum, may be situated behind the tumour, or may have a tumour on either side of it.

In the place of amenorrhœa there may be irregular bleeding, which is a common symptom of fibroids apart from pregnancy, and also occasionally the breasts of a nulliparous woman whose uterus harbours fibroids may enlarge and secrete, whilst a uterine souffle can often be heard over a soft fibroid complicating a non-gravid uterus, and softening of the cervix—so indicative of pregnancy—may be absent or badly marked when, in addition, there is a fibroid present in that structure. Again, owing to the presence of the fibroid, Hegar's sign and the other changes in shape peculiar to the early months of pregnancy will be absent. Then, although in pregnancy the uterus quickly gets larger and softer, as has already been pointed out, in certain of the degenerations of fibroids, notably the cystic, the same obtains.

From all of which, therefore, it will be gathered that pregnancy can only be diagnosed with certainty when the foetal heart is heard or the foetal movements felt, that is, not until the eighteenth or twentieth week at the earliest. If, however, a woman of a child-bearing age with a bleeding fibroid suddenly ceases to menstruate, she is probably pregnant.

The presence of a fibroid in a pregnant woman may, as a rule, be discounted, since only in a small minority of cases will trouble eventuate. All that need be done, therefore, is to keep a watchful eye on the patient for certain complications which occasionally occur.

Effect of the Tumour on the Pregnancy. The percentage of miscarriages or premature labours is greater when fibroids coexist than when they are absent. This adverse influence of the tumour is brought about in various ways. It may be that the decidua covering the site of the tumour is not healthy, with the result that hæmorrhage takes place into it, causing partial

separation of the ovum; or, later, a portion of the placenta separates for a similar reason; or the cavity of the uterus may be so situated between the tumours that it is unable to enlarge with the growing ovum, which is consequently expelled. Again, the presence of the tumour may excite contractions in the uterus, or the position of the tumour on the posterior surface of the body of the uterus may retrovert this organ and cause incarceration. In these cases, associated with an impacted retroverted gravid uterus, I have been able to push up the fibroid and the patient has gone safely to term. In other cases, where the fibroid has been situated low down in the uterus, I have noticed that with its upward growth the tumour has gradually risen, followed by the relief of the pressure.

Effect of the Pregnancy on the Tumour. Fibroids become softer, and some of them at any rate increase in size during pregnancy. It may thus happen that a fibroid which is nearly filling the cavity of the pelvis before pregnancy entirely does so with the increased size due to such a condition, impaction results, and serious pressure symptoms may arise.

Pressure symptoms due to a fibroid encroaching on the pelvic cavity I have seen, but they have never been sufficiently serious to warrant operative treatment. Again, as I have already pointed out when discussing the degenerations that fibroids are liable to, there is one variety which is peculiarly associated with pregnancy, namely, red degeneration, for eighty per cent. of the reported cases have occurred in pregnant women.

Just as an ovarian tumour may have its pedicle twisted during pregnancy, so may the stalk of a pedunculated subperitoneal fibroid become twisted, with results already noted.

Pressure symptoms, apart from those due to impaction, may also be due to the size of the tumour, but danger in this respect from mere size is very rare and I have never met with such a case.

Labour. As with pregnancy, so with labour, no harm as a rule will happen to the patient, and she will be safely delivered of a living child.

Of the two, pregnancy and labour, I think complications are more likely to supervene with the latter; at any rate, this has been my experience. And doubtless, if one had the opportunity of carefully examining the patients before labour many of these complications would be avoided; and it is quite certain that if a patient whom one knows to have a fibroid should become pregnant, it is one's duty to examine her from time to time.

Effect of the Tumour on Labour. A fibroid tumour may complicate labour in three ways: either by causing malpresentation of the child, by obstructing its birth, or by exciting ante-

partum or post-partum hæmorrhage. The malpresentation is brought about by the tumour being situated low down and preventing the head entering the pelvis; obstruction is caused in a similar way; thus rarely a submucous fibroid or a polypus has had to be removed before the child could be born. A more likely cause of obstruction is a cervical fibroid, a fibroid of the broad ligament, or a subperitoneal fibroid. If the latter is pedunculated it may be possible to push it above the presenting part, if it is sessile the complication becomes a very serious one, as is also the case with cervical or broad-ligament fibroids, for in these cases the abdomen has to be opened and the case dealt with on its merits.

Fibroids cause post-partum hæmorrhage by preventing efficient retraction of the uterus, but this is a rare complication.

If the placenta is situated over a fibroid the chorionic villi may have proliferated and involved the tumour, causing the placenta to be adherent and necessitating hysterectomy. Again, even when the placenta has separated, its escape from the uterus has been prevented by a submucous fibroid situated low down.

Effect of Labour on the Tumour. A fibroid may be bruised during delivery of the child.

Puerperium. As a rule fibroids are harmless during the puerperium; rarely they place the woman's life in jeopardy.

Effect of the Tumour on the Puerperium. The presence of a fibroid in the uterus may be a cause of subinvolution, and if serious hæmorrhage due to the tumour has resulted, the puerperium will be prolonged and thrombosis of the femoral vein may result.

If a fibroid has been bruised during labour and then becomes infected, a septic puerperium will ensue that might be mistaken for puerperal fever.

Effect of the Puerperium on the Fibroid. Complications may arise in this way from extrusion, infection or degeneration of the tumour.

A submucous fibroid, as the uterus diminishes in size, may become polypoid and eventually be expelled. Such a result is always associated with most serious hæmorrhage and often with sepsis.

Infection of a fibroid may result from a septic miscarriage or labour. If a tumour thus becomes infected and its presence is unrecognized, the illness may be attributed to "puerperal fever" and the patient allowed to die without operative interference.

Again, red degeneration may come on so quickly after labour that the symptoms it gives rise to, of fever and abdominal pain and tenderness, have led to a suspicion of puerperal sepsis.

Whilst, therefore, it is very necessary to remember the special dangers associated with fibroids should a woman become pregnant, it is also important to recognize that only on rare occasions will any trouble arise, and that interference will not be necessary—except where there is a danger of obstruction—until it does.

This treatment differs strikingly from that indicated where an ovarian tumour complicates pregnancy, in which case the tumour should be removed at the earliest opportunity.

The Dangers of Diagnosis.—It is not always so easy to diagnose the presence of a fibroid as one might anticipate from the classical description in the various textbooks; or if one is certain that there is a fibroid in the uterus, one cannot always be certain that there is no other diseased condition coexistent.

I have seen a kidney as well as the spleen situated in in the pelvic cavity both diagnosed as fibroids. Tubal gestation has also many times been found associated with fibroids.

Diseased Fallopian tubes are often found in association with fibroids. Thus in Noble's cases there were 290, or thirteen per cent., and, as I shall point out directly, carcinoma has been found frequently.

In dealing with fibroids, the subjects of pain, the menopause and carcinoma of the body of the uterus must also be dealt with.

The Perniciousness of Pain.—Apart from dysmenorrhœa, if a patient with a fibroid complains of pain in the region of the tumour this should make you suspicious and your prognosis guarded. Fibroids, apart from any complications, are painless tumours. Painful contractions may arise from the uterus trying to expel a fibroid polypus, and pain associated with fibroids may be due to pressure, secondary degeneration or peritonitis. The impacted fibroid may give rise to severe pain from pressure on the nerves in its neighbourhood. Red degeneration, septic infection, and sarcomatous degeneration are all sources of severe pain. Axial rotation of a subperitoneal fibroid may cause intense agony due to congestion. Peritonitis set up in the neighbourhood of infected subperitoneal fibroids may be the source of the pain, which also becomes chronic from adhesions resulting therefrom. Lastly, apart from the fibroid, there may be some other condition causing the pain, such as salpingitis, pyosalpinx or ovarian disease.

The Menace of the Menopause.—Most fibroid tumours cease to grow with the onset of the menopause, and some even become smaller, but the old idea that they generally atrophy and frequently disappear is not warranted by clinical or post-mortem experience. It is very doubtful whether they ever entirely atrophy, and as a rule the most one can hope is that

they will stop growing and become perhaps a little smaller.

Submucous and interstitial fibroids delay the menopause, so that menstruation may still continue to be profuse and frequent long after the patient has reached fifty years of age. This fact alone shows one the futility of postponing operative procedures for bleeding fibroids because the patient is approaching the normal age for the menopause.

It sometimes happens that menstruation ceases, and then after a certain time bleeding of an irregular character supervenes, due to a small submucous fibroid becoming extruded into the uterine cavity and forming a polypus by the atrophy of the uterus.

Fibroids do not necessarily stop growing at the menopause; there are records of the uterus having to be removed for serious pressure due to fibroids in women of sixty-three and seventy-nine years of age respectively. At times fibroids become rapidly larger at or after the menopause, the increase in size being due to some degeneration taking place in the tumour.

The most common change to take place in fibroids at this time is one of a septic character, very likely because the blood supply is diminished, and in many cases due to a submucous tumour becoming polypoid.

It must also be remembered that carcinoma of the body is more likely to arise at this time.

It has already been noted that fibroids may become smaller at the menopause and so get impacted.

The Catastrophe of Carcinoma.—It seems as if fibroid tumours of the uterus must in some way predispose to carcinoma of the corporeal endometrium, for an investigation of sufficient cases to eliminate any gross error shows that carcinoma, when associated with fibroids, occurs with a relatively greater frequency than when these tumours are absent.

The advent of carcinoma in the body of the uterus is serious enough, but when, in addition, a bleeding fibroid is present the catastrophe becomes one of the first magnitude, for carcinoma is difficult to diagnose in its early stages in these cases since hæmorrhage, which is its first symptom, is already present.

It must be remembered that carcinoma of the body is most usually developed in women between the ages of fifty and fifty-four. It may be that the first indication of the disease is some irregular bleeding or an addition to the amount already being lost. Carcinoma will in time slough and infect the fibroid, causing a very offensive discharge.

In conclusion, therefore, whilst I have impressed the fact that a fibroid tumour is more dangerous than many are willing to admit, nevertheless I do not wish to exaggerate the

danger. It is true that the majority of fibroids require no treatment and give rise to no inconvenience. It is equally true that a large number of women lose their lives every year because of their fibroids, and many more are a nuisance and burden to themselves and their relatives for a similar reason.

Lastly, I am certain that intelligent anticipation of the complication fibroids are liable to, by removing these tumours before the patient is severely handicapped by their ill effects, will diminish, and is largely diminishing, the number of deaths, illness and misery due in so many cases to their inefficient treatment.

Adeno-Fibroma.—This is a fibroid tumour into which the gland tubules of the endometrium have penetrated. It is really a combination of adenomatous disease of the uterus and a fibroid, but how the epithelial structures become incorporated with the fibroid is unknown.

In age incidence and clinical manifestations adeno-fibromata resemble ordinary fibroids and are practically always diagnosed as such. More rarely the tumour is localised and is sub-peritoneal, interstitial or submucous, but they differ from fibroids in the same situation in having no capsule and so cannot be shelled out.

Sarcomata.—Sarcoma in the muscular coat may arise from the connective tissue of that region, from the muscle, or rarely from a fibroid tumour. In this situation it forms, as a rule, a single tumour.

Symptoms and Signs. The symptoms and signs of sarcoma of the uterus have already been dealt with under *Sarcoma of the Endometrium*.

Treatment. Total extirpation of the uterus is the only treatment likely to be of any avail.

Fibrosis of the Uterus.—The exact nature of fibrosis uteri is not yet settled, but the majority of investigators who have directed their energies to the disease have come to the conclusion that it is septic in origin, due to infection from a septic labour or abortion or to an attack of gonorrhœa; but some think that the process may sometimes be due to a non-infective inflammation. The disease practically always occurs in married women between the ages of thirty-five and forty-five who have had children.

In a well-marked case the muscular tissue of the uterus has mostly disappeared and fibrous tissue is found in its place. The walls of the arteries are thickened, so that they are readily recognized on section of the uterus, and the endometrium is atrophied, although it may occasionally be thickened.

Symptoms. The outstanding feature of this disease is menorrhagia, and the loss of blood is not only often very profuse, but also the number of days during which the loss occurs is increased.

The disease generally supervenes slowly, the patient gradually becoming worse over a series of years.

Signs. The uterus is somewhat enlarged, hard, and on dilatation of the cervix for diagnostic purposes the cavity will as a rule be found to be normal in size, but the walls of the uterus are much increased in thickness, up to two inches or more. On curetting the uterus the endometrium is usually found to be very thin.

Diagnosis. In some ways the diagnosis of fibrosis is arrived at by elimination. The practitioner first of all has, as far as possible, to exclude all other diseases causing menorrhagia by bimanual and intra-uterine examination. In addition he must watch the effect of the drugs enumerated under the section on menorrhagia. In the absence of any obvious disease, and when treatment by drugs and curetting has failed, a diagnosis of fibrosis is justified.

It is important to establish the diagnosis of fibrosis, since the only effective treatment is hysterectomy, unless possibly the menopause is imminent.

The usual history of fibrosis uteri is that of protracted treatment, repeated curetting and invalidism.

Treatment. When the disease has become fairly established nothing short of hysterectomy will be of any avail.

Subinvolution.—In six or eight weeks after labour the uterus should have reached the size which is normal to a parous woman, the cavity should measure between two and a half and three inches.

If at the end of this period the uterus is larger than it should be, or if during this period the size does not decrease at the recognized rate, then the uterus is said to be subinvolved.

When we came to examine subinvolution more carefully we find that cases of this disease can be divided into two classes, an acute and a chronic.

Acute Subinvolution.—By this I mean subinvolution occurring during the puerperium, more especially in the first few days, a condition nearly always associated with sepsis and which will be found adequately dealt with in most textbooks of obstetrics. On appropriate treatment involution may subsequently proceed satisfactorily.

Chronic Subinvolution.—By chronic subinvolution I mean those cases met with for the first time months and even years after a labour or miscarriage, the time when they come under observation depending upon the severity of the symptoms and the temperament of the patient, some women putting up with discomforts for years which others will only tolerate for weeks.

Subinvolution is merely a name given to describe a certain condition of the uterus

generally associated with a definite set of symptoms. Its causes are various and all of them are probably not known. Suffice it to say that in the majority of cases it is due to sepsis of a greater or less intensity, and in the remainder to various diseases affecting the general health and thus interfering with the normal physiological processes. Misplacements of the uterus or non-suckling may be the originators of the condition.

Symptoms. The patient complains of menorrhagia, leucorrhœa, pelvic pain and aching.

The menorrhagia and leucorrhœa are principally due to the fact that the amount of endometrium is increased and that the organ is more vascular, whilst they may partly be due to an associated chronic endometritis.

The pelvic pain is due to the increased weight of the uterus, to congestion and to a misplacement if one is present.

Signs. The uterus is enlarged and not very rarely misplaced backwards, the malposition being due to the increased weight.

Diagnosis. The symptoms date from some labour or miscarriage, although at times there may be an interval of amenorrhœa before the menorrhagia declares itself, and in these cases it is often found that the subinvolution is due to some retained products which have set up chronic inflammation.

Treatment. The best treatment is to dilate the cervix, examine the interior of the uterus and remove any retained products if present, and curette the uterus, the patient being kept in bed for a fortnight and put on a course of ergot.

Short of this the patient should be kept at rest and be given hot douches for at least a fortnight, and should take an ergot and strychnine mixture in an acid medium for some weeks.

Superinvolution.—In this condition, instead of involution stopping when the uterus has reached its normal size it continues, so that the size of the uterus becomes less than normal, in fact the uterus atrophies.

The disease is a very rare one and the cause is not known.

The uterus may atrophy as the result of some serious and wasting disease, or if the endometrium sloughs, and will atrophy after the ovaries have been removed or destroyed by suppuration.

This, however, is hardly the same thing as puerperal atrophy apart from any of the above-mentioned causes which may complicate the puerperium, for superinvolution connotes a puerperal atrophy with no other evidence of disease.

Symptoms and Signs. The symptoms and signs are those of the menopause.

Treatment. There is no known treatment which is of any avail.

Diseases Involving the Endometrium, Muscle or Peritoneum.—The diseases of the uterus already mentioned as originating in the endometrium may by growth and extension involve the muscular and peritoneal coats, and in a similar manner diseases originating in the muscle may involve the endometrium and peritoneum. There are two diseases, however, which, though they involve the uterus, had their origin elsewhere, and they are chorion-epithelioma and perimetritis.

Chorion-Epithelioma.—This is a very interesting and rare tumour which only occurs in women who are or who have been pregnant.

It is interesting to note that about forty per cent. of the reported cases have followed on "hydatid mole."

Chorion-epithelioma is really a carcinoma of the chorionic villi, and as a rule very malignant.

The epithelium of a chorionic villus consists in the early months of pregnancy of two layers, an inner layer composed of large cells with oval nuclei and definite cell boundaries—this is known as "Langham's layer"—and an outer layer composed of multinucleated protoplasm with no cell boundaries—this is known as the syncytium.

In chorion-epithelioma the tumour is composed of masses of multinucleated protoplasm and polyhedral cells derived from the syncytium and Langham's layer respectively.

Chorion-epithelioma most usually occurs after pregnancy has terminated; very rarely, as in a case of my own, it declares itself whilst the ovum is still in utero. Exactly how long after pregnancy it may be expected to develop it is impossible to say, since it may arise quite early in the puerperium and has arisen some years after the last pregnancy.

Symptoms. The most characteristic symptom is hæmorrhage, which occurs in nearly every case suddenly, is irregular and very severe. Associated with this is most often a highly offensive brownish discharge.

The patient will complain of symptoms of fever, including rigors. Abdominal or pelvic pain is usually absent, rarely is it complained of. Cough and hæmoptysis may appear.

Signs. The patient looks very ill, is very anæmic, quickly becomes weaker and wastes, and usually has fever; the absorption of septic products causes rigors, though some think that these may also be due to metastases.

The uterus is enlarged and nodules of growth may be felt projecting from its peritoneal surface, and on making an intra-uterine examination broken-down tissue in a putrid condition can be found.

The uterus becomes fixed and metastases appear in the lungs, brain, liver and vagina.

Prognosis. The prognosis is very bad, the patient as a rule quickly dying. There is a rare class of case where the primary tumour was found in the vaginal wall, of which the prognosis appears to be much better. Perhaps if the disease were recognized earlier and treated surgically the prognosis would be better, in fact more recent returns of operations seem to point to this.

Diagnosis. When the disease follows soon after a miscarriage or labour it is most often regarded as being due to the decomposition of retained products, being treated accordingly; and after the uterus is emptied and curetted the patient often improves for a little while; this diagnosis is thus apparently confirmed.

With an offensive discharge and a broken-down tumour felt on intra-uterine examination, a sloughing fibroid has been diagnosed. If the disease arises a long while after pregnancy, its nature may be mistaken unless the scrapings which had been removed by a curetting undertaken for the hæmorrhage are very carefully examined by a professed pathologist.

Treatment. In the majority of cases the only chance of recovery the patient has lies in an early removal of the uterus, ovaries and tubes. In some of those rare cases where the primary growth was in the vagina this was removed and the uterus left, the patient recovering, but in other patients under similar circumstances death soon resulted. The presence of metastases should not deter the operator, since these have been known to disappear after the uterus was removed.

Perimetritis.—In perimetritis the peritoneum covering the uterus, as well as the rest of the pelvic peritoneum, becomes inflamed. As a result, adhesions are formed between the uterus and the structures in its neighbourhood. These adhesions may be absorbed or they may become organized, in which latter case the uterus will become fixed and misplaced. For further information on this subject the reader is referred to the section dealing with perimetritis and misplacement.

Injury to the Uterus—

Laceration of the Cervix.—The cervix may be lacerated during childbirth or in the course of some operation on the uterus. In the latter case the laceration is generally sutured and, healing, causes no further trouble.

Laceration due to childbirth may cause trouble at the time from hæmorrhage or a few days later from sepsis, but these conditions we have not to deal with here.

As a rule if laceration of the cervix gives rise to any complaint at all, it does so some time after the birth of the child in cases when the laceration has been bilateral, when the two

halves of the cervix hypertrophy and a condition known as "ectropion" exists in which there is chronic endocervitis, causing leucorrhœa and sterility. The condition must be diagnosed from an "erosion" of the cervix and has been mistaken for carcinoma.

Treatment. The cervix should be repaired by the operation known as trachelorrhaphy; this will cure the leucorrhœa, may cure the sterility, and is further indicated in that there is some reason to think a lacerated cervix may predispose to cancer.

Congenital Abnormalities.—Most of the congenital abnormalities of the uterus are so very rare that they need not be discussed here, but there are two affecting the cervix which are much more frequently met with and to which a few words must be devoted; they are hypertrophic elongation of the cervix and a conical cervix with a pin-hole os.

Hypertrophic Elongation of the Cervix.—In this condition the vaginal portion of the cervix is lengthened, and in some cases it may present at the vulval orifice.

Symptoms. The patient may complain of dyspareunia and sterility and, if the cervix protrudes at the vulva, of a certain amount of discomfort and leucorrhœa. There may be no complaints.

Signs and Diagnosis. The uterine cavity is elongated, the uterus is at its normal height and in its normal position, the vaginal fornices are deeper and the vaginal portion of the cervix much longer than normal, and in these respects hypertrophic elongation of the cervix differs from prolapse of the uterus, the other condition in which the cervix may present at the vulva, for here, although the cavity of the uterus is lengthened, the fundus is at a lower level than normal, the uterus is retroverted, the vaginal fornices are obliterated or partly so, and the vaginal portion of the cervix is of normal length.

There is never any difficulty in the diagnosis.

Treatment. The excess of cervix should be amputated.

Conical Cervix and Pin-hole Os.—The above nomenclature adequately describes the malformation, which is generally associated with an acute antelexion.

This malformation is met with under two conditions, one the "infantile uterus," which is smaller than normal and which is associated with primary amenorrhœa, and the other the "infantile-shaped uterus," which is of normal size and which is associated with dysmenorrhœa and sterility.

Treatment. There is no treatment for the first variety, for the second dilatation of the cervix will often relieve or cure the symptoms.

Hæmatometra means a distension of the

uterus by an accumulation of blood. The commonest cause is some congenital or acquired atresia of the genital passage as noted under the sections dealing with retained menstruation.

It may also be due to cancer of the uterus.

Pyometra.—Pyometra means a distension of the uterus by an accumulation of pus. The condition may be secondary to that of hæmatometra or may be primary, and in this case it is most frequently due to cancerous ulceration. It may also be due to senile endometritis and a sloughing fibroid.

Pyometra may be present even with a patent cervical canal.

Treatment. The treatment will depend on the cause. It is always best before performing the radical abdominal operation for carcinoma of the cervix to pass the sound into the uterus to ascertain if a pyometra is present. C. B.

DISEASES OF THE OVARY

Congenital Defects

Absence.—The ovaries may be absent altogether or on one side only. Cases are on record where an ovary was present on one side and a testicle on the other. Accessory ovaries have been described. They usually lie on the line of the ovarico-pelvic ligament, outside the normally placed organ. Glendinning states that these bodies are of the nature of fibro-adenoma probably connected with the Wolffian tubules.

None of these anomalies are of surgical importance.

Misplacement.—An ovary may lie in the sac of a congenital inguinal hernia. It may here be accompanied by the cervix of a double uterus. Such congenitally misplaced ovaries have become inflamed or undergone torsion.

Variations in Size.—The ovaries vary considerably in size. Occasionally they are found twice as large as normal without being diseased. These "giant" ovaries do not give rise to symptoms.

A hard sclerotic state is sometimes found which has been attributed to chronic fibrotic inflammation ("cirrhosis of the ovary," "chronic fibrotic ovaritis"), but there is no evidence that the condition is due to inflammation. The stroma is intensely fibrous and the follicles are largely absent or not developed. These "cirrhotic" ovaries are sometimes associated with a very severe and intractable dysmenorrhœa, and they have often been removed on this account. It is very questionable, however, if the ovaries are ever the actual seat of dysmenorrhœa.

Recurring attacks of monthly pain are never seen after hysterectomy, as would be the case if "ovarian" dysmenorrhœa was a possibility,

and there is every reason to believe that these cases would be better treated by removal of the uterus.

Inflammation

Oöphoritis or "ovaritis" is very rarely primary. It occasionally happens, however, that the corpus hæmorrhagicum formed after dehiscence of the follicle becomes infected (probably by intestinal organisms) and suppurates.

Rare examples of primary ovarian tuberculosis or streptothricosis (actinomycosis) are on record.

Much more commonly oöphoritis is secondary to salpingitis. In acute cases the latest dehiscent follicle becomes infected. An ovarian abscess is thus produced which may communicate through the adherent abdominal ostium of the tube with the cavity of a pyosalpinx (tubo-ovarian abscess) or may be separate from it or not so associated.

An ovarian abscess produces a considerable enlargement of the ovary, which, adhering to the surrounding structures, tends to under-burrow the broad ligament.

In chronic salpingitis the ovaries become surrounded by adhesions (perioöphoritis) and undergo peripheral sclerosis. As a result the follicles are unable to dehisce, and one or more follicular retention cysts, on either side, may be formed, that in time may lead to the disorganization of the entire organ. Such a cyst may communicate with the cavity of a hydrosalpinx, forming a typical retort-shaped swelling (tubo-ovarian cyst).

Symptoms. The symptoms of a primary ovarian abscess are very obscure until it ruptures, when fulminant peritonitis is set up. Rupture of a primary ovarian abscess is one of the abdominal "catastrophes" in which with few or no premonitory signs a patient in a short time is in the throes of acute "peritonism."

The symptoms and physical signs of ovarian inflammation secondary to salpingitis are similar to those produced by salpingitis alone (see p. 1021).

Treatment. The treatment of a primary solitary ovarian abscess is removal of the affected ovary and drainage of the pelvis.

Ovarian inflammation complicating salpingitis is dealt with by salpingo-oöphorectomy, with or without the removal of the uterus (see p. 1022).

New Growths

The regions of the ovary and testicle stand apart from the rest of the body as areas in which are normally sequestered certain portions of protoplasm (the generative cells) which maintain, intact, the wide growth potentialities of the primitive blastomere. Under circumstances of which we know nothing these

cells (ova, spermatoblasts, and their predecessors and derivatives) may originate new growths, in which may be reproduced, either singly or combined, all the tissue types met with in the fully-developed embryo and its coverings.

The testicle and ovary are thus the natural seats of embryonic cell sequestration and teratoma formation, particularly in the case of the ovary, in which differentiation from the primitive generative cell type has occurred to a less degree than in the testicle. Thus it comes about that an organ which developmentally contains neither ectoderm nor endoderm produces some of the largest epithelial neoplasms met with in the body, and that nearly all primary ovarian tumours, if examined closely, will be found to exhibit cell and tissue types which have no counterpart in the normal organ.

This conception of the rôle played by the ovary in tumour formation must be borne in mind when considering the complexity of tissue and the apparent illogicality of type that characterizes ovarian new growths.

Cysts.—The cysts of the ovary may be divided into those derived (1) from the Graafian follicle, (2) from certain spaces in the ovarian hilum, the remains of the embryonic mesonephros, and (3) those that originate as a new growth unconnected with a previous cavity. The follicular cysts will first be dealt with.

Follicular Retention Cysts. The presence in the ovary of small cysts due to failure of the follicles to dehisce is very common. When a number of such cysts exist the ovary becomes entirely disorganized. This is a condition often seen in chronic salpingitis with perioöphoritis (see p. 1020).

Solitary ovarian retention cysts may attain a considerable size. The cavity is lined by a cubical or flattened epithelium according to the size of the cyst, and the contents are of watery consistency and give the mass a semi-translucent appearance.

Lutein Cysts. The corpus luteum may become cystic. These cysts are of peculiar interest because they bear some unknown relation to malignancy of the trophoblast, being present in a large proportion of cases of chorio-carcinoma and malignant vesicular mole. In appearance they are similar to the ordinary retention cysts, but microscopically the cavity is lined by lutein cells.

Ovarian Blood Cysts. The hæmorrhage into the follicle after dehiscence may be excessive. In some cases it is poured out into the peritoneal cavity in quantities sufficient to produce signs of severe internal bleeding.

In other cases it accumulates in the follicle, and distends the ovarian tissue over it until a

blood cyst as large as an orange may result. Rupture may then occur, with further bleeding into the peritoneal cavity.

Cysts of the Ovarian Hilus. Cysts derived from the remains of the mesonephros may be unilocular or multilocular, most commonly the latter. The tumour originates in the meso-*o*phoron and, invading the ovary on the one side and the broad ligament on the other, expands these structures over it. The contents of the cyst are a clear fluid and the lining epithelium is of the short columnar type. These cysts are said to be particularly prone to the germination of intracystic papillomata of a malignant or semi-malignant character. Their surface, when many loculi are present, is bulbous and semi-translucent, except when the cavities are filled with intracystic growth. In this case the tumour appears more or less solid, and sprouting through its outer wall are seen warty-looking nodules.

We now pass on to the neoplastic cysts, of which there are three main types.

Cyst-Adenoma. This is the typical ovarian cystoma. It arises at all ages, and may attain a huge size. The wall of the cyst is composed of the stretched tunica albuginea of the ovary and has a characteristic bluish-white appearance. Enclosed in it are a number of loculi of various sizes containing a mucinoid material of different degrees of viscosity. The smaller loculi are lined by a very perfect columnar-celled epithelium, but in the larger this gets flattened or disappears altogether.

Many solid areas exist which microscopically show a number of spaces lined by a luxuriant epithelium lying in a loose and cellular connective tissue. The growth is moderate in rate; from two to five years being required to form a mass large enough to fill the peritoneal cavity up to the costal margin.

Dermoid Cysts. A dermoid cyst is usually unilocular. The cavity is filled with a fatty material in which is incorporated a quantity of pale-coloured hair. Projecting into the cyst cavity is the so-called embryonic area, a mass of tissue covered by a coarse skin with much-exaggerated sebaceous glands and numerous hair follicles, beneath which a number of tissue types are found, including bone, muscle, cartilage and so forth. Projecting into the cyst cavity from the embryonic area are frequently found one or more well-formed teeth. Ovarian dermoids, like other endogenous teratomata, appear most frequently between twenty and thirty years of age.

Compound Ovarian Teratoma. These cysts are much less common than the dermoid. They are multilocular, with large areas of solid tissue. The loculi are lined by different varieties of epithelium, some presenting typical

skin with well-marked vernix caseosa, others a mucous membrane, and others columnar ciliated epithelium like that of the trachea. In the solid portions of the growth are massed together in indefinite arrangement every type of tissue known in the embryo, down to trophoblast and chorionic mesoderm.

In rare cases, projecting into one of the cyst cavities, is the more or less well-formed hinder portion of a fœtus.

These tumours are of the greatest interest as showing a definite attempt at parthenogenesis on the part of certain of the ovarian cells.

Intracystic Papillomata and Malignant Ovarian Cysts. A considerable proportion of ovarian cysts are malignant. The malignancy may arise in any or all of the tissues composing the cyst, but in the larger proportion it is the epithelium lining the loculi that takes upon itself unbridled growth.

The commonest type of proliferation is papillomatous. Papillomata are often found in the cavities of cysts, but not all of them are malignant. Hard flat-topped warts are seen, in which the protuberance is mainly made up of dense fibrous tissue. These produce no results.

More serious are the villous-like papillomata, in which a series of branching connective-tissue stalks are seen, covered by a columnar epithelium, varying in thickness from a single row of cells to large heaped-up masses. No hard and fast line can be drawn between innocency and malignancy in these cases. When the epithelium is single-layered complete malignancy is absent, but, nevertheless, these growths, if they break through the cyst wall, produce peritoneal implantations. It is in cysts of this type that the remarkable phenomena of spontaneous disappearance of the secondary nodules after removal of the primary is occasionally met with.

When the epithelium is many-layered the cyst is malignant, for though metastasis by the blood or lymph streams does not occur, the peritoneal implantations are persistent and cause death.

Papillomatous cysts are usually stated to be derived from the mesonephric remains situated in the hilus of the ovary, but any cyst containing an epithelial lining may form intracystic papillomata.

Besides the papillomatous types of malignancy or semi-malignancy, solid carcinomatous masses presenting an alveolar or tubular structure are often found incorporated with the substance of the tumour. These masses are very rapid in growth and malignant in character, and metastasize in the typical manner of a carcinoma. Secondary nodules in the pleuræ and lungs are very common.

The ovary is a favourite site for metastatic carcinoma, especially of the bowel, stomach or gall bladder. Large tumours are formed, which are in part cystic, owing to inclusion of dropsical follicles in the new growth.

Malignant disease of other types is also met with. Thus sarcoma and endothelioma occur, forming large and rapidly growing tumours.

Dermoid cysts rarely become malignant, but examples of squamous-celled carcinoma developing from the embryonic area are on record.

Multilocular teratomata (or "embryomata"), on the contrary, often undergo malignant degeneration, the type of the growth being very variable. Thus only one cell type of the many contained in the teratoma may be at fault, a carcinoma, sarcoma, endothelioma or chorion epithelioma resulting. In other cases many or all of the tissue types represented in the teratoma appear to develop malignancy, so that the metastatic nodules present the same diversity of tissues that characterize the original tumour.

Lastly, may be mentioned the very interesting malignant colloidal cyst, in which is produced an intracystic cell growth rapidly degenerating into a colloidal substance. These cysts rupture spontaneously and the colloid-producing growth becomes implanted in the peritoneum, from whence large quantities of the substance are poured into the peritoneal cavity ("pseudomyxoma peritonei"). Though the colloid material may be removed the colloid-forming tissue is diffused over the peritoneum and cannot be extirpated. The abdomen refills in about six months.

Solid Ovarian Tumours

Papillomata. The germinal epithelium covering the surface of the ovary may develop papillomata. These may take the form of a hard racemose mass chiefly composed of connective tissue, or may assume a villous appearance. The first type is innocent, but the second grows luxuriantly, forms a large mass and early gives rise to secondary nodules on the peritoneum with marked ascites.

These growths are very interesting, because in them, much more than in the case of intracystic papillomata, the removal of the primary growths is apt to be followed by spontaneous disappearance of the peritoneal nodules.

Fibromata. The ovary originates large fibromata, either as a diffuse overgrowth of the stroma, or as a local encapsuled proliferation. These latter are possibly developed from the corpora fibrosa or follicular scar masses.

Ovarian fibromata are not malignant, though a degree of hydroperitoneum often accompanies them. They grow comparatively slowly and give rise to no symptoms at first.

Myomata. Myomata of the ovary are rare. They occur chiefly in the ovarico-uterine ligament and are derived from certain of the muscle fibres that pass out from the side of the uterus towards the ovarian hilum.

Carcinomata. Carcinoma developing in a cystoma has already been considered.

Primary solid carcinomata, either of tubular or alveolar character, also occur.

Secondary carcinoma of the ovary is common, especially in relation to primary growths of the intestine, stomach or gall bladder. The growths are bilateral and often partly cystic. They attain a large size and not infrequently their secondary nature is entirely overlooked by the surgeon.

Surface deposits of secondary carcinoma also occur, producing a nodular condition of the ovary. This has been pointed out by Sampson Handley as especially common with mammary growths.

Endotheliomata and Sarcomata. A great variety of malignant connective tissue growths of the ovary occur, many of which have not been classified. Secondary sarcoma is known, especially in relation to melanotic primary growths.

Symptoms of Ovarian Tumours

Ovarian Cysts. An innocent cyst of the ovary gives rise to no early symptoms. It lies at first on the side from which it grows, but as it enlarges it usually gets directly behind the uterus, so that by the time it rises up into the abdomen its position is practically central. Percussion gives a dull note in nearly all cases.

Fluctuation is present, but a fluid thrill is only obtained if the cyst is uni- or pauci-locular, and if the contents be not viscid. Large cysts often cannot be felt from the vagina.

Symptoms, when they appear, are due to: (1) bulk, (2) pressure, (3) torsion, (4) inflammation, (5) rupture and (6) malignant degeneration.

1. *Bulk.* Cysts of huge dimensions produce invalidism by sheer weight. Respiration is interfered with and the legs may be swollen with cedema. Ovarian cachexia is typically present in these cases, the patient looking extremely wasted and ill, while the abdomen is of immense size.

2. *Pressure symptoms* are present, not only in very large tumours, but also in those of small size when impacted in the pelvis.

Impacted cysts are usually adherent, else they would rise out of the pelvis. The bladder is obstructed and retention results, and the bowel or even the ureters may be injuriously pressed upon. The uterus is forced forwards against the pubis and a tense fluctuating mass occupies the pelvis behind it. Much pain is occasioned

when the cyst is very tightly wedged in the pelvis.

3. *Torsion.* Axial rotation of the pedicle of an ovarian cyst produces violent symptoms. The pain is severe and often paroxysmal at first. The cyst enlarges rapidly from effusion of serum and blood into its cavity. The abdomen becomes distended and rigid and fever supervenes as peritonitis is set up around the semi-necrotic cyst wall.

Untreated, many of these cases would end in death, others, however, terminate in encystment of the partly necrotic cyst by peritoneal adhesions, with complete subsidence of the symptoms. Such cysts, when removed later, are found the subject of universal adhesion.

4. *Inflammation.* Torsion of a cyst is followed by inflammation and adhesion. Besides this, infection may occur in other ways. Thus damage may be followed by inflammation, especially in the case of a dermoid complicating labour, in which it has been crushed by the passage of the child's head. Spontaneous inflammation also occurs, probably by infection from the intestinal organisms, such as *B. coli* commune or streptococcus *faecalis*, but *B. typhosus* has been recovered from such cysts after enteric fever. An inflamed cyst as a rule becomes acutely tender, and signs of local peritonitis are present. If suppuration occurs the fever is high and intermittent, and the patient presents a toxic and wasted appearance. There may be singularly little pain in some of these cases.

5. *Rupture.* Rupture of a cyst may be due to trauma or may occur spontaneously. Its results vary. Simple serous contents are rapidly absorbed without symptoms. Mucinoid material sets up local peritonitis and becomes encysted. The contents of a dermoid are more irritant, while if the cyst be infected beforehand, violent peritonitis is at once set up. Rupture also occurs spontaneously as a result of intracystic papillomatous growth. Hydro-peritoneum then develops very rapidly, and in a short time the peritoneum is studded over with secondary epithelial implantations. Coincidentally the patient begins to waste markedly, though as a rule there is but little pain at first.

6. *Malignant Degeneration.* The development of malignant disease in an ovarian cyst produces rapid growth, and often considerable pain. As soon as the neoplasm has penetrated beyond the bounds of the cyst wall, secondary growths in the omentum, liver and the surface of the peritoneum generally appear, together with ascites. On examination of the abdomen several irregular tumours may be made out, while from the vagina the main mass appears fixed in the pelvis.

The patient wastes rapidly and rarely survives more than a few months. A similar condition of rapid ascites and wasting is seen with the semi-malignant papillomatous cysts already described.

Of great interest are the proliferating colloidal cysts previously referred to, which on rupturing fill the abdominal cavity with a substance like "size." This material, if evacuated by operation, re-forms again from colloid-producing secondary peritoneal growths which are irremovable. Cases are known in which the abdomen has been thus emptied several times within the space of a few years, for reaccumulation takes place comparatively slowly.

Solid Tumours. The symptoms of the solid tumours of the ovary are very similar to those of the cysts.

Fibromata grow slowly and unless torsion occurs are usually discovered by their bulk alone or by pressure symptoms on the bladder or other organs.

The sarcomata and endotheliomata grow rapidly and give rise to pain and severe pressure symptoms. Both are associated with the presence of free peritoneal fluid, as are, in a lesser degree, the fibromata. All varieties of solid ovarian tumours are constantly confounded with uterine myomata. It should be borne in mind that "fibroids" never cause ascites, and that free fluid and amenorrhœa or scanty menstruation are in favour of an ovarian growth.

Diagnosis

Ovarian tumours have to be distinguished from those arising in the adjacent organs and parts. The distinction between ovarian and broad-ligament cysts will be considered later (see p. 1026).

Uterine enlargements, especially those due to pregnancy and myomatous growths, may mimic ovarian tumours. The diagnosis rests firstly on proving by examination that the uterus can be felt apart from the tumour. If this is impossible a uterine origin of the swelling cannot be excluded.

In pregnancy certain typical signs and symptoms are present which should distinguish it. A hydramniotic uterus may feel just like a cyst. In this connection it may be remarked that ovarian cysts do not cause amenorrhœa unless bilateral, and entirely destroying both ovaries. Such growths are nearly always malignant. Doubtful cases should be examined under an anæsthetic.

Uterine myomata are sometimes indistinguishable from ovarian tumours, especially the ovarian fibromata. A "fibroid" of the uterus usually gives rise to menorrhagia, but with ovarian cysts the monthly loss is as a

rule scanty. The distinction is not of much practical importance, because the treatment in either case is removal.

Tubal disease, especially hydrosalpinx, may simulate ovarian growths. The distinction may be impossible. In either event an operation is indicated.

Hydronephrosis closely simulates an ovarian cyst when the cystic kidney extends far downwards. The mass is, however, markedly unilateral, begins in the loin and may extend under the ribs. Moreover, the resonance of the colon may be detected over it.

Pancreatic cysts are resonant in front, more or less, and do not extend into the pelvis.

Retroperitoneal cysts are also resonant in front, whereas an ovarian cyst is nearly always dull.

In regard to their accidents and degenerations, ovarian cysts and tumours may simulate several conditions. Thus the resemblance between axial rotation and ruptured tubal gestation and acute salpingitis has been referred to already.

Malignant ovarian cysts and tumours are often mistaken for myomata of the uterus, from their painless nodular feel and the fact that the uterus is often indissolubly adherent to them. The history is short, however, in these cases, menorrhagia is absent as a rule, and there is evidence of free fluid in the peritoneal cavity.

Bilateral ovarian malignancy, by reason of the rapid increase in the size of the abdomen, and the fact that the menses may have ceased from destruction of the ovarian substance, has been mistaken for pregnancy, the nodules felt per abdomen having been misinterpreted as parts of the fœtus.

An over-distended bladder has often been mistaken for an ovarian cyst for want of the use of a catheter.

Ascites is often thus confounded, and conversely the enlargement due to an ovarian cyst may be mistaken for free fluid in the peritoneal cavity.

In simple cases the distinction is easy, for a cyst is dull on percussion in front, while in ascites the dullness is limited to the flanks.

When fluid in the peritoneum is encysted, as in some cases of tubercular peritonitis and other inflammatory conditions, the diagnosis is more difficult, for the flanks may be resonant. The front of the abdomen is only patchily dull, however, unlike the defined area of loss of resonance that characterizes an ovarian cyst. Finally free fluid and a cyst may coexist.

Many cases of papillomatous ovarian cysts have been repeatedly tapped under the delusion that the ascitic condition was due to cirrhosis of the liver.

Treatment

It will be noted that the diagnosis of an ovarian tumour is somewhat difficult. Fortunately this is not a matter of much moment, because practically all of the conditions which simulate it so closely as to be indistinguishable call for the same treatment, namely—abdominal section. The rule that all ovarian cysts should be operated upon has of late years been still further supported by the ascertained fact that a considerable proportion of these tumours are malignant, or are liable to become so.

Ovariectomy may be an extremely simple operation, but, on the other hand, the removal of a densely adherent or malignant cyst may be very formidable or quite impossible.

The incision should be central, and on opening the abdomen the character of the tumour should be explored with the hand. The practice of tapping these cysts has largely fallen into disuse, because many being multilocular are not readily evacuated thus, and moreover there is the risk of disseminating malignant cells in the event of this contingency. Tapping should therefore be reserved for unilocular cysts of obvious innocency, in which the contents are a thin fluid. Dermoids, teratomata, mucinoid cysts or those suspicious of malignancy should be removed whole, as is of course the case with inflamed or suppuratory tumours. The pedicle of an ovarian cyst consists of the ovarian hilus and the ovarico-pelvic and ovarico-uterine ligaments. The tube is also pulled into the pedicle in many cases. These may be stretched into a narrow cord or may be represented by a sheet of tissue.

In the first case simple transfixion and ligature in halves in the old classic manner will suffice, but in the second several ligatures in chain will be required.

In any case it is best first to clamp the pedicle temporarily with two or more forceps, and having removed the tumour to replace these by ligatures. The tube should be spared if the opposite ovary be healthy and the cyst not malignant. If the cyst be suspected of malignancy the uterus should be removed also, together with the opposite appendage.

Adhesions should be dealt with as far as possible before the cyst is tapped or lifted out of the abdomen. The omentum and colon are the parts most commonly requiring separation.

Universally adherent cysts can usually be removed after patient and careful separation, but occasionally this is impossible without gravely wounding the adjacent bowel and mesenteries. In such a case the surgeon should evacuate the contents, if this be feasible, and should then deliberately suture up the hole

in the cyst and close the wound. When the cyst subsequently refills it must be tapped at intervals as occasion requires. An irremovable suppurating cyst should be opened, stitched to the parietal wound and drained. In the case of a malignant cyst it sometimes happens that any attempt to free it from the structures to which it is adherent is followed at once by profuse bleeding. Under such conditions it behoves the surgeon carefully to consider whether it is worth while to make an attempt to remove it before any manipulations are begun, for in these cases, having once started, it may be impossible to stop on account of the bleeding.

Where obvious secondary growths in the omentum and peritoneum are present the question of the propriety of removing the primary tumour is again a matter for consideration.

In papillomatous cysts in which the secondary nodules are small and the primary growth easily removable the removal is justifiable, because occasionally these implantations spontaneously disappear. Where, however, the cyst is fixed and the growth, both in it and in the secondaries, is massive in character, the operation should be desisted from.

In semi-solid or solid bilateral tumours suggestive of malignancy a careful search should be made for a primary growth in the bowel, stomach or gall bladder. If such is found and it is easily removable both it and the secondary tumours should be extirpated, for although of course the ultimate outlook in such a case is not good, none can foretell the vagaries of malignant disease.

If the primary growth be irremovable the ovarian tumours should still, if possible, be removed to relieve the patient of the pressure symptoms and other distress caused by them.

Ovarian Gestation

Fertilization and grafting of the ovum in the Graafian follicle is an uncommon event. The oöperm burrows into the substance of the ovary so that the gestation sac lies outside the follicular cavity. Its further progress varies. In most cases early rupture, either into the follicle or on the ovarian surface, takes place, in both cases with profuse intraperitoneal hæmorrhage. Occasionally it would appear that the gestation proceeds to term encapsuled by the stretched ovary.

Diagnosis. The signs and symptoms are indistinguishable from those of the much commoner tubal gestation (see p. 1023).

Treatment. Immediate operation is called for. The ovary being found at fault, it must be removed with or without the tube, according to the state of the latter. A living ovarian gestation which has proceeded to the later months could probably be removed with far

greater ease than would be the case in primary tubal pregnancy.

Acquired Displacement of the Ovary

Prolapse of the ovary may occur by reason of abnormal weight or on account of a relaxed condition of the structures suspending it.

As regards the first of these, all ovarian tumours when small tend to gravitate into the pelvis, dermoids in particular, on account of their high specific gravity. Laxity of its suspensory apparatus is most commonly seen in parous women and is then the legacy of child-bearing.

An ovary prolapsed into Douglas's pouch gives rise to dyspareunia, especially if it is also the seat of adhesions secondary to salpingitis, as is often the case. Dragging pain in the groin regions may also be present. Many ovaries lying in the recto-uterine pouch, however, give rise to no symptoms.

Treatment. If the ovary is diseased as well as prolapsed it must be treated operatively.

An apparently unenlarged organ, giving rise to few or no symptoms, should be let alone. If, however, pain demands interference the ovarico-uterine ligament may be shortened through an abdominal incision. The uterus is often retroverted in these patients, and in this case intraperitoneal shortening of the round ligaments suspends both uterus and ovaries.

V. B.

DISEASES OF THE FALLOPIAN TUBES

Congenital Defects

Absence.—One or both tubes may be absent altogether or merely represented by a segment of their normal course. If both tubes are thus absent or defective the individual is sterile. Abnormalities or absence of the uterus and ovaries frequently coexist.

Accessory Ostia.—An accessory abdominal ostium forming a little anemone-like projection on the free surface of the tube is not uncommon. As many as two may be found on one tube. The clinical interest of these remains of the three cœlomic ostia of the Mullerian duct arises from the occasional formation of cysts derived from them. Such cysts are attached to the outer part of the tube, are monolocular and rarely attain a large size or give rise to symptoms.

Inflammation

Pathology.—Salpingitis is due, in the majority of cases, to infection spreading from the uterine cavity. All infected states of the endometrium may give rise to salpingitis. It is therefore seen as a complication of gonorrhœa, septic miscarriage or labour, operative procedures on

the uterine cavity, and breaking-down new growths there.

Exceptionally salpingitis may be due to infection spreading from other organs in the peritoneal cavity, such as the appendix. Most rarely of all the inflammation begins *de novo* in the tube. Thus a hæmatosalpinx due to tubal gestation or menstrual reflux may suppurate, while tubercular salpingitis is as a rule a primary lesion.

The most virulent forms of salpingitis follow septic labour or miscarriage. From them streptococci are isolated.

Gonococcal infection also produces severe results as regards the tube, suppuration nearly always resulting. The gonococcus, however, is not very virulent in the peritoneum, and hence the suppuration is confined to the tube as a rule.

In many old-standing cases of pyosalpinx the pus is extremely fetid. Such pus is often sterile, the organisms that were responsible for the process having perished. From similar cases cultures of staphylococcus or *B. coli* commune may be recovered. These usually represent a secondary infection.

The histological changes in salpingitis vary. In very acute cases the lining of the tube is necrotic. In suppurative cases the plicæ are the seat of leucocytal invasion and the epithelium is irregular in parts and desquamated. In old-standing cases enormous thickening of the wall may be seen. This is due partly to cedema, partly to fibrosis, but in some cases there is probably a proliferation of the muscle fibres. The epithelium lining the tube is hypertrophic and greatly convoluted, so that the plicæ have become papillary and a cross section has a markedly adenomatous appearance. In a hydrosalpinx the wall is represented by attenuated fibres and a single layer of somewhat flattened epithelium, with here and there remains of one of the plicæ. Tubercular salpingitis exhibits well-marked giant cells and excessive interstitial hypertrophy of the tube wall.

Suppurative Salpingitis.—In the acutest form of suppurative salpingitis no closure of the abdominal ostium occurs, and the pus formed in the tube runs straight out into the peritoneal cavity, where it may become loculated or spread diffusely over the whole peritoneum.

These cases are fulminant in onset, with severe abdominal pain and rigidity, fever and other signs of acute peritonitis. No tumour is formed unless the pus becomes encysted.

Pyosalpinx.—In all the lesser degrees of salpingitis the abdominal ostium of the tube quickly becomes occluded and the inflammatory products accumulate in the lumen. If suppuration is taking place a pyosalpinx is the result.

The mass formed by a pyosalpinx varies in size and consistency. When large the wall is thin, but in other cases great thickening of the tube occurs, with but little distension of its lumen.

It is important to bear in mind that the swelling clinically apparent in any salpingitis is a *conglomerate*, of which the tubal enlargement is only a part, the rest being made up of the thickened mesosalpinx, adherent omentum, appendices epiploicæ and bowel and peritoneal exudate.

The symptoms are similar to those of the fulminant cases, but less severe, and after the lapse of a few days a definite mass is formed lying to one side of and behind the uterus. In the case of bilateral disease the entire back of the uterus is surrounded, because the distended tubes curl backwards, inwards and downwards towards the floor of Douglas's pouch.

Non-suppurative Salpingitis.—An inflamed tube does not always suppurate. In the absence of pus formation the condition may subside, though probably the abdominal ostium remains permanently closed. In other cases a diffuse sclerotic inflammation of the tube wall goes on producing great thickening and adhesion, the ovary becomes matted up with the tube, and the whole mass is commonly referred to as "a diseased appendage." Sometimes an acutely inflamed tube is found distended with blood (hæmorrhagic salpingitis).

The symptoms of non-suppurative salpingitis are similar to those of the more acute varieties at the outset, except that the local signs are more limited to the pelvis and the constitutional symptoms less severe.

In abortive cases the tumour formed is soft and entirely disappears after the lapse of a week or two. In cases that do not abort the physical signs are similar to those of pyosalpinx, except that the mass is neither so large nor so tender, and fever is less constant. The diagnosis as to whether pus is present or not is often difficult and sometimes impossible.

Hydrosalpinx.—Where, as a result of inflammation, both ostia of the tube are sealed, and where the tube wall has not become sclerotic, great distension due to accumulation of the normal watery tubal secretion may take place, forming a hydrosalpinx. A hydrosalpinx is, therefore, a post-inflammatory condition. It forms a thin-walled fluctuating swelling, curling backwards behind the uterus. Its character may, however, be masked by the thickening and adhesions around it.

The symptoms are, or were, those of salpingitis which have in part or entirely subsided, leaving a fluctuating tumour in the region of the appendage.

The Course of Salpingitis.—Fulminant cases

may proceed until the classic signs of general peritonitis are present, and may end in death. Cases of pyosalpinx usually run an acute course for several weeks, with the formation of a big inflammatory mass.

The pus may be spontaneously discharged into the pelvic colon or rectum, the tube first adhering there. As the sinus formed rarely completely empties the tube, and in any event leaves its cavity in communication with that of the bowel, and, further, as both tubes are usually affected, the appearance of pus per rectum does not tend to marked improvement as a rule.

The general course of a pyosalpinx unoperated upon leaves a tender indurated swelling behind and to the side of the uterus, which is subject to recurring exacerbations of inflammation, with fever and pain, anæmia and wasting.

The ovary is often the seat of a secondary abscess from an early stage. In nearly all cases of chronic pyosalpinx it is more or less disorganized by œdema and follicular cyst formation.

In sclerotic non-suppurative salpingitis the course of the disease is very similar, except that the recurring acute outbursts of inflammation are not present. A persistent mass is present, and the patient suffers from more or less continuous pain and discomfort.

A hydrosalpinx may give rise to similar symptoms, but in old-standing cases the presence of a fluctuating tumour is the only remaining sign of the attack of acute inflammation that initiated it.

Diagnosis.—Acute salpingitis has to be distinguished from inflamed pelvic neoplasms, both solid and cystic, and especially from axial rotation or inflammation of an ovarian cyst or uterine myoma. In both the onset of pain is sudden, but in salpingitis no mass can at first be felt, whereas in the case of a cyst or myoma a tumour is present from the very beginning. An inflammatory tumour is more tender, more fixed and less defined than that due to a neoplasm. Acute salpingitis is one of the many lesions capable of producing the so-called "acute abdomen," and as such has to be diagnosed from those lesions.

The fact that the pain and tenderness begin in the lower abdomen and are most marked on vaginal palpation should distinguish it from catastrophes affecting the upper abdominal organs.

Of those affecting the lower, there are three of which it is necessary to speak more particularly—appendicitis, ruptured tubal gestation and intestinal obstruction.

The diagnosis between *acute appendicitis* and acute right salpingitis is often difficult. In general it may be said that an acute appendix cannot be touched from the vagina, and that

where marked tenderness exists, or still more a swelling is felt from the right and posterior fornix, the case is probably one of salpingitis.

Ruptured tubal gestation is distinguished, as a rule, by the menstrual history, the discharge of blood from the uterus and the absence of fever at the onset. Moreover a patient with a ruptured tube looks as though she was losing or had recently lost much blood. This is not the case in salpingitis.

Acute intestinal obstruction may be mimicked by the vomiting and flatulent abdominal distension. Though inertia of the bowels may be present with salpingitis, absolute obstruction is not present, nor is the vomiting "regurgitant," *i. e.* it does not occur if nothing be introduced into the stomach. In salpingitis also there are the definite local signs which are not present in intestinal obstruction.

Chronic salpingitis, on account of the mass formed, is liable to be mistaken for a pelvic new growth. Thus myomata or ovarian tumours are closely simulated. The history of inflammation and the tenderness, fixity and indefiniteness of the lump will usually decide the diagnosis, but in some cases the distinction is impossible.

A subacute or chronic salpingitis appearing causelessly in an undoubted virgin young woman should always suggest a tubercular origin.

Treatment.—All fulminant or severe attacks of salpingitis seen soon after their onset should be operated upon. The uncertainty of the diagnosis and the course of the case are warrant for this.

A case seen somewhat later, in which the symptoms appear to be tending to subside, may very well be watched, in the hope that the attack will abort.

Patients with high fever and undoubted pyosalpinx, but in whom the process appears to have become limited to the pelvis and to have passed its severest stage, are also with advantage treated expectantly until the acute symptoms have subsided, for the operation is better borne when the patient has in a measure recovered from the first violent effects of the attack. In pursuing this advice the surgeon must, of course, be prepared to operate immediately if the symptoms suddenly exacerbate, and in any case if the patient appears to be losing ground.

Subacute or chronic salpingitis should always be operated upon if there is the slightest reason to suspect the presence of pus, or if exacerbations occur, or if after watching the patient for some time no improvement be manifest in her condition.

Very old-standing disease of the appendages which has ceased to give rise to any acute symptoms calls for operation if the patient desires the quickest road to complete recovery. If she objects to an operation the danger of

leaving the condition is not so great that the surgeon need strongly press it. One of the great disadvantages of leaving cases of persistent salpingitis unoperated upon is that whereas in early cases it is usually possible to conserve at least one ovary, in cases dealt with late these organs have either undergone abscess formation or cystic degeneration, or have become so indissolubly mixed up in the inflammatory mass that their removal cannot be avoided. The operation for salpingitis is best carried out through an abdominal incision, the vaginal route being cramped and unsatisfactory.

The removal of the tube (salpingectomy) is effected by dissecting it off the mesosalpinx after it has been freed from the adhesions that tether it, and separating it from the uterus at the tubo-uterine junction. Salpingectomy is the operation of election whenever the ovaries are sufficiently healthy to be conserved and when there is no indication for the removal of the uterus.

The removal of the tube and ovary (salpingo-oophorectomy) is indicated when the ovary is too involved to be spared. The appendage having been freed from adhesions, is pulled up, the ovarico-pelvic ligament is clamped and divided, and the ovary and tube are separated from the outer half of the broad ligament. Their remaining attachments are then transfixed with a needle armed with silk or catgut and are ligatured close up to the uterus, after which the appendage is cut away. The ovarico-pelvic ligament is then ligatured, and all other bleeding points having been secured and the opposite appendage examined, the wound is closed with or without drainage, according to the state of affairs.

Removal of the uterus with the tubes or appendages is indicated where both sides are affected, and where the uterus itself is markedly unhealthy. It is principally performed in bad cases of double pyosalpinx with gonorrhœal infection of the uterus. The ovarico-pelvic ligaments and round ligaments of either side having been clamped and divided, the appendages are freed from their attachment to the broad ligament, and the layers of the latter having been separated, the uterine arteries are sought for and clamped just as they enter the side of the uterus. An anterior flap of peritoneum, together with the bladder, having been turned back, the uterus is ready for amputation.

If the hysterectomy is to be sub-total, *i. e.* the cervix is to be conserved, the division takes place across the supravaginal cervix. If total hysterectomy is desirable the uterine arteries are divided inside the clamps holding them, the anterior vaginal vault is opened, and the cervix is seized and drawn upwards and forwards while the remaining attachment of

the uterus to the vagina and broad ligament is divided. In either case, after all the clamped vessels have been ligatured the peritoneum is closed across the pelvis between the ovarico-pelvic ligaments by a continuous suture.

After operations for salpingitis the pelvis may require drainage. It is best to take this precaution in all cases of acute infection. In chronic cases, even where pus is present, it is not as a rule necessary, but each case must be judged separately. A rubber tube inserted through the lower end of the abdominal wound is the best method of drainage.

Salpingostomy, or the opening up of a closed tube, is sometimes indicated where the sealing of the abdominal ostium is the sequel of an old salpingitis which has quite subsided. It is doubtful, however, whether the new opening often remains patent. Certainly very few patients have become pregnant after it.

New Growths

Myomata and Adenomyomata and Fibromata.—All these growths are very rare in the Fallopian tube.

Myomata may occur with similar tumours in the uterus. They are always small.

Adenomyomata and fibromata are probably always the result of a localised inflammatory affection of the tube, chiefly tubercular. It has previously been remarked that salpingitis often produces great sclerotic thickening of the tube. Such thickening, when limited to one segment, results in a more or less definite tumour in which portions of the proliferated epithelial lining of the tube may be caught up.

Carcinoma and Sarcoma—

Carcinoma of the tube is a rare disease. From recorded cases it appears always to be preceded by old-standing salpingitis. The growth is papillary in character and usually develops inside a hydrosalpinx. The symptoms are those of pain and tumour formation on one side, accompanied in a considerable proportion of cases by a blood-stained watery discharge from the uterus. Directly the growth escapes from the confines of the tube peritoneal metastasis takes place, with ascites.

Chorio-carcinoma arising in the tube is on record, starting either directly from a tubal gestation or by deportation of trophoblast from an intra-uterine pregnancy.

A sarcoma of the tube is very uncommon. Its histological type is variable, all forms having been met with.

Treatment.—All forms of tubal new growth should immediately be removed. There is no means of accurately diagnosing the character of a chronic mass in the tube region short of operative exploration. If at the operation the

tumour is held to be malignant the uterus and the opposite appendage should be removed, as well as the one affected.

Tubal Gestation

Pregnancy in the tube most commonly follows a period of sterility. It would appear that women who have had a pregnancy in one tube are prone to become pregnant in the opposite tube. In other words there is a predisposition to the occurrence in these individuals. The determining cause is unknown. Early pregnant tubes are usually conspicuously healthy, except at the point of gestation. Many theories have been evolved, but none satisfactorily explain the occurrence.

The fertilized ovum (oöperm) grafts in the mucosa of the tube and burrows its way into the muscular wall, wherein it develops. It lies here in a space called the gestation sac, the periphery of which consists of a mass of cells called the trophoblast, which have the property of producing lysis of the maternal tissues with which they come in contact. The products of this tissue destruction form the pabulum of the growing ovum until such time as a system of chorionic villi can be developed and nutrition by destruction give place to nutrition by transudation.

The thickness of the tube wall is not great, and as the gestation grows it becomes stretched over it. The gestation sac is continually enlarging as the trophoblast erodes and destroys the tubal tissues, and further in this process numerous maternal vessels are opened up to pour their contents into certain large inter-trophoblastic blood accumulations designed to form the intervillous blood spaces.

Sooner or later, then, the tube must give way, the gestation sac perforating either outwards (extra-tubal rupture) or into the lumen of the tube (intratubal rupture). In many cases before this takes place excessive hæmorrhage into the gestation sac has converted it into a large intramural hæmatoma. This blood-clotting forms the "tubal mole," and bound up in it will be found the amniotic cavity, the foetus and such chorionic villi as have been already formed.

Extra-tubal Rupture is usually intraperitoneal, but may be intraligamentous if the perforation takes place between the layers of the mesosalpinx. It is most often seen when the gestation is implanted in the isthmic segment of the tube, because here the lumen is relatively very small.

A much rarer form of extra-tubal rupture is that into the cavity of the uterus, which can only occur when the gestation is situated in that part of the tube which lies in the uterine wall (interstitial pregnancy).

The result of extra-tubal rupture is hæmorrhage, either into the peritoneum, the broad ligament or the cavity of the uterus, as the case may be.

Intraperitoneal hæmorrhage is much the commonest and most severe. In many cases it is so profuse as to give rise to a diffuse extravasation all over the abdominal cavity (hæmoperitoneum), and not merely to a local collection in the pelvis (hæmatocele).

Intraligamentous hæmorrhage produces a large hæmatoma lying between the layers of the broad ligament.

Intra-uterine hæmorrhage could not in an ordinary way be distinguished from bleeding coming from abortion of a normal pregnancy.

Extra-tubal rupture in most cases necessarily destroys the life of the ovum, but exceptionally the villi may maintain their attachment to the tubal tissues, the hæmorrhage cease, and the ovum continue to grow. In this case it expands out through the rupture either into the peritoneal cavity or between the layers of the broad ligament, and gaining further attachment to the tissues with which it comes in contact, forms for itself a tubo-peritoneal or tubo-ligamentary sac in which it may continue till term.

In *Intratubal Rupture* the hæmorrhage takes place into the lumen of the tube, usually in the ampullary segment. It may run from here into the peritoneum or, if the ostium be blocked, it accumulates in the tube, forming a *hæmatosalpinx*. If a mole has been previously formed this may be expelled into the tube or even forced along the tube into the peritoneum (*tubal abortion*). The escape of blood in intratubal rupture is slower than in extra-tubal rupture, often it takes place in successive gushes. It drips from the abdominal ostium into the space behind the uterus and forms a large collection there which rapidly becomes encysted by adhesion between the bowels and omentum. This encysted collection is termed a *pelvic hæmatocele*. The blood in an hæmatosalpinx often finds its way into the uterus through the abdominal ostium and appears at the vulva.

Finally it may be pointed out that combined ruptures of the tube frequently occur, the gestation sac first perforating in one direction and then in another. In tubal pregnancy the uterus enlarges and the endometrium hypertrophies to form a decidua. This latter is often shed entire as a uterine cast, after the rupture of the tube.

Symptoms.—A gestation in the Fallopian tube gives rise to no symptoms other than those of normal pregnancy until the gestation sac ruptures. Bearing in mind the differing series of events that may attend tubal pregnancy, it is seen that the symptoms must be variable. Rupture takes place usually between the

second and the eighth week. As a rule a period of amenorrhœa has preceded the event and the patient believes herself pregnant, but not infrequently no such history can be obtained.

Acute Intraperitoneal Rupture. These are the fulminant cases. Without warning the patient may be seized with acute pain and faintness and in an hour or less may present all the signs of severe intraperitoneal hæmorrhage. Examination commonly reveals no tumour in these cases. Liquid blood cannot be felt and the mass formed by the gestation is too small.

Intrabubal Rupture and Less Acute Forms of Intraperitoneal Rupture. In most of these cases a mole has first been formed by extravasation into the gestation sac and the rupture of the tube occurs subsequently. The patient is seized with an attack of sudden pain and faintness, which may be repeated in a few hours or days. Soon afterwards a bloody discharge from the vagina begins. Pain in the lower abdomen now becomes continuous, and examination finds it rigid and somewhat distended. After a period during which all the symptoms may have become more marked a definite mass will be found, either to one side of the uterus (hæmatosalpinx) or lying directly behind it and pressing it forwards (hæmatocele). The latter may attain a very large size. The patient looks blanched and the temperature at first is subnormal. After some days, however, it rises as inflammatory reaction takes place around the effused blood.

Intraligamentous Rupture. The symptoms of this event are similar to those just described, but the tumour felt is more laterally placed.

Tubo-Peritoneal or Tubo-Ligamentary Pregnancies. If the gestation has proceeded after the rupture of the primary gestation sac, an increasing swelling is felt in the abdomen over which fetal movements and heart sounds can be later detected. The uterus is pushed forwards or sideways and may be felt distinct from the swelling. There is a history of an attack of abdominal pain during the early months which subsided.

The natural history of these late gestations is to proceed to term, when "spurious labour" takes place. The fœtus dies at, or soon after, this period and may remain sequestered in the abdomen for the remainder of the patient's life. Very often, however, suppuration occurs round the sac, with the formation of one or more sinuses through which fragments of the fœtus may be extruded. These late gestations do not, however, always proceed to term without untoward symptoms. The secondary sac may rupture and the fœtus escape amongst the intestines, or hæmorrhage may occur into or from it.

Diagnosis.—Acute tubal rupture has to be distinguished from the other abdominal catastrophes. Few of these and none of the common ones produce symptoms of hæmorrhage. The intense blanching, the restlessness, the rapid respiration and pulse-rate are all very characteristic. The history of a missed or overdue "period" is helpful. The fact that no tumour can be felt from the vagina will not disturb the diagnosis.

The less acute types resemble the various causes of pelvic peritonitis. Thus salpingitis, twisted or inflamed tumours, or appendicitis may be suggested. The history, the discharge of blood per vaginam, the absence of fever at the outset, the blanched appearance of the patient, and the indefinite tumour that lies at the back of the uterus, are the points on which the diagnostician must rely.

The distinction between acute salpingitis and tubal gestation is difficult when the case is seen late, for then the presence or absence of fever has lost its value. As a matter of fact a large number of cases sent into hospitals as salpingitis turn out to be tubal gestation and vice versa. Fortunately, the value of exact diagnosis is chiefly academical in such circumstances, the main point being to diagnose the correct treatment.

Old hæmatocèles and blood-distended tubes may be mistaken for solid tumours such as uterine myomata or ovarian fibromata.

Lastly, it may be pointed out that in cases of "tubal abortion" the patient, misled by the vaginal loss and perhaps by the passage of a uterine cast, usually considers that she has miscarried.

Treatment.—All cases of tubal pregnancy, except those rare instances in which the gestation attains to six months or over, should be operated upon. It is true that in hæmatocèles or hæmatosalpinx the result of early rupture may be absorbed if let alone, but such expectant treatment involves the risk of further rupture, of serious infection of the blood mass, and even of overlooking a beginning tubo-peritoneal or tubo-ligamentary pregnancy.

The operative treatment of tubal pregnancy gives singularly good results—indeed, there is no such dramatic success in surgery as the salvation of a patient moribund of acute bleeding from a ruptured tube.

The abdominal route should always be chosen. In urgent cases the affected tube must be immediately sought for and clamped and removed. Intravenous saline infusion should be proceeded with while the surgeon is evacuating the blood from the peritoneal cavity. Too much time should not be wasted over this if the patient is very bad.

In cases of tubal abortion and hæmatocele

a more deliberate course can be taken. These cases should be drained if fever has been present before the operation. In most cases the tube alone requires removal, but sometimes the ovary is so involved that it cannot be spared.

In the rare event of an interstitial gestation two courses are open: either the cornu affected can be excised by a wedge-shaped incision or the uterus itself may be removed.

In a case of broad-ligament hæmatoma the sac must be cleared of blood clot and either cut away or brought up to the abdominal wound and drained.

Lastly, in regard to gestations advanced to or beyond the sixth month the best course appears to be to keep the patient under observation and let her go on to term. After spurious labour and death of the fœtus have occurred the removal of the products of conception is easy.

The difficulty in dealing with a living extra-uterine gestation after the sixth month is the profuse hæmorrhage that must occur when the placenta is separated. If the surgeon's hand is forced by premature rupture of the extra-uterine sac, or by hæmorrhage or any other complication, and he is obliged to operate while the placenta is still "live," the course he should pursue will depend upon the position of this structure. In some cases it is attached chiefly to the omentum and then can be readily removed after ligation and division of the omental vessels. Where, however, it is attached on the parietes, the retroperitoneal cellular tissue or the mesentery, he had better content himself with removing the fœtus only and deliberately suturing up to the sac, thus leaving the placenta to become sequestered in imitation of nature.

V. B.

THE BROAD LIGAMENT

Inflammation ("Pelvic Cellulitis")

Inflammation of the cellular tissue of the broad ligament is usually secondary to infection either of the vagina, cervix, body of the uterus, tubes or ovaries.

In the case of a primary lesion in the vagina or cervix, the lower portion of the cellular tissue is inflamed, *i. e.* that beneath the ureters and uterine arteries.

If, however, the primary site of infection be higher, then the upper portion suffers.

Broad-ligament cellulitis may occasionally be primary, as in inflammation attacking a cyst, hæmatoma or sequestered extra-uterine fœtus.

When cellulitis of the broad ligament is secondary to salpingitis, the mass formed and the symptoms due to it are merged in those due to the tubal disease.

When, however, it follows lesions of the cervix and vagina, it is a much more definite

entity. It is chiefly seen thus after septic labour or abortion, but may follow surgical or other wounds.

The process is essentially one of lymphangitis, and tends to spread outwards to the lateral pelvic wall and so up into the iliac fossa. Extension may further occur into the space between the cervix, vagina and bladder, or backwards into the utero-sacral ligaments.

A mass is formed by the oedematous tissues which may subsequently become the seat of abscess formation. In this case the pus usually points above the groin or into the vagina, but it may pass into the thigh through one of the pelvic foramina or under Poupart's ligament, or it may discharge into the bowel or bladder. Instead of bursting, the abscess may become shut off, its walls being formed of indurated inflammatory tissue (chronic cellulitis). After a long period the abscess becomes encapsuled, and finally, as the fluid loses its purulent character, a true inflammatory cyst may result.

Symptoms. The onset of pelvic cellulitis is marked by severe pain and fever. A swelling is noted to the side of the uterus, which, as it enlarges, appears as a markedly lateral mass in the lower abdomen which is dull on percussion. After some days resolution may occur, but if pus forms the fever becomes markedly remittent and the patient shows signs of toxic absorption, with perhaps rigors, and fluctuation is noticed in the swelling.

In other cases the symptoms subside to a degree, but a hard tender mass remains, which is the seat of recurring exacerbation.

Diagnosis. Acute cellulitis could scarcely be mistaken for anything else. The swelling is markedly centralized in the tissue around the lateral vaginal fornix, but may extend from here forwards between the vagina and bladder, or backwards by the side of, or behind the rectum. Palpation of the pouch of Douglas, through the posterior vaginal vault, reveals it empty. The swelling is close under the vaginal mucous membrane and may extend to within an inch of the vaginal outlet.

If the cellular tissue of both broad ligaments is involved (complete cellulitis) a very characteristic hardening of the whole of the pelvic floor is felt and the cervix feels as though it was set in the mass.

Chronic cellulitis may, from the defined mass that results, be mistaken for a tumour, especially a myoma in the broad ligament. The history of the case is, however, entirely different.

Inflammatory swellings in the pelvic peritoneal cavity, such as a pyosalpinx or inflamed ovarian tumour, lie behind the uterus and in front of the rectum, and appear more or less central when palpated from the abdomen, and on percussion are not entirely dull.

It has been remarked that a degree of inflammation of the upper part of the broad ligaments accompanies salpingitis and oöphoritis, and it may here be added that typical "lower route" cellulitis may complicate them.

Treatment. Cellulitis at the outset should be treated by fomentations applied to the lower abdomen and warm antiseptic vaginal douches.

If pus forms, or is suspected of forming, the swelling should be explored and drained. It is best opened, as a rule, just above Poupart's ligament. The pus should be searched for with the finger or some blunt instrument. If the abscess is definitely pointing into the vagina it should be evacuated there. Very large collections of pus may require several incisions and counter-incisions. The mass formed by chronic cellulitis may be watched for a time in the hope of resolution.

If this does not occur, and if doubt exists as to the possibility of a pyosalpinx or tubo-ovarian abscess being present, the abdomen had better be opened and the swelling explored. An abscess, if found, can be drained very well this way. Otherwise the same procedure as that advised for an acute abscess had better be followed.

New Growths

Intraligamentous Gestation.—The subject of tubal gestation has already been discussed (see p. 1023). The hæmatoma formed by intraligamentous rupture of the gestation sac should be operated on by the transperitoneal route and evacuated. The problem of the treatment of a living gestation in a secondary tubo-ligamentous sac has been dealt with (see p. 1025). A sequestered foetus should be removed, preferably by the retroperitoneal route if it is infected or suppurating, but otherwise through an ordinary abdominal incision.

Broad-Ligament Cysts.—Various types of cyst occur in the broad ligament.

Tubal cysts are derived from persistent remains of the primitive tubal ostia. They have already been described (see p. 1019).

Parovarian or epoöphoronic cysts take their origin from the remains of the collecting tubules of the mesonephros and the Wolffian duct (Gärtner's duct), which persist in the mesosalpinx. They may attain a large size and are nearly always unilocular. The contents are a clear and watery fluid, and the lining epithelium is cubical. Ciliated epithelium has been described, but when occurring probably points to a Mullerian origin.

Serous cysts also occur, often as a complication of inflammatory disease of the tubes, and are probably due to blockage of the lymphatics of the cellular tissue. A chronic abscess of the broad ligament may become converted into a

cyst having a thick adherent wall. Hydatids occur in this situation.

Large cysts of the broad ligament pass beyond its confines and widely undermine the peritoneum of the general abdominal cavity. The intestines, and particularly the pelvic colon, thus come to lie sessile on them. The ureter is usually displaced inwards, but may exceptionally run across their upper surface. They may cross the middle line under the floor of Douglas's pouch or behind the rectum, and may give rise to a most complicated alteration in the anatomy of the parts.

Symptoms and Signs. All broad-ligament cysts have three characteristics: they are covered by the spread-out peritoneum, the Fallopian tube is stretched across them, and the ovary is not an integral part of the swelling.

They are, moreover, sessile except when formed in the outer half of the mesosalpinx, they are markedly unilateral, and they displace the uterus to the opposite side. Unless inflamed or formed as a result of inflammation, they give rise to no pain as a rule. They grow slowly and produce an abdominal swelling which is distinctly placed to one side. If pedunculated, torsion may occur, with the same symptoms as those described on page 1017. They may also suppurate like an ovarian cyst, and very rarely may originate malignant intracystic papillomata.

Diagnosis. It is often impossible to differentiate between these cysts and those of the ovary proper. A cyst markedly fixed and unilateral should be suspected of an intraligamentous position.

When very tense a broad-ligament myoma is simulated. In other respects the remarks applying to the diagnosis of the ovarian cysts on page 1016, are cogent here.

Treatment. The cysts must be removed. This undertaking, when a peduncle is present, is carried out exactly as for a cyst of the ovary. When the cyst is sessile it must be shelled out, if possible, from under the peritoneum that covers it after this has been incised.

The relations of large cysts may, however, be so complicated and their adhesion so great as to render an attempt at extirpation extremely hazardous. If it is determined to attempt it the anatomical relations mentioned just now must be borne in mind. In many cases removal of the uterus facilitates the extirpation. In default the cyst, after being emptied, may be drained by fixing it to the abdominal wound, or part may be removed and the rest so treated. Cases so dealt with do well, the cyst cavity becoming obliterated without untoward symptoms.

Myomata.—Myomata growing from the uterus may bulge into the broad ligament. More

rarely the growth originates there. When large a broad-ligament myoma produces the same anatomical alteration in the parts as has been described in connection with cysts in this situation.

Symptoms and Signs. If myomata coexist in the uterus, or if the tumour be primarily uterine, menorrhagia is probably present. A pure broad-ligament myoma has no effect on the menses. The general symptoms and signs of these tumours are otherwise the same as those of myomata in general.

Diagnosis. That of myomata in general. The likeness to a cyst of the broad ligament has already been remarked upon.

Treatment. Removal of the tumour is the proper course. It can sometimes be enucleated by itself, but more commonly removal of the uterus as well is expedient or necessitated (see p. 1012). V. B.

THE PELVIC PERITONEUM

Inflammation ("Perimetritis").—Inflammation of the pelvic peritoneum may be due to a great number of causes.

The term "perimetritis" is a relic of the days before abdominal section in diseases of the female genital organs had been established and when gynæcology was a department of medicine instead of, as now, a branch of surgery. The actual cause of an attack of pelvic peritonitis was, in those times, an assumption which could only be verified post-mortem, and the word perimetritis was coined to cloak in a dignified manner the practitioner's ignorance on all points beyond the obvious, namely, that the patient had pelvic peritonitis.

The use of the term perityphlitis is a parallel instance. Both words should be dropped from the literature.

Pelvic peritonitis is in a large proportion of cases due to salpingitis, the signs and symptoms of that disorder being chiefly due to the secondary involvement of the peritoneum.

Besides this method of origin a number of others less common exist, such as infection or axial rotation of a tumour of the uterus or ovary, effusion of blood following the rupture of an extra-uterine gestation, or an unduly bleeding ovarian follicle, pelvic appendicitis, and so forth.

The diagnosis of these various conditions one from another is discussed under their various headings. Inasmuch as they all present the signs of pelvic peritonitis they have certain features in common, namely rigidity and tenderness of the lower abdomen, more or less in the middle line, together with tenderness, and later tumour formation behind the uterus and in front of the rectum as felt per vaginam.

The distinction of these general features of pelvic peritonitis from those of pelvic cellulitis has been already considered (see p. 1012).

Treatment. The treatment of pelvic peritonitis is that of the primary disease causing it, and is in almost all instances operative. When the primary cause is obscure the indication for surgical interference is still stronger, for though it may be justifiable and proper to defer resort to surgery in the case of symptoms the cause of which is with reasonable probability known, it is obviously taking an additional risk to pursue such a course when it constitutes the only means by which accurate diagnosis and direction as to appropriate treatment can be attained.

New Growths.—Most of the new growths found in the pelvis originate from the organs contained therein.

Primary peritoneal tumours (endotheliomata) are extremely rare. Secondary tumours, on the other hand, are common and may be derived from any of the various kinds of malignant disease that may originate within the abdomen or may metastasize from cancer elsewhere, as in the case of the breast.

Hæmatocele.—An encysted collection of blood in the pelvic peritoneal cavity is usually the result of a ruptured extra-uterine gestation, but may originate from an ovarian follicle after dehiscence, a ruptured ovarian cyst, a perforated uterus, or from the tearing of adhesions connected with the pelvic organs.

An hæmatocele may become absorbed, organized or may suppurate. In the first event the *status quo ante* is attained, except for trifling adhesions; in the second massive adhesion and binding together of the adjacent parts will result; in the third an abscess forms, which may terminate in general peritonitis, spontaneously discharge by the bowel or vagina, or become sequestered to form an inflammatory cyst with grumous contents.

Treatment. An hæmatocele should be removed by operation. In most cases the abdominal route is the best, but if suppurating or highly infected it may be drained by posterior colpotomy.

Abdominal Gestation.—Tubo-abdominal gestation secondary to tubal gestation has been described (see p. 1024).

The possibility of primary abdominal gestation is granted, but cases presenting unequivocal evidence of such an occurrence are very rarely forthcoming. V. B.

DISEASES OF THE BLADDER AND URETHRA IN WOMEN

Examination of the Patient. It may be convenient, before passing on to a consideration of the special diseases affecting the bladder and

urethra, to describe the method of examination of any urinary disease.

The examination is conveniently conducted under three heads—

1. The history of the illness. 2. The examination of the urine. 3. The physical examination of the patient.

1. The first of these it is unnecessary to discuss here at any length, for, though an attentive hearing should always be given to the patient's account of the onset and course of the illness, yet it is but comparatively rarely that, either from the history as given by the patient or from the sharpest cross-examination, we are enabled to determine with any confidence the primary seat of the trouble. Perhaps in no other branch of surgery is the history so frequently misleading as in genito-urinary diseases, for not only may the patient wilfully mislead, but may readily do so from inaccurate observation. Again, in no region of the body is the pain referred in so misleading a manner as here, a tumour in the kidney giving rise to sensory vesical disturbance, a stone in the ureter to pain in the urethra, cancer in the bladder to lumbar pain, and so on. It is for these reasons that too much attention must not be paid to the patient's own account of her trouble.

2. *The Examination of the Urine.* It is unnecessary here to describe details of an ordinary urinary examination. All that it is proposed to do is to emphasize the important steps from a purely diagnostic point of view.

The first essential, when investigating any suspected urinary disorder in the female, is that the specimen of urine submitted for examination should be a freshly catheterized one. The surgeon must not from any mistaken feeling of delicacy rely upon the examination of the urine passed naturally, for such a specimen is always contaminated by vaginal secretion, consequently it is useless for the purposes of a bacteriological examination, and frequently leaves one in doubt as to the origin of any blood or pus cells found to be present. It is assumed that the freshly catheterized urine is subjected to the usual clinical examination as regards colour, smell, reaction, specific gravity, and the presence or absence of albumin and sugar.

Unfortunately, all too frequently the examination stops here, and the far more important microscopic and bacteriological part is omitted, or reserved for exceptional cases. It cannot be too emphatically stated that by far and away the most valuable part in the examination of any specimen of urine is the microscopical one of the centrifuged deposit. The old method of allowing the deposit to settle at the bottom of a conical glass is to be deprecated, for in the warm urine micro-organisms develop so quickly that most misleading conclusions are thus arrived at,

quite apart from the fact that many of the finer cellular constituents of the urine soon lose their characteristic appearance. Unless a routine practice is made of thus examining the deposit of all urines, no matter how clear and free from turbidity the water may be, much valuable information is certain to be lost and the key to the solution of many an obscure problem pass unrecognized. It is a common and grievous mistake to suppose that because a urine is acid and pellucid it is necessarily sterile. This is far from being the case, and many such urines are found to be severely infected with the coli, tubercle and other organisms. The only safe rule is to bacteriologically examine every urine. Such an examination rarely takes more than a few minutes. After the urine has been well centrifuged (the clearer the urine, the longer the time that must be allowed for this) the deposit is examined, at first unstained, and then, after being dried, stained with methylene blue. Attempts are continually being made to draw diagnostic conclusions from the appearance of the pus cells, blood corpuscles and epithelium which may be found in the urine. For example, it is stated that the presence of numerous mononuclear leucocytes indicates a suppurative condition of the kidney, while an increase in the multinuclear cells points to cystitis. Further, that the outline of the pus cells in renal trouble is less clearly defined and the cells are more granular than in cystitis. These statements are, however, erroneous—the presence or absence of mononuclear pus cells has no diagnostic importance, and the loss of the sharp contour and granular appearance of the leucocytes are only indications that the cells have been long in contact with the urine, but nothing more. Nor can any conclusion be drawn from the epithelial cells seen in the urine. It is a common fallacy to believe that the epithelium of the various portions of the urinary tract (urethra, bladder, ureter and kidney pelvis) can be identified. As a matter of fact the epithelium lining the whole tract is of the so-called transitional type throughout; a distinction can be drawn between superficial and deep cells, but not as to their origin. Therefore the simple microscopical examination of the cellular elements of the urine rarely enables one to determine the site of the lesion.

As regards the bacteriological part of the examination, although undoubtedly skill and special facilities are necessary to make an exhaustive report on an infected urine, yet for the purpose of routine diagnostic work a few stains and a good microscope are the sole requisites.

If no micro-organisms are to be seen the urine may be regarded as sterile, provided neither pus cells nor albumin be present.

Should pus cells be there, but no organisms seen in the methylene-blue stained film, it is probable that the condition is tubercular, and therefore a thorough search for this organism should be made, with films specially stained for their identification. I would also urge the advisability of searching for the tubercle bacillus in those urines where, though pus cells are absent, albumin is present. Only those who thus make a systematic search for this bacillus in every pathological urine appreciate the frequency with which this organism is present in totally unsuspected cases.

A note of warning must be uttered lest the inoffensive smegma bacillus should be mistaken for the tubercle organism. Attention has already been drawn to the fact that when the urine is voided naturally in the female it invariably becomes contaminated by the vulval secretion. It is therefore of prime importance that the urine which is submitted to examination for the tubercle bacillus be withdrawn by a catheter; otherwise the presence of the smegma bacillus may prove misleading.

3. *The Physical Examination of the Patient.* It is essential for a thorough examination of the urethra and bladder that the patient be placed in the so-called lithotomy position, viz. with the pelvis raised and the thighs well abducted and flexed. The position is an unpleasant one, but it is unavoidable, and with a little management can be shorn of much of its repugnance. It is convenient to carry out the examination systematically, as follows—

(a) *Inspection of the Meatus Urinarius and External Genitalia*, specially looking for evidence of abnormality, past or present inflammation, prolapse of the urethra or bladder, and new growths.

(b) *Digital Palpation* through the anterior vaginal wall of the base of the bladder, the lowest portions of the ureters, and the urethra. By this means valuable data may often be obtained, such as the presence of a vesical or ureteral calculus, the induration of a malignant growth, etc.

(c) *Expression of the Urethral Secretion.* This is especially important in the examination of a suspected case of gonorrhœa. It is carried out as follows:—The meatus is first carefully cleansed, then, whilst the fingers of the left hand hold the labia apart, the index finger of the right hand is introduced into the vagina and gently, but firmly, strokes the urethra from behind forwards until a bead of secretion appears at the meatus. This is then removed by a sterile platinum loop and submitted to a microscopical and bacteriological examination.

(d) *Two Urine-glass Test.* This test, which is so useful in the male in showing whether any turbidity of the urine from pus or blood is due

to a urethral lesion or not, has not the same value in the female, partly on account of the shortness of the urethra, and partly because of the frequency with which the voided urine is contaminated by menstrual or vaginal secretion. Consequently the presence or absence of a urethral discharge is generally best determined by the expression of it in the manner described above.

When, however, this test is employed the patient is given two vessels and asked to pass half the urine into the one and the remainder into the second. The two samples of the urine are then compared and any difference in appearance readily noted. If the first portion passed is turbid from pus or blood, whilst the second portion is almost, or quite, clear, it may be assumed that the pus or blood in the first portion came from the urethra, and not from the bladder or kidney.

An attempt is, however, often made to extend its use to the distinction between kidney and vesical trouble. It is said that when the bladder is affected the first portion of the urine is clearer than the second, for as the bladder fills with the urine the pus sinks to the bottom of the organ and is expelled with the last portion of the urine; but when the pus comes from the kidney it is so intimately mixed with the water that when passed both portions are uniformly turbid. This is an error which has often been exposed, but, like many other traditions of urinary surgery, it dies a hard death. It must be unfortunately owned that the two urinary-glass test is not reliable in distinguishing between bladder and kidney trouble.

(e) *Irrigation of the Bladder.* After the patient has micturated the next step in examination is to pass a glass catheter into the bladder, so that the residual urine, if there be any, may be drawn off, and its character and amount ascertained. Whilst the catheter is in situ the bladder is gently washed out with boracic acid solution, or some other indifferent fluid, until it returns quite clear. This simple manoeuvre often gives a clue to the seat of the trouble, whether it be in the bladder or kidney. For in the latter case the fluid very soon returns clear, no matter how turbid the urine was previously; but if the bladder be at fault, even after long and persistent irrigation it is with difficulty that the fluid is got to return clear. The reason for this is that when the bladder is inflamed the pus thickly coats and adheres to the walls and recesses of the organ and is only removed by irrigation with much labour.

(f) *Electrical Illumination of the Bladder and Urethra.* In a large number, indeed probably the majority, of urinary cases it will be found

that, though the examination as so far described yields much valuable information, yet alone it is not sufficient to establish the diagnosis, and resort must be made to the cystoscope and catheterization of the ureters. The details of this procedure are, I take it, outside the scope of this article.

It may be noticed that no mention has been made of the use of the sound or of palpation of the bladder by means of the finger introduced per urethra. The reason is that the former is now an obsolete instrument, having completely given place to the cystoscope, which gives all the information the sound does and a great deal more. For the same reason the digital exploration of the bladder per urethra is no longer justified. In numerous cases it has led to a permanent incontinence of urine, and the information it can give falls far below that obtained by the cystoscope.

Urethritis.—By far the most common cause of urethritis is an inoculation with the gonococcus. Indeed, the other causes, such as traumatism and infection with septic wound organisms, so rarely give rise to more than a transitory inflammation, that the demonstration of a urethritis is almost pathognomonic of gonorrhœa.

Symptoms. Generally the first symptom noticed by the patient is an increasing burning and irritation about the vulva and pain on micturition. The meatus becomes swollen and hyperæmic, with the lips everted and moistened with a tenacious mucous secretion, which rapidly becomes copious and purulent. Palpation of the urethra is very painful and expresses a purulent secretion from the meatus. The symptoms generally increase in severity up to the second or third week; and then, if all goes well, a change for the better begins to take place, the inflammation and symptoms slowly abate, so that at the end of the fifth or sixth week the entire process is over. This rapid recovery, however, is liable to be indefinitely prolonged by a variety of causes, as relapse, or by the extension of the inflammation to the bladder or elsewhere. In such cases the disease is apt to become chronic, the diffuse inflammation of the acute stage becoming localised in one or more small circumscribed areas. Here, in consequence of the prolonged irritation of the gonococci, there is called forth a proliferation of the subepithelial tissue cells, forming a small-celled infiltration. These areas of infiltration are most frequently situated round or about the lacunæ and ducts of the mucous glands. As they are accompanied by a considerable increase in vascularity they present a granular appearance. After a time these subepithelial infiltrations undergo a form of sclerosis and pass into a fibroid scar.

Diagnosis. In the acute stage the diagnosis presents no difficulty. If the disease is suspected the patient may be asked to pass water into two urine-glasses. If the urine in the first glass is turbid and in the second glass clear, the suspicion of urethritis should be at once raised. The diagnosis is confirmed on finding the urethra swollen and tender to the touch and exuding pus at the meatus.

A simple microscopical examination of a stained film of this pus will usually settle any doubt as to the character of the infection. In the chronic stage the disease is very frequently either entirely overlooked or confounded with catarrh of the bladder. The diagnosis rests upon (a) the expression and microscopical examination of the secretion; (b) the detection by the palpating finger of general or localised tenderness and induration of the urethra; (c) the urethroscopic appearance of the mucous membrane.

During the stage of the soft small-celled infiltration the mucous membrane is hyperæmic and redder than normally. Its epithelium is œdematous, dull and loosened, so that it is readily detached, leaving small erosions. In consequence of the swelling and œdema of the mucous membrane, the longitudinal folds, into which the urethra is normally thrown when the passage is not distended, are coarser and less numerous. The mouths of the urethral glands are surrounded by a zone of hyperæmia and often blocked by purulent matter. *Pari passu* with the gradual cicatrization of the soft infiltration, the hyperæmia, turgescence and elasticity of the affected mucous membrane diminish, so that the red angry-looking membrane becomes paler and paler as the infiltration hardens.

The epithelium becomes thicker and less transparent and the longitudinal folds of the mucous membrane gradually disappear. In the later stages, where considerable contraction of the inflammatory area has taken place, these folds may entirely disappear, so that the urethra, as seen through the endoscope, appears as a stiff, inelastic tube with smooth pale walls.

Treatment. The treatment of urethritis in women is surrounded by many difficulties, and is as a rule very imperfectly carried out. In the main the treatment proceeds on similar lines to those laid down in connection with the male.

In the acute stage emphasis should be laid on the necessity for rest and a light diet, and the avoidance of alcohol and other irritants. Internally the balsams and copious drinks of bland fluids may be prescribed with a view to diminishing the urethral irritation. Locally the parts must be kept clean and provision made

for the absorption of the copious discharge. Hot sitz-baths and the application of fomentations of camomile tea may be employed for the relief of the pain. As soon as the patient can tolerate it, the vulva and vagina (not the urethra) should be freely irrigated two or three times a day with a hot solution of permanganate of potash (1 in 5000); as the inflammation subsides the strength of the lotion should be increased, or be superseded by one of nitrate of silver (1 in 1000).

In the subacute and chronic stages it is useless to attempt to influence the disease by the administration of balsams and like remedies. The only constitutional treatment which holds out any promise of success is the vaccine therapy. Locally, in addition to the vaginal and vulval douching, more powerful solutions of silver nitrate may be occasionally applied, by means of the urethroscope or small urethral syringe, directly to the urethra.

Prolapse of the Urethra.—Both in young children and in old women we occasionally see a prolapse of the urethral mucous membrane protruding from the meatus and appearing as a dark red berry-like tumour. The prolapse generally involves the whole circumference of the urethra, but may affect but a small segment. The condition sometimes occurs quite suddenly as the result of violently straining at stool or of a violent fit of coughing. At other times, especially in old women, the prolapse is a gradual process, dependent on a general senile involution of the generative organs.

The diagnosis seldom offers much difficulty, the only condition likely to be mistaken for it is the protrusion of a small tumour, more especially a vascular caruncle from the meatus. The true nature of the condition is determined by a careful examination with a probe. It may be remembered that prolapse is common in childhood, but rare between the ages of twenty and forty, while vascular caruncle is not met with under the age of twenty.

Treatment. In the acute cases a cure may sometimes be effected by simply reducing the prolapse and keeping the patient to bed for a few days, but as a rule some operative procedure is called for. An old and thoroughly effective method is to insert a metal catheter and then tie a piece of fine silk tightly round the base of the prolapse, so as to strangle it. In a few days the mucous membrane shrivels up and drops off, and the condition is healed. Instead of ligaturing, the prolapse can be excised and the edges of the divided mucous membrane sutured with fine silk.

Tumours of the Urethra.—By far the most common new formation affecting the urethra is the so-called *vascular caruncle*—a term which is applied somewhat loosely to a small bright-

red vascular growth of an innocent nature which frequently develops at the urethral orifice of women. These growths are not all of the same nature, some are not really neoplasms, but mere masses of granulation tissue which have been evoked by some chronic inflammatory irritation, generally gonorrhœa; others are true vascular growths of the nature of angioma. These small growths often give rise to very distressing symptoms, chief of which are pain during and after micturition and dyspareunia. The diagnosis is generally easy, the most likely error being to mistake a caruncle for a prolapse of the urethral mucous membrane.

Treatment. The simplest and most effective method of dealing with these innocent growths is to destroy them with a fine-pointed cautery. But it must be remembered that when dealing with the granuloma form of caruncle the urethritis must also be treated.

Apart from vascular caruncle, innocent growths of the urethra are too rare to call for comment here.

Both carcinoma and sarcoma frequently attack the urethra, but generally do so secondarily, having their origin either in the bladder or peri-urethral tissue. Consequently they are rarely suitable for radical operative treatment, and all that can be done is to ease the intolerable suffering of the patient.

Developmental Abnormalities of the Urethra.—These require but a brief mention here. The most common variety is that of hypospadias, where the posterior wall of the urethra is more or less imperfect. In the slight forms this abnormality has no clinical significance, it causes no trouble and requires no treatment. In the gravest cases, where the whole of the urethral canal is wanting, incontinence of urine is present. To cure this a plastic operation is called for, but it is difficult, and a good functional result is decidedly rare.

A less common abnormality is that of epispadias. Here, again, the failure in the development of the urethral wall may affect only the meatus or the whole of the urethra. And, as in hypospadias, no treatment is indicated unless incontinence is present.

Malformations of the Bladder.—The bladder is liable to various congenital malformations, the most common and serious of which is the incomplete union of the anterior wall. In its severest form there is a cleft running through the wall of the bladder, the symphysis, mons veneris and clitoris, so that the whole of the bladder and urethra is laid open. In consequence of the abdominal pressure the base of the bladder is everted through the cleft, so that it is presented as a large red tumour just above the symphysis. The mucous membrane

thus exposed to irritation and infection becomes inflamed and ulcerated, and bleeds at the slightest touch. Unfortunately this terrible condition is not incompatible with life, and many of these unfortunate beings grow up into adults. In consequence of the continual escape of urine the integument of the thighs and vulva becomes inflamed and excoriated, and this, together with the accompanying stench of decomposing urine, makes up a condition of the utmost misery. Nevertheless several cases are recorded where not only adult life was reached, but even pregnancy took place.

Treatment. Much ingenuity has been expended in devising operative methods for the cure of this condition, but without avail, and it has at last been recognized that it is not possible to close the defect in the abdominal wall so as to make an efficient bladder; and plastic operations with this object are generally worse than useless. The most satisfactory way to deal with the condition is to divert both the ureters into the large bowel. This (Madyl's operation) is done by implanting the trigonum of the bladder, with ureters still attached, into a loop of the sigmoid gut. The operation, which is a formidable one, should not be done in infancy, but between the fifth and tenth years. As a rule it enables the patient to have a very fair control over the liquid fæces, and at present it is certainly the operation of choice.

Incontinence of Urine.—This most distressing malady is characterized by the involuntary escape of the urine. When this only occasionally happens it is often termed enuresis, when continually, incontinence. It may be conveniently classified under the two heads: (a) where the trouble is due to some functional disturbance, and no defect of the urethra or bladder is present, sometimes called "essential incontinence"; and (b) where the escape of the urine is due to a definite local lesion. The causes of both varieties are numerous. For instance, to the former group belong injury or organic disease of the central nervous system, unconsciousness arising from almost any cause, grave debility, especially in the course of high fever, hysteria and the enuresis of children. To the second group belong pressure upon the bladder from neighbouring parts—gravid uterus, myoma, urinary fistulæ, vesical growth, calculus and traumatic injury to the sphincter muscle, such as is occasioned by pressure during childbirth or over-distension from a digital examination of the bladder.

Treatment. This naturally is entirely dependent upon the cause of the trouble, and consequently must be preceded by an exhaustive examination of the patient. In those cases

where the cause cannot be removed steps must be taken to diminish the irritation of the skin occasioned by the dribbling of the urine—extreme cleanliness, smearing of the thighs and vulva with oxide of zinc powder and ointment, and the use of a well-fitting urinal.

Enuresis Nocturna.—This distressing condition chiefly affects young children, and has a tendency to disappear at or before puberty. At present there is much obscurity as to the cause of the trouble. By many it is regarded as being usually due to some defect in the central nervous system, and they seek to trace some evidence of inherited neuropathic trouble (such as epilepsy). But this explanation is for most cases unsatisfactory. Many of them seem to be the result of reflex action set up by some slight local or remote irritation. In France, especially, considerable stress is laid upon the association of adenoid hypertrophy of the nasopharynx with nocturnal enuresis. Fischer maintains that fifteen per cent. of adenoid children suffer from bed-wetting, and that in seventy-one such cases the removal of the adenoids cured forty-five and improved twenty-three. Personally I have been struck with the frequency with which an abnormal urine is present in these cases, and have on several occasions detected the presence of an early tuberculosis.

Treatment. Both constitutional and local treatment is indicated. A simple open-air life, especially at the seaside, with freedom from school pressure, is generally more effective than drugs, from which I have obtained but little help. The most useful of these are, however, bromide of potassium, belladonna, strychnine and iron tonics. Locally the following can be recommended:—The occasional instillation of a few drops of nitrate of silver solution (one to ten per cent.) to the neck of the bladder; the galvanization of the sphincter muscle by means of a metal sound introduced per urethram; vibratory massage through the anterior wall of the vagina to the sphincter region; and, lastly, Cathélin epidural injection of saline fluid into the canal of the sacral vertebra.

Vesical Fistula.—By far the greater number of urinary fistulæ in the female can be traced to traumatism during childbirth, or to some injury inflicted during a gynæcological operation. In childbirth the damage is more frequently caused by the long pressure of the fœtal head on the bladder wall, than to any lack of manipulative dexterity on the part of the accoucheur.

As a rule the fistulous opening is between the bladder and the vagina; far more rarely between the bladder and the uterus.

Symptoms. In those cases where the lesion is caused by a tear or cut in the vesical wall,

incontinence immediately follows on the injury, though in the lying-in woman the escape of the urine may not be noticed for a few days. On the other hand, should the fistula be the result of a necrosis of the bladder wall, say from damage received during childbirth, no urine escapes until about the fifth or seventh day, that is until the necrotic tissue begins to separate.

Diagnosis. The exact diagnosis can only be established after a careful examination has been made, of the vagina with the speculum and probe, and the bladder with the cystoscope. The latter, it is true, requires some ingenuity to effect on account of the leakage from the bladder, but, by first packing the vagina with gauze, it can generally be done. The first thing to be ascertained is whether the involuntary escape of the urine is in consequence of a fistulous opening, or merely from some insufficiency of the sphincter muscle of the bladder. If from the former, then the situation and size of the defect must be determined.

Treatment. It is important to remember that all fistulæ, save those that result from malignant disease, have a natural tendency towards spontaneous cure from the contraction of the scar tissue. Even where a large defect has taken place in consequence of the sloughing of part of the vesical wall, a complete spontaneous cure is not impossible. From this it follows that it is a mistake to operate as soon as the fistula forms. Sufficient time should always be allowed for a natural cure to take place. Hence it is rarely advisable to operate within a couple of months from the onset of the incontinence. Moreover, quite apart from the frequency with which a natural cure is effected, there is another good reason for delay, and that is the improvement which takes place in the surrounding tissues. And until all the necrotic tissue has separated and the inflammation subsided it is impossible to operate with success.

Whilst waiting for this to occur it is desirable that every step should be taken both to improve the condition of the local part and to facilitate the spontaneous closure of the defect. The first of these is brought about by rigid cleanliness and the free use of mild antiseptic vaginal douches; the second by draining the bladder by means of a glass catheter.

Cystitis.—Our views as to the origin, frequency and importance of cystitis in the female have completely changed during the last twenty years. And, though there are many points in the etiology which are still obscure and on which most conflicting views are held, yet the great advance in our bacteriological knowledge, together with the more recent methods of diagnosis by the help of the cystoscope and

ureter catheterization, have opened a new chapter in the treatment of this disease.

We now know that cystitis is always the result of a definite bacterial infection, and that cold and heat, traumatism, irritating foods and drugs, or over-distension of the bladder, which formerly were regarded as direct causes of the inflammation, are only more or less powerful predisposing causes by producing a diminution in the local resistance of the tissues, but they do not and cannot alone give rise to a true cystitis. A large number of micro-organisms are capable of setting up a cystitis, but the most common are the staphylococcus, the coli, proteus and tubercle bacilli, and the gonococcus. These micro-organisms may reach the bladder in a variety of ways. As a rule the infection takes place per urethram, generally as the result of an inflammation which has spread from the vulva, or, more rarely, which has been carried directly by a catheter or other instrument.

At other times the bladder becomes infected by an inflammation spreading through the vesical wall. This sometimes happens in cases of pyosalpinx, peritonitis and intestinal inflammation. In almost all the cases of tubercular cystitis the infection of the bladder is secondary to tubercular mischief in the kidney.

Symptoms. It is convenient to divide cystitis into the acute and the chronic forms, according to the severity of the disease.

The chief symptoms are frequent and painful micturition and the passage of urine containing pus. As the urine collects in the inflamed bladder it gives rise to an increasing degree of discomfort until it is evacuated, when as a rule there is a period of relief. If the neck of the bladder is acutely inflamed the act of micturition may be exceedingly painful.

In the acute form of the disease the bladder irritation is almost constant and the wretched patient is compelled to empty the bladder every few minutes. In the absence of complications the general condition is usually good, fever being either absent or but slight and temporary. Should the pyrexia continue in spite of a rational treatment the suspicion of further complications—ascending inflammation of the kidneys—would be raised.

The amount of pus in the urine varies with the intensity of the disease; it is seldom accompanied by blood, unless tumour, stone or other complication is present.

Diagnosis. Although to the expert urologist the diagnosis of cystitis is attended by no difficulties, this is far from being the case with the practitioner, who naturally lacks both the experience and equipment of his colleague. Mistakes arise, firstly by not recognizing the condition when present, and secondly by

diagnosing cystitis when the trouble, or at any rate the chief trouble, is elsewhere. In order to avoid the first error it must be understood that, although those cases which run an acute course are accompanied by such distressing symptoms as to lead the patient to seek advice, those cases which begin as, or pass into, sub-acute or chronic inflammation are often attended by no pain, but only an occasional local discomfort, which troubles the patient but little and which, from various motives, she does not mention unless directly questioned concerning it.

The second great error, viz. that of erroneously diagnosing cystitis to be present when the trouble lies elsewhere, is due to the unfortunate belief that the association of dysuria with pyuria is pathognomonic of cystitis. Nothing could be more misleading, and it cannot be too emphatically stated that a diagnosis of cystitis can only be arrived at from a thorough physical examination of the patient, and never by merely hearing an account of the subjective symptoms or seeing a specimen of the urine. When one also bears in mind the frequency with which cystitis is but a relatively minor complication of stone, serious trouble affecting the kidney, pelvic viscera or urethra, the need for a full and careful physical examination is obvious.

By means of the two urine-glass test and the use of the catheter the important distinction between a urethritis and a cystitis can generally be drawn. But to determine whether in a case of pyuria the bladder or the kidney is at fault, the use of the cystoscope and ureter catheter is necessary.

Treatment. In the acute stage the first and chief indication is complete rest. The patient must be kept in bed until the dysuria has entirely disappeared. For the relief of the pain hot fomentations of camomile tea may be applied, with benefit, to the hypogastrium and vulva. Of the many sedatives advocated for the relief of the intolerable dysuria, I prefer the following—

R Antipyrin gr. vi
 Pyramidon gr. vi
 Heroin gr. $\frac{1}{10}$.
 M. ft. pulv.

One of these powders, dissolved in an ounce or two of warm water, is injected into the rectum at bedtime.

For most cases of dysuria this mixture is far superior to morphia, which, on account of its unpleasant after-effects, should be as far as possible avoided.

The diet should be of a simple bland nature, in the severe cases consisting mainly of gruel and barley water—alcohol being especially injurious.

Medicinally, in addition to the use of sedatives, one or more of the urinary antiseptics may be given, such as a ten-grain dose of urotropin or helmitol, three times a day.

Until the acute symptoms have abated all forms of local treatment are strictly contraindicated; but in the later stages of the disease they are invaluable. Whatever mode of treatment is adopted it should be applied with the greatest gentleness, otherwise it will cause more harm than good. Two methods of local treatment are employed—one the simple washing out of the bladder with a relatively weak antiseptic fluid, and the other the instillation of a few drops of a much stronger solution.

As a rule it is well to begin with irrigation and pass on to instillation, if the simple washing out fails to effect a cure.

Of the large number of fluids which have been advocated for the treatment of cystitis, there are only two or three which have stood the test of time. The first and foremost of these is undoubtedly nitrate of silver (1 in 4000 to 1 in 1000). For all forms of cystitis, with the single exception of the tuberculous, this solution is worth all the rest put together. The organic preparations of silver, like protargol, are nothing like as effective and much more expensive.

Next to nitrate of silver I prefer a solution of oxycyanate of mercury (1 in 5000 to 1 in 1000).

When washing out the bladder it is well to use a glass catheter to which a short portion of rubber tubing has been attached. Either an irrigator or syringe may be employed, but in either case only two or three ounces should be injected at a time. It is a mistake to distend the bladder with large quantities of the fluid.

When applying stronger solutions by instillation a small syringe holding about a drachm, or less, is employed. The urine is first drawn off and the bladder washed out with warm sterile water. Then from ten to thirty minims of nitrate of silver solution (one per cent. to five per cent.) is injected. This may be repeated twice or thrice a week.

C. L. G.

GENERAL PREPARATIONS

The success of modern surgery is largely dependent on preliminary preparation, so that a disquisition on general principles will not be amiss.

First, in respect to *instruments*. These should be all metal, and when plated should show no rust. The old-fashioned screw lock is the best for artery forceps and scissors, but for other instruments the newer lock (Collins) is prefer-

able. The following list comprises the most important gynæcological instruments.

1. A nest of tubular specula (Ferguson).
2. Bullet forceps for the cervix. Four.
3. Large and small Martin's posterior specula.
4. Uterine sound (Sims').
5. Pessaries. Both Smith-Hodge and ring pessaries are essential. They should be made of hard vulcanite, which, not being perishable, may with impunity remain in place three to four months.

The ring variety is used to keep up prolapse of the uterus or relaxed vaginal walls. A Smith-Hodge will keep in place a uterus that has been replaced from a position of retroversion.

6. Hegar's dilators or their modifications are required to dilate the cervix. The most convenient forms are of different sizes at each end. They should be boiled before use and then placed in weak solution of lysol, which makes an excellent lubricant. For dilatation, after preliminary preparation of the patient (p. 1037), the cervix is fixed by bullet forceps, a Martin's posterior speculum is inserted, and the cervix is wiped with sterilized cotton-wool, soaked in an antiseptic solution. The dilators are held in the middle and passed with steady force.

At all operations instruments after use are placed in a separate basin.

7. Martin's curette efficiently removes the endometrium on all the walls as well as the fundus. Its one disadvantage is that it does not remove a satisfactory fragment for microscopical examination. On this account many operators use a Hegar's curette as well.

8. Braun's syringe. Liniment of iodine or formalin, either pure or diluted, can be injected into the uterus by means of this instrument. It has a long slender nozzle with two small lateral holes pointing backwards, designed to prevent injected fluid being forced into the Fallopian tubes. It holds about twenty minims. When injecting by means of this syringe let the cervix be exposed and cleansed as for curettage. The nozzle is inserted until the uterine fundus is reached, then the fluid is gently forced in whilst the syringe is being withdrawn.

9. A Bozeman's double current catheter is a useful instrument for washing débris from the uterus. It is desirable to have two different sizes, the smaller being about the thickness of an ordinary lead pencil. They can readily be taken apart to be cleaned. The double flow which they provide guards against the danger of over-distension of the uterus.

10. A douche can is a more convenient receptacle for solutions than any syphon arrangement which has for its object the suction of fluid from a bedroom jug. The survival of

the latter is due to its lightness, small bulk and portability.

11. Sea-tangle, tupela or sponge tents are not used as frequently now as formerly; the former, however, still have their field of usefulness. The dilatation they cause has the advantage of considerably softening the cervix, so that further dilatation can be accomplished readily and rapidly. Tents should be passed by sight after the cervix has been prepared as for curettage. They should be held in forceps and it is advisable to use two or three slender tents rather than one big one. The big tent frequently offers great difficulty in its removal, sometimes necessitating the splitting of the uterus. A number of small ones are easily removed when pulled on singly.

12. Bandl's sound is an instrument used in the treatment of endo-cervicitis and erosions of the cervix. It is readily sterilized in the flame of a spirit lamp if boiling water is not available. To introduce it, the cervix is exposed through a Ferguson's speculum or after the manner described for curetting. When the vagina is filled with a lotion such as solution of sulphate of copper, pyroligneous acid, etc., the fluid readily finds its way into the cervical canal through the perforated sound. The sound is passed up to the internal os before the fluid is passed into the vagina.

13. Playfair's probes are used for the same purpose as Bandl's sound, and they may also be employed instead of Braun's syringe to apply caustics to the uterine wall. Several of these should be obtained, and those made of copper are preferable to aluminium ones. Before use a piece of cotton-wool is wound in a spiral manner from the top towards the handle for about two inches, care being taken to twist it firmly. In this way detachment of the cotton-wool is prevented. The probe thus prepared is sterilized by dry heat, or by being boiled, before use, and no reliance should be placed on the supposed antiseptic solutions to destroy the virus contained in contaminated wool.

14. Scissors. Two shapes are required, elbowed and curved on the flat. The curved pair should at least be eight to ten inches long, with blunt points. The other is sharp-pointed and curved to forty-five degrees.

15. Needles. For vaginal work only curved needles are required. They should be strong, fully curved, and wide-eyed. Stout needles will be found to yield the most satisfactory results; fine needles are difficult to manipulate, they often fail to carry the desired thickness of suture, and are very prone to be broken in the grip of the holder. Needles should at all times be held just below the eye by the metal holder; a neglect of this precaution will almost certainly

result in fracture. For perineal operations very large ($2\frac{1}{2}$ in. long) half-curved needles are required.

16. Needle holder. Personal preference guides the choice of needle holder. It is most important to select a long pair with narrow handles, as short wide ones cause the hand to obscure the view and shut off the light. Martin's needle holder, with long scissors handle and a clip to fix the grip when taken, is most satisfactory.

17. Strong vaginal clamps, about half a dozen.

18. Kocher's long artery forceps. Two.

19. Landau's forceps. Two.

20. Artery forceps complete the list, although every gynæcologist has some special instrument or instruments to which he attaches importance.

Ligatures.—Catgut is the most useful material for vaginal work, though silk and silkworm gut have special indications. The advantage of catgut is that the stitches are absorbed and do not subject the patient to the pain and danger of their removal.

The simplest way to prepare catgut is to soak it in ether for twenty-four hours and then boil it in superheated alcohol. For the latter purpose the catgut is rolled on a small glass reel and placed in a bottle of one ounce capacity, three-quarters full of alcohol, and corked. This bottle is put in a saucepan of water and boiled. The alcohol is raised to the temperature of the boiling water. Larger bottles are very liable to burst from internal pressure. Specially constructed brass pots are supplied for sterilizing large quantities of catgut by this method, which is also useful for sterilizing sea-tangle tents.

The following method has come into very general use of late years, and can be depended upon to sterilize the catgut and at the same time leave it pliable without being slippery.

Albolene Method. The catgut is rolled in coils about the size of half-a-crown. These coils are strung on a piece of silk and hung in an oven placed in a sand bath, care being taken to avoid contact between the catgut and the sides of the oven.

The temperature is slowly raised to 180° F. and kept there for an hour, then slowly raised to 220° F. and kept there for another hour.

After being dried in this manner the catgut is put in liquid albolene (refined petroleum) until it is cleared. It is usually convenient to leave it over night. The vessel containing the catgut and albolene is transferred to the sand bath, and the temperature of the albolene slowly raised to 300° F. and maintained for an hour.

From the albolene the catgut is placed in tincture of iodine, where it is stored for twenty-

four hours. For preparing catgut by this method a special apparatus with a heat regulator and thermometer is obtainable at a moderate cost, but two saucepans can readily be made to serve every purpose. The bottom of the larger is covered with a layer of sand one inch thick. The smaller saucepan is placed on this and the space between them filled with sand. There should be a layer of sand at least half an inch wide surrounding the inner saucepan. The lid is perforated for a cork through which the thermometer runs. A hook inside the lid holds the silk from which the catgut is suspended. This inner saucepan serves as a dry oven first, and then contains the albolene for sterilization. The same albolene may be used repeatedly.

Sea-tangle tents can be sterilized by boiling in superheated alcohol. Instrument makers supply catgut sterilized by any of the well-recognized methods.

If silk is used in the vagina it should not exceed No. 3 in size, and No. 2 is useful for tying off small vessels. To prepare silk it is soaked in ether for twenty-four hours, and then boiled for ten minutes on two separate occasions, in a 1 in 1000 solution of corrosive sublimate. It is stored in absolute alcohol.

Silkworm gut is sterilized by boiling and kept in corrosive sublimate solution or alcohol.

Position for Examination and Operation.—The modified lithotomy position is by far the most satisfactory, and is best obtained in a special gynæcological couch of the Schultze pattern. There are many cheap tables specially designed to give this position with all its modifications, and such a table is indispensable to the operating gynæcologist.

The cross-bed position, with the knees drawn up and separated, and the buttocks brought to the very edge of the bed, is a good substitute for that obtained on a special table, provided means are taken to prevent the patient straining or becoming tired. A common plan is to have the knees held by assistants.

Another plan is to have the feet placed on chairs with the knees drawn up and separated. This is not convenient if an anæsthetic is given. Then the legs must be held in flexion and abduction by assistants, or some self-retaining apparatus. The principle of all these appliances is an adjustable rigid bar fastened by straps to the lower end of the thighs, and by another set of longer straps to the head and foot of the bed on the side opposite to that of the operator. A sweeping-brush handle can be bandaged under the separated knees and attached by bandages to the bed as above described.

A satisfactory bimanual examination can often be obtained if the patient lies close to the side of the bed with her legs drawn up and separated, a pillow under her shoulders and

another underneath her buttocks. In this way the abdominal muscles are relaxed.

The bladder and rectum should always be empty before attempting any examination or operation.

It is nearly always best to sit while doing any vaginal operation. The douche stand is placed on the left and the instrument table on the right, or, preferably, a combined douche stand and instrument table at one side.

Shallow porcelain or enamelled iron trays are used for instruments. Each tray should contain the instruments for one operation only, and enough hot water to cover them.

These trays, sterilized by boiling, are placed on the upper shelf of the table, where, in addition, are ligature bottles, a tray for needles, and also one containing the assistant's instruments, viz. scissors, forceps, etc.

It frequently happens that an operator may have to dispense with an instrument assistant. Under these circumstances it is important to have a number of needles threaded with suitable ligatures, which should be made long enough to serve for several stitches.

Gauze wipes for removing blood are preferable to continuous irrigation; wipes for vaginal work are made of pledgets of cotton wool the size of a walnut wrapped in one thickness of gauze and sterilized by steam, but boiled pledgets of plain cotton-wool will do.

A long waterproof coat beneath his sterile gown will keep the operator's clothes dry.

Lastly, it is advisable to avoid, if possible, vaginal operations at night. At all times it is important to see that the patient is situated so as to make use of all the available light. This is usually obtained by placing the buttocks opposite the light of the largest window.

Whilst three assistants are desirable, one assistant to hold bullet forceps and speculum is an absolute necessity. He stands at one side of the patient with his upper hand resting on the pubes and firmly grasping the bullet forceps, which are thus held properly, neither being unduly dragged on, nor so unsteady as to offer insufficient resistance to the operator's manipulations. The assistant's other hand, passed beneath the patient's knee, can hold the speculum, instruments or ligatures. This assistant should be on the same side as the table.

The proper disinfection of the patient, operator and assistants next engages attention.

There is a mistaken idea that vaginal surgery does not call for the perfection of asepsis required in abdominal work. It is a fact that acute sepsis is almost unknown after vaginal operations, but imperfect healing, painful cicatrices, stitch abscesses, acute endometritis, even

salpingitis and pyosalpinx result from neglect of aseptic precautions.

Preparations for the avoidance of infection may be considered under the following heads—

1. The patient.
2. The instruments.
3. The assistants.
4. The operator.

Emergency operations are rarely necessary in gynæcological practice. This being so, it is well, but not imperative, to prepare the patient for two or three days beforehand. The preparation includes a daily warm bath and thorough cleansing with soap and water, free purgation, shaving the pubes, and at times the exhibition of antiseptic vaginal douches.

Many authorities condemn preliminary douching, and advance in confirmation of their views the evidence furnished by bacteriologists as to the inefficiency and harmfulness of any antiseptic applied to the skin or raw surfaces. These observations show that septic organisms will perish within a few hours if artificially introduced into an undisturbed, normal, healthy vagina. On the other hand they are much more persistent when placed in a vagina previously douched with an antiseptic lotion.

These findings have greatly influenced modern surgical opinion, but at the same time it is certain that a greater degree of safety is ensured if septic pus or necrotic decomposing masses already present in the vagina are removed by repeated douching before operation. Practical experience points to the fact that a single douche is less efficient than if it is repeated on several consecutive days.

The attendant should never forget that a soap and water enema is required early in the morning of operation in addition to the purgative administered the night before.

In a properly appointed hospital the patient is usually anæsthetized in an adjoining room. This is not necessary. Less anæsthetic is required if it is administered after the patient has been placed on the gynæcological couch. Ether is the anæsthetic of choice.

After the patient has come well under the influence of the anæsthetic, the nurse, having thoroughly disinfected her hands (see p. 1039), adjusts to the legs sterilized wide linen bags joined in front with an abdominal apron. This enables the operator to make a bimanual examination without contaminating his hands immediately before operating and protects the assistants' hands during operation.

While the douche fluid is allowed to play over the vulva the skin is thoroughly cleansed by scrubbing with pledgets of sterile cotton-wool soaked in a liquid soap and held with a forceps. While washing in this manner the glass nozzle is discarded, and the end of the

rubber tube pinched so as to cause the escape of a strong stream through a small aperture. After thorough scrubbing the lather is washed away and the skin disinfected with a solution of biniodide of mercury in seventy per cent. methylated spirit (1 in 1000). Then the vaginal nozzle is fitted to the douche tube and held upright, while the fluid runs, to free it from air before being passed into the vagina. In washing out the vagina the pledgets of cotton-wool held in a forceps again become a most useful adjunct, although the usual advice is to stretch back the perineum with two fingers. By either method the rugæ of the vagina are smoothed out, but with the former the hands are not contaminated. The soap is washed out, and it is a good plan to leave in a plug of cotton-wool soaked in the antiseptic solution whilst the other preparations are being completed.

The aseptic condition of any skin surface, however carefully prepared, is not to be depended upon, and the best means to adopt for protecting the operator's hands from the vulvar skin constitutes a problem of considerable difficulty. The following plan is simple, cheap and effective.

A rectangular piece of Bilstroth tissue is split to the centre on its long axis. When the edges are pulled apart this sheet is shaped like the letter Y. Safety pins are attached to the angles and it is sterilized by boiling.

This sterile sheet is secured by safety pins to the leggings in such a manner that the angle of the opening is between the anus and vulva on the perineum, to which it is fastened by a clip forceps or by a stitch.

If the bath under the table is placed on a stool it saves splashing and economizes the length of Bilstroth tissue that has to cover the anus and hang down over the bath. This bath need not be sterilized, but is covered with a sterile sheet of Bilstroth tissue, in the centre of which is cut a slit to allow fluids to run through, but not large enough to allow instruments dropped accidentally to fall into the bath.

In septic conditions painting the vulva with liniment of iodine is an additional precaution that can do no harm, but for aseptic cases it is better to harden the skin with a saturated solution of picric acid in methylated spirit.

In spite of all these preliminary precautions no instrument should be passed into the uterus until the external os is carefully wiped off and disinfected.

Instruments.—Instruments can be sterilized by dry heat, by steam or by boiling in water. The latter is the simplest method and the one usually adopted. A fish kettle makes an admirable sterilizer. If washing soda is added to the water it enhances its value as a sterilizing agent, with the additional advantage that it

prevents the rusting of the instruments. Lysol and Lux soap have the same property, but none of them should be employed in sterilizing silk, rubber materials or Bilstroth tissue.

Knives are not greatly harmed by boiling, and any injury is lessened by wiping the blade with ether and wrapping it gently in cotton-wool before placing in the boiling water, where it need remain only three minutes. Many prefer to carry knives submerged in pure lysol, thus having them always ready when required. Cases for this purpose can be obtained from any instrument maker. Needles are sterilized by boiling, but after being used must always be thoroughly dried before being laid by.

No modern operator is unprovided with rubber gloves, and the thin cheap ones are much more generally useful than the thicker and more expensive kind. These gloves stand repeated boiling in plain water, provided they are always thoroughly dried and powdered with French chalk immediately after use. If but seldom required, it is stated that gloves, in common with all other rubber materials, may be preserved for long periods if they are stored in a ventilated box impregnated with the vapour of paraffin oil: but rubber perishes if brought into actual contact with the oil.

Dressings, Gowns, etc.—Iodoform gauze is extremely useful, in fact almost indispensable, to the gynæcologist. Long experience has shown that nothing else exactly takes its place, not that iodoform is a germicide, yet on account of its power to prevent decomposition it will remain in the vagina, uterus or abdominal cavity without undergoing putrefactive changes much longer than other varieties of gauze. The fear of iodoform poisoning arising is very remote if only the gauze is used.

I have always found moist iodoform gauze satisfactory and reliably sterile. If the sister's asepsis is known to be dependable, she should cut the gauze in strips and roll it into bandages, as this is the most convenient form for use during operations. It is stored in an air-tight jar, which is thoroughly disinfected outside before the lid is removed. Iodoform gauze does not stand disinfection by heat or steam.

There are now innumerable steam sterilizers at all prices on the market. For home sterilization the Schimmelbusch is the best known. There is a very mistaken view that high-pressure steam is of more value in sterilization than the vapour which rises from boiling water. As a matter of fact the latter is more powerful and is the form provided by a Schimmelbusch sterilizer.

In an emergency steam sterilization can be obtained in the ordinary vegetable steamer without fear of wetting the materials sterilized.

The gowns employed for surgical operations

should button behind and have long sleeves narrowed at the wrist to allow the gloves to slip over them. Men who adopt rubber gloves but retain their short-sleeved gowns make a great mistake in technique, for it is impossible to keep ligatures, instruments, and the assistants' hands from touching the skin of the operator's forearm.

Gowns, towels and dressings are sterilized by steam.

Hands.—An operator's hands must be most sedulously cared for, and anything that tends to roughen them avoided. The nails should be kept short and the skin around the base pressed back to prevent the formation of skin tags. These tags hinder thorough disinfection and are also a source of danger.

It has recently been suggested that dipping the hands, without preliminary washing, into liniment of iodine is all that is required to secure asepsis. Washing the hands is discouraged for the reason that the water causes swelling and maceration of the epithelium, which prevents penetration of the iodine. This practice is based on the undoubted fact that it is comparatively easy to kill the surface germs of epithelium. The spirit in the liniment cornifies the disinfected surface. It is now almost universally accepted that the deep layers of the skin cannot be rendered germ free by any known process of disinfection. While the micro-organisms found in the depths of the skin are usually of a comparatively harmless nature, this is not always the case. The hands are constantly liable to pick up resistant organisms, so that it seems safer to scrub thoroughly the surface epithelium with a nail brush and plenty of soap and water, frequently changed. The nail brush should be boiled each time it is used and kept in a sterile dish submerged in lysol solution. Each man has a brush for himself. The nails and the insides of the fingers require particular attention, and the scrubbing ought to be continued at least as long as there are any visible stains on the hands.

As an antiseptic a 1 in 1000 solution of biniodide of mercury in seventy per cent. of methylated spirit is the most efficient that can be used on the hands with comfort and safety. It does not crack or roughen the skin or injure steel instruments. The hardening effect from this is as great as that obtained from iodine. No matter what hardening agent has been used the skin soon macerates when exposed to the moisture of blood and lotions and the deep-seated bacteria are set free. From this it is clear that gloves add an element of safety that should not be neglected. If gloves are put on when the hands are taken out of the biniodide solution the antiseptic injures the skin. To avoid this the hands are thoroughly rinsed in

methylated spirit, which should also be placed in the gloves before putting them on. The spirit acts as an excellent lubricant and saves the necessity of using soap or any other grease. The glove is grasped by the gauntlet and pulled on with one movement. The reservoir of methylated spirit prevents sweating and maceration, and guards against the fear of infection from the escape of secretion when the glove is accidentally pricked or torn.

Dry gloves have become very popular, but it is difficult to understand how the inside of the glove fails to become septic very rapidly from sweating and maceration.

With practice rubber gloves do not in any way interfere with operative skill. Moreover, vaginal operations are a matter of sight and not touch, when long-handled instruments are used instead of short.

Operations in Private Houses.—An operation can be carried out in a private house according to the plans described above. But it often happens that in such cases the assistants are few and untrained, and the personal care of the operator is required for all details, which in more favourable circumstances may be left to the supervision of the assistant.

The room should be well lighted and ventilated; all the superfluous furniture, curtains, carpets and pictures are better removed the day before operation. The walls are dusted with wet cloths, and the floor scrubbed with an antiseptic solution such as lysol or creolin. These preparations should be made at least twenty-four hours before the surgeon is expected, as it is inadvisable to stir up the dust and dirt in a room immediately before operation.

It is a great advantage to have the room thoroughly disinfected with formalin vapour. If a special instrument for this purpose is not available, half a pint of formalin and an equal quantity of water may be evaporated in a shallow dish placed over an alcohol lamp. The doors, windows and chimney must be thoroughly stopped and the room left undisturbed for twelve hours. The windows and doors are then opened for several hours before the room is used.

A number of basins, jugs and other vessels should be boiled. Those that are too big to boil may be disinfected by immersion for at least twenty-four hours in a large tin bath containing a solution of corrosive sublimate (1 in 500), after having been thoroughly scrubbed with soap and water and rinsed with boiling water.

When working with little help and untrained assistants the problem of asepsis becomes almost insoluble. It is imperative that the patient be placed in the correct position and anesthetized, and all the instruments, basins and other

utensils laid out in their proper order before the final disinfection. It is extremely difficult to attain the ideal in this respect, and if it is necessary to touch anything with the hands, they must be rescrubbed before putting on gloves.

Finally, it is always advisable for an operator to conduct every operation with as little handling as possible of materials, for it sometimes happens that in spite of every care one's hands are unavoidably contaminated.

It occasionally happens that the time limit before an operation is not sufficient to permit of the great disturbance of the room and furniture necessitated by carrying out the details described. Under these circumstances the carpet should be sprinkled with sawdust soaked in corrosive sublimate solution and swept without raising dust. If sawdust is not obtainable washed tea-leaves make a good substitute. The windows are cleaned and the furniture wiped off with cloths moistened in the same antiseptic. The tops of shelves and presses are unfortunately often very dusty, and as open windows are nearly always a necessity in such a room this dust becomes a positive danger. To avoid its disturbance sheets saturated in carbolic lotion or corrosive sublimate solution should be laid gently over the furniture. A sheet of oilcloth under the side of the bed protects the carpet. On this is placed the bath to receive water and blood running down from the field of operation.

If the bed has a tendency to sag in the middle this may be overcome by putting boards across under the mattress.

E. H. T.

PUBERTY

Psychical and Physical Manifestations.—We apply the term "pubescent" to the period of female life when certain physical and psychical attributes mark the passage from childhood to womanhood. Hair then grows more rapidly over the pubes and external genitals; alterations occur in the contour and size of the breasts; the throat becomes fuller and the voice changes, while the whole figure of the girl indicates the development of sexual activities and the commencement of adolescence. There are certain psychical manifestations which occur contemporaneously with these physical signs. The intuitive knowledge of sexual sensations, feelings and attractiveness brings with it instinctive attitudes to her male associates and companions. Nature's defensive armour against sexual advances is instinctively assumed. Passions and emotions hitherto unknown or in abeyance are experienced; the girl begins to realize her power of sex, and strives to be the predominant partner in its influence with her

male and in rivalry with her female friends. Mental competition tends to develop her activities. She becomes more alert in conversation, more apt in rejoinder, and more intelligent in her work and studies. Her natural gifts in powers of memory, conception and imagination are more fully evidenced in her school life. In short, the child has become the woman, with all the distinctive features of her sex.

Where an improved hygiene maintains "physical culture" exercises, the gymnasium and outdoor games bring a corresponding development in the whole physique of the girl.

Sexual Activities and Menstruation.—With this transitional phase in her life are generated those localised activities in her generative organs, the ovaries and uterus, which are shown in the appearance of menstruation. During this time the evolution of the correlated structural changes and physiological processes in the ovaries and uterus is rapidly proceeding. The ovaries are assuming their primary position in the rôle of generative functional activity and the control of the physiological integrity of the uterus. The corpus luteum is asserting its relation to the metabolism of the ovary and uterus, and the lutein secretion is beginning to exert its mysterious influence not only on the generative organs and their functions, but on the entire economy, both from a psychical and a physical aspect. Henceforth for some thirty to thirty-five years of her life, if the normal interval of twenty-eight days be maintained, these organs will have but some twelve days physiological rest, allowing for the periods occupied by recuperation, œstrus and pro-œstrus; still less where there is a departure from this usual rhythmic regularity.

Here arises the question of the relation of ovulation to menstruation. It is true that the former functional activity may occur without the latter, and all the evidences of puberty may be present, though the girl does not menstruate. From some cause, either physiological in the blood current or in the nervous system, or in some congenital or acquired abnormality or malformation, the outward and visible sign of the rhythmic ovarian activity is absent. The egg is matured, and, in its maturation, the physiological effects of ovulation follow, but the uterine participation in the process is arrested, and the secondary and consecutive functioning uterine activity is absent (*vide Menopause*). The age at which this physiological and psychical change occurs varies, and is influenced by family peculiarity and maternal habit, climate, race, the affections of childhood, the character and quantity of the blood current, and environment. Anomalies in its first appearance are met with in all races and countries,

as in the rare occurrence of an apparent menstrual flow in early infancy, one instance of which we have seen a few days after birth. Here the infant's breasts were also enlarged and turgid. In another remarkable case we were consulted for profuse menorrhagia and metrorrhagia in a girl aged eight. But precocious menstruation in this sense is the rare exception, whereas a comparatively early appearance of the flow is frequently seen.

Time of Appearance.—In all climates there is a considerable difference as to the time of the first appearance of menstruation. This latter does not necessarily correspond with the onset of puberty. The menstrual flow may occur prematurely, and the other distinctive signs of pubescence be absent, or these may be present for a considerable time before the uterine discharge appears. In warm countries, as in India, menstruation in Europeans born in the country commences as a rule somewhat earlier than in temperate climates. In most European countries the average time may be taken as between the ages of thirteen and fifteen, though we find it occasionally beginning during the eleventh, or delayed until the seventeenth or even to the twentieth year. For instance, we have delivered the daughter of well-to-do parents in Ireland in her eleventh year. (See *Question of Examination*.)

In the northern climates, as in Lapland and Finland, the average time of puberty is from the ages of sixteen to eighteen, and menstruation in the poorer classes of Russia does not commence until sixteen to seventeen. In North America Engelmann's statistics show that the average age is fourteen, and that the race of those who have settled there does not appear to have any special influence in determining the time. We find examples of early menstruation—that is, between the ages of eight and eleven—in such countries as some Southern European States, Egypt, Western Africa, and in Australia among the aborigines.

Both Precocious and Delayed Menstruation, with or without the attendant evidences of pubescence, will suggest inquiry into the family maternal antecedents and the previous history of the girl's childhood. The occurrence of such infective diseases as typhoid fever, diphtheria, malaria and the exanthemata influence both its appearance and non-appearance. More particularly has tuberculosis to be remembered in this relationship. Only in exceptional cases is a vaginal examination called for. The occasional invasion of the genitalia of children and young adults by such pathological degenerations as tubercle, sarcoma, papilloma, cystic disease of the ovaries, and, more rarely, carcinoma, has, however, to be remembered. If there be hæmorrhage or other suggestion of

local disease, a carefully conducted examination under anæsthesia should be made without delay. There is also an imperative call for an examination in delayed menstruation when it is attended by symptoms significant of the usual consequences of primary amenorrhœa. On three occasions we have known a variety of therapeutic remedies used, including in one case resort to different spa waters, for an amenorrhœa which was proved on examination to be due to congenital malformation of the uterus with imperfectly developed ovaries. In such cases this congenital arrest of development of the internal genitalia is often attended by corresponding want of development or malformation of the labia, introitus and vagina. In one instance of absence of the vagina which came under our notice, there were associated psychasthenic symptoms, which were ameliorated by the construction of an artificial vagina. Another reason why examination should not be postponed in these cases is that the non-appearance of the menstrual flow may be due to atresia of the vagina, or an imperforate hymen, leading to all the dangerous consequences of retentio mensium.

Affections of Pubescence.—At puberty predisposing elements of weakness or disease, though they have been present from birth, or subsequently acquired, become the active factors in the causation of both *constitutional* and *local* affections. Among the chief of these are congenital abnormalities in the heart, anæmia, and chlorosis; tubercular disease; spinal neuroses and actual scoliosis; petit mal and epilepsy; hysteria; neuroses of digestion; rheumatism and chorea; skin affections; laryngeal neuroses; ocular troubles due to congenital refractive errors; hereditary syphilitic taint and syphilides; insomnia and somnambulism.

In the genitalia—malformations in the *ovary*, cystic or other ovarian degenerations, chronic oöphoritis due to gonorrhœal infection or rheumatism; in the *uterus*, atresia, stenosis, tuberculosis and retro-displacement; in the *vagina*, abnormalities, as absence or atresia, imperforate hymen, abnormalities of the introitus; such are the principal pre-existing states which materially affect the arrival of puberty.

Prepubertal Conditions.—Many of the constitutional affections of childhood will have called for treatment before the age of puberty. Some, however, especially among the poorer classes, escape attention, and from the stress of life have been neglected. So, when the critical age arrives, the girl with congenitally weak heart and poor blood suffers from deficiency of hæmaglobin and diminution of the corpuscular elements. Anæmia, leukæmia, and chlorosis result, with all their associated evils. The active sexual life begins with cardiac

complications which, though functional in their incipency, may eventually lead to some organic lesion. The same hæmic degenerations are potent factors either in originating or developing tubercular disease, whether in lung or bone. When accident sows the seed in the soil, it is well prepared for the germination and fructification of the infective germ. The fruit is gathered in the fatal effects of contagion and infection in the over-populated district or tenement. The girl whose back has been casually regarded as "weak," or whose complaint of pain has been lightly treated, develops a spinal neurosis with painful points, or there is a pronounced curvature and scoliosis, with pelvic deformity, which force attention to the spine. There may have been a diphtheritic paralysis in early years, an arrested poliomyelitis, or a morbus coxarius, which still further aggravates the pelvic mischief. Future Cæsarean sections and craniotomies are the harvests reaped here.

From early years the child may have been what is so frequently and ignorantly, in popular parlance, called "nervous." The appearance of some one or more characteristic symptoms of a group indicative of an organic or functional disorder of the nervous system has passed unheeded; the slight choreic movement or spasm of face, muscle or head, the passing convulsive seizure in an arm, the walk in sleep, the restless nights, are ascribed to the "nervous temperament" or an undue precocity and exceptional intelligence. School competition is encouraged, further study is enforced, hours of piano or violin practice are insisted upon; pubescence comes, and, with it, chorea or the epileptic seizure, somnambulism, and the nervous breakdown, with the onset of some erotic, neurasthenic, psychasthenic, or hysterical development.

Dermatoses and Syphilis.—At puberty skin troubles frequently show themselves in various papillar and other facial eruptions—erythematous, acneform, lichenous and eczematous. These are sometimes associated with absent or delayed menstruation, and are usually aggravated previous to or during the menstrual epoch. Poverty of blood or dietetic errors are the principal causes. The dermatoses may have a nervous origin, or the source of the skin affection may be found in an hereditary syphilitic taint. Collateral evidence of the latter is present in the characteristic teeth of Hutchinson; in the nails; in corneal infiltration; symmetrical osteoid enlargements, as, for example, the parietal "bosses" described by Parrot. The appearance of the typical congenitally syphilitic girl is unmistakable. The ill-developed stunted form; the sallow, muddy-looking skin; the square forehead, and the characteristic flattened nose and the wrinkles

at the angles of the mouth, all combine to form a picture which unmistakably shows the effects of syphilis on development and cranial and facial formation. A troublesome dermatosis is the occurrence of perspiration on any slight exertion—"hemidrosis." There is with this a peculiar odour when the axillæ and feet are implicated.

Aural, Ocular and Throat Affections.—Deafness from ossicular and ligamentous rigidity in the middle ear, with sclerotic thickening of the drumhead and the tympanic lining, often makes its appearance at puberty. In the eye, the choroid tunic is affected by chronic choroiditis, and pigmentation with atrophic changes are seen in the retina, or the brunt of the congenital taint falls on the cornea and the corneo-iritic angle. Interstitial keratitis, cyclitic congestion and blockage of the lymph channels follow.

Pharyngeal and laryngeal neuroses are not uncommon during pubescence. In the pharynx, spasmodic movements of the palatal muscles attended by audible noises in the ears; enlargements of the tonsils, and attacks of folliculitis; in the larynx, weakness or loss of voice, due to paretic states of the intrinsic laryngeal muscles; spasmodic cough from reflex excitation of the recurrent laryngeal nerve. Hyperthyroidism and goitre make their first appearance, and the early indications of Graves's disease are seen in the slight periodical enlargement of the thyroid, with the associated exophthalmos, more pronounced at the catamenial periods and often attended with exaggerated heart action and palpitation.

Abnormal Sexual Activities.—Abnormal sexual activities, whether in their absence or excess in the child and growing girl, are the source of many of the neuroses and psychic manifestations which come more prominently into notice at puberty. Whether in the main we agree with or reject the theories of Sigmund Freud, which have recently attracted so much attention, as to the causal relationship between the sexual experiences and the psycho-neuroses, we must recognize the conscious and unconscious influence on the mind of sexual impulses, either through their repression and unfulfilment, or their aggravation and excessive gratification. Hence eroticism is so frequently the precursor of neurasthenia and hysteria. Masturbation is the widely recognized cause of various disorders of mentalization. In it we have a complexity of causes operating. There is, in the growing child, the unnatural and recurrent excitation of the sexual organs, bringing a state of constant unconscious unrest of these at a time when the completion of the sexual cycle through the physiological activity of the sex organs cannot be attained. There is consequently a nervous break and explosion at each repetition of the

act which reverberates throughout the whole system of the girl. Hence, in masturbation we have a frequent cause of insomnia, startings and restlessness in sleep, nightmares and disturbing dreams. Later on, there is the depression, with mental and physical reactions, which follow on the need for secrecy, and the sense of shame or remorse. At puberty, when, with menstruation, the genitalia, in the ovarian secretion and uterine functions, are beginning to assert their predominating influence in the developing woman, there is, from self-abuse, the "throw-back" on all the generative forces and phenomena in the baulking of the natural completion of the sexual organism by coitus. Nature, whether the fault be in some flaw in her own constructions, or in her mistakes, or in the disregard of her laws, resents such interference with her plans, and often unreasonably visits on the woman punishment for consequences for which she herself is responsible.

Absence of Menstruation.—At puberty the absence of the menstrual flux is not infrequently the attendant on one of three conditions of the genitalia:—(1) Healthy ovaries with aplasia of the uterus; (2) unhealthy ovaries with a normal uterus; (3) congenital absence or atresia of any or all of the genitalia. With these conditions, we find such psychic states as agoraphobia, claustrophobia, sensations of unreality; neurasthenic fatigue; "borderland" ideas and misconceptions, as unreasonable dislike to relatives, friends and teachers; distaste for the company of men on the one hand, or erotic behaviour and advances on the other. Later on, these lesser psychic disturbances may merge into true apprehensive delusions—melancholia and other forms of actual insanity.

On the physical side, primary amenorrhœa has occasionally associated with it acromegaly, undue obesity, looseness of the sacro-iliac joint; sacral pain and backache; constipation, chlorosis and functional cardiac affections.

General Management of the Pre-Pubertal Period.—From what has been said it is obvious that the years of childhood afford in many instances *premonitory indications* of the nature of the trouble which may arise during pubescence. As examples of some such warnings we may take those which occur in one of the organs of special sense. There have been recurrent attacks of phlyctenular conjunctivitis, with defects in vision and headaches; indications of naso-pharyngeal obstruction from adenoids and enlarged tonsils, in physiognomy and oral breathing, or some defect in hearing due to these naso-pharyngeal obstructions. Or the child may have been of the type we have included under the head of "nervous." There has been an abnormal precocity, with accompanying

irritability of temper and hyper-sensitiveness. Slight epileptiform or choreic spasms have been present during her earlier years. Spinal weakness has shown itself in slight curvature with muscular fatigue. The circulation from childhood has been habitually languid, and the girl is subject to coldness of the extremities, with possibly the coexistence of a cardiac abnormality, congenital or acquired. An acute disease such as rheumatism, pneumonia, diphtheria, or a severe attack of scarlatina or measles, may have bequeathed as its sequel some permanent delicacy. The signs already referred to of transmitted syphilis may be apparent.

In the poorer classes of society such warnings frequently pass unheeded, though under an improved national system of school inspection in the State schools such neglect of these defects in the sense organs, or any constitutional weakness, should be impossible. In the case of the well-regulated private school it is inexcusable. The head of any State or private school for girls ought to be instructed in the special dangers likely to arise during the period of pubescence, and should be alive to those antecedent indications of individual weakness at this critical time. State intervention in improved sanitation generally, and especially in medical inspection of dwellings and the notification and isolation of infective disease, will do much in this direction. We have, however, to look more to the realization of the importance of hygienic rules and precautions in the domestic life of the home, both of rich and poor, and the enforcement of these by the heads of families and teachers of schools, to save the womanhood of the nation from ills, many of which are preventable, while others can at least be ameliorated. It is not overstating this need in insisting that every head mistress, before being permitted to act as such, should possess a certificate of proficiency in general hygiene, including a knowledge of dietetics, and the principles which govern cleanliness, proper clothing, exercise, study, rest, sleep, isolation in sickness, and ventilation.

The great failure, both in domestic and school life, is the lack of appreciation, on the part both of parents and teachers, of the difference in the mental and physical capabilities between individual members of a family or amongst the pupils of a school. There is a tendency to exact from all, both physically and mentally, the same devotion to household duties and physical exercises, the same proofs of mental excellence, irrespective of the great dissimilarity which may exist between individuals, both in the family and the school.

Recognition of these general principles which deal with the predisposing causes of ill-health during childhood and the effects on the girl of

her environment, sees puberty approach under more favourable conditions. Special attention has been paid to the eyes, ears, nose, throat and teeth. Refractive errors have been corrected, attention has been given to hypertrophic states of the tonsils and defective respiration, through the removal of nasal abnormalities and adenoids; signs or symptoms of spinal weakness or curvature have been met by suitable orthopædic remedies and gymnastic exercises. The causes of anæmic or chlorotic states and respiratory troubles have been inquired into and treated. Efforts have been made by a general tonic, hygienic, dietetic and therapeutic regimen to correct any flaws observable in the nervous system and the mental development of the girl.

Management of Puberty—Errors of Menstruation and Question of Examination.—In a fair proportion of cases menstruation commences naturally, and there is but little pain and no symptom specially requiring attention. On the other hand, from the start there may be dysmenorrhœa and irregularity in the quantity and quality of the flow, as also in its normal rhythmic periodicity. The menses may be present, or manifest at uncertain intervals, though the menstrual flux is absent; or the girl may pass into womanhood, and reach her seventeenth year, without any evidence of ovulation or menstruation. Where there are lapses in the recurrence of the period, if the health of the girl should not suffer, inquiry into her habits and the routine of her daily life will often elicit some cause which explains their non-appearance and the continuance of the irregularity. There has been some indiscretion, such as over-exertion, cold bathing, or undue mental strain. Rectification of these errors and resort to simple remedies, will generally be sufficient to ensure a return of the regularity. In the great majority of such cases ovulation occurs, though the menstrual evidence of it is absent. Here there is no justification for any local examination. Two broad rules are to be followed with regard to the examination of virgins during pubescence. The first is to avoid, both by questions asked her and conversations carried on in her presence, the direction of her attention to her sexual organs as the cause of whatever symptoms or signs which may be present. A morbid sexual introspection, if aroused, may become a permanent source of neuroses, or lay the foundation of the future neurasthenia or psychasthenia. Parents or those in charge of the patient can give any information required, and this can be supplemented by a general examination carried out in such a manner as is calculated to divert her mind to other organs than the sexual.

The adoption of this plan is the more emphatic-

cally to be insisted upon in the instance of a daughter or school-girl for whom we are consulted while her health is in every other respect good, though there be protracted delay in the appearance of menstruation. It is not amenorrhœa in the true sense of the term, and nature's dilatoriness is generally rectified by time. Not infrequently this is an hereditary family characteristic.

On the other hand, it is necessary to be equally emphatic on the point that examination must not be deferred when inquiry leads to a well-grounded suspicion that the physical or mental affection for which advice is sought is linked with, and correlated to, some malformation or abnormality in the external or internal genitalia. Such an examination has to be conducted with the utmost gentleness, and always under the influence of an anæsthetic—preferably nitrous oxide gas and ether. By the bimanual recto-abdominal and recto-vaginal examination, supplemented when necessary by the recto-vesical, the buttocks being slightly raised, even if there be a closed introitus, the presence or absence of the genitalia, or malformation of these, may be detected. Such information is not only needed to prevent mistakes in treatment, but is of the highest importance with regard to the future married life of the woman. Unlikely though it be, the possibility of conception having occurred has to be kept in mind in cases of menstrual irregularity associated with other symptoms of ill-health. We have delivered a girl of ten years of age at the eighth month under anæsthesia who was absolutely ignorant of the cause of the tumour for which she was told an operation was necessary. As the infant died shortly after birth, and the breasts, which secreted freely, were at once treated, she remained, so far as we knew, without any knowledge of the true reason for the operation. We have had other cases of quite young girls brought to us by mothers for digestive troubles and constipation attendant upon amenorrhœa, where examination has revealed pregnancy as the cause.

General Hygiene.—To the supervision of the general hygiene of, and the moral influence exerted at, the pubertal period, while attention is directed to any disorder of function, we must look for the regulation of the health during pubescence. All such supervision must have a special relation to the catamenial epochs. They include the healthful environment and the habits of the girl. The hygienic details include bathing and cleanliness, exercise and games, the judicious use of the gymnasium, and the apportionment of exercise and play to the physical strength of the girl. Equally important is the adjustment of the amount of study and the severity of mental tests to her intellectual

powers. This is always the danger, possibly unavoidable, of class and school competitions in which little regard is paid to relative capacity or the difference in individual tastes and aptitudes. The absurdity of the enforcement of long hours of musical practice, in which the old simile of the uselessness of "trying to extract a musical note from a piece of putty" is applicable, may be taken as an example.

Moral Influences.—With regard to moral influences, cheap fiction of the novelette type, and many theatrical plays to which young people of both sexes are taken; the popular "Palace" cinematograph theatres, with their vivid portraiture of sexual passion, dangerously suggestive to the youthful female mind; the commingling of the young of both sexes in outdoor games; the whole effort, shown in modern female clothing, to attract attention and excite sexual desire, and which delicate-minded women themselves do not hesitate to pronounce "indecent"; the free access to a Press that brings into prominence the libidinous details of every divorce case; all these influences, added to the utter indifference as to their effects shown in home life, and often through the example of the mothers themselves, excite in the girl, who is just experiencing her first instinctive impulses of sexual desire and passion, morbid feelings and erotic sensations. In the well-ordered school, with a head who is fully alive to the inherent dangers of the pubertal period, and who studies the individual temperaments of her pupils, keeping a careful watch, both herself and through her subordinates, over their tendencies and habits, these evil influences are absent.

But most female schools are presided over by spinsters who have not the instinctive protective sense of motherhood, or the experience which married life teaches, to prompt such supervision over, and advice to, those committed to their care as will carry them safely through this critical time.

Qualified medical women are now to be found in most localities, and every female school should have its course of physiology conducted by one of these, or if this be not possible, by the head mistress herself, whose capacity as a mistress should cover the ability to do this. A valuable and delightful adjunct to such a course is one on botany and the physiology of plant life. This instruction, judiciously given, would present many studies which unavoidably touch on topics that excite the imagination and arouse sexual ideas and impulses in a more healthful way to the student. On the moral influences exerted on the female mind in home and school life, during pubescence, depends the future *mens sana in corpore sano* of the individual

woman and, collectively, the healthy motherhood of the nation and the race.

H. M. J.

THE MENOPAUSE

Menstruation: Psychological and Physical Influences.—Whatever view may be taken of the nature of the menstrual molimen, and the physiological phenomena which anticipate and accompany the appearance of the flow, one fact is clear—menstruation in its first advent in the girl, and its cessation in the woman of advanced life, has a profound influence, both psychological and physical, on the female organism. The various views and hypotheses which have been advanced to explain the menstrual functions are dealt with in the article which treats of the physiology of menstruation.

The close connection between ovulation and menstruation, even if we in part accept Reigel's view that they are not necessarily interdependent, is sufficient to explain why the cessation of the menstrual function should seriously affect the general health of the woman. With a rhythmic regularity important generative and metabolic processes, in which the ovaries and uterus mutually participate, are associated with nervous and circulatory disturbances which are continuous throughout the entire period of sexual activity in the life of the woman. By the gradual decline or sudden stoppage of these reproductive processes the whole system is necessarily affected. During this periodic wave-cycle ("Wellenbewegung") of actions and reactions, lasting for some thirty to thirty-five years of life, there are regular alternations in functional activity, as shown in the temperature, respiration, blood pressure and heart action, which are associated with variations in general and local metabolism. This metabolic increase or diminution affects the nitrogenous elimination in the quantity of urea excreted, the proportion of hæmoglobin and fibrinogen present in the blood, as also its calcium content. These latter changes influence its coagulability.

What *exact* influence is exerted in the economy (outside its effects on the uterus) by the corpus luteum and the formation of lutein tissue, as also by the increase and decrease of the ovarian secretion, we do not know. That lutein influences the fertilization of the ovum, is associated with the changes occurring in the uterus for its reception when fertilized, and possesses active katabolic properties in nitrogenous metabolism, is a clear conclusion from the results of recent experimental physiology.¹ We are also justified in concluding that it has an important relation to the development and functional activity of

¹ See *Lutein in Premature Menopause*.

the mammary gland. The influence of the ovarian secretion on the osseous system is clinically shown by the effect of oöphorectomy in cases in which the operation has been successfully performed for the cure of osteomalacia.

Contemporaneously with this periodic increase and decrease in function there are psychophysical activities and manifestations, in which the entire nervous system participates. The normal correlation between sexual impulses and cerebral inhibition and control is variously influenced in different women. Race, climate, maternity and the conditions of environment more or less affect such relation.

It is true that we occasionally do not detect any discoverable proof that the loss of such independent or correlated functional energies in uterus and ovaries affects permanently in any degree, either from the mental or physical side, the general health of the woman. This is exemplified in the apparent absence of any ill effect when there has been early cessation of menstruation, or when oöphorectomy or pan-hysterectomy has been performed in early life. The temporary disturbance—lasting for varying periods—passes off, and we detect no objective signs when from either of these causes menstruation has ceased from the years of twenty-five to thirty and upwards. But it has to be conceded that very frequently the ulterior effects are not traceable. The woman is lost sight of, and her after-history is unknown. It is most difficult, if not impossible, to trace psychical interferences with, and their subtle influences on, her mental attitude throughout her future life.

So in regard to the physical side. A symptom which has its origin in some abnormal state of an organ of special sense or functional nervous disturbance may not appear to have any direct relation to that particular organ. In their incipency such abnormalities may pass unnoticed, or are not complained of. Thus the secondary effects of the cessation of generative processes in which the entire genitalia have regularly participated, and which have brought in their train various visceral reflexes and neuroses, may escape the notice of the physician, or he may not realize their relation to this interruption. Some general statement of freedom from pain is accepted, and as there is no other indication of ill-health the individual passes from under review. Yet, in the great majority of such cases, if inquiry be made into their history in detail, it will be found that there have been present physical disturbances of one form or another, however so slight or transient. To take a few examples. They are recognized in defects of vision, the result of retinal hyperæmia or a transitory optic neuritis. The manifestation of refractive errors which have been

previously latent becomes now pronounced through the weakening of a previously sufficient corrective accommodation, and such errors are a frequent cause of headache, sickness and ocular migraine. Or there may have been varying degrees of paresis of the intrinsic muscles of the larynx, with alterations in the voice and periodical attacks of aphonia. The auditory apparatus may be affected, with a resulting hyperæsthesia and intolerance of certain sounds, and diverse forms of tinnitus, probably due to vasomotor effects on the circulatory current in the labyrinth. Again, nasal respiration may be impeded and audition suffer, through hypertrophy of the turbinals, which is often overlooked as the cause of tinnitus, migraine and deafness. Such abnormal reflexes and other visceral neuroses are equally observed in amenorrhœa and dysmenorrhœa.

Early Indications of the Approach of the Menopause.—It is most important to recognize the early indications of the approaching cessation of menstruation. In order to do this, we must understand the limitation in regularity, duration, quality and quantity of flow which are consistent with the healthy molimen. These vary considerably in different women. The perfectly normal period comes with a regular interval, seldom varying, of twenty-eight days, though a shorter time, say of twenty-one days, is quite consistent with health, if this be the ordinary habit of the individual. The same variation is seen in the duration of the flow. Any time within from two to seven days may be approximately set down as the healthful limits of duration. There are exceptions to this rule, even to a flow of twenty-four hours at one end of the scale, and eight days at the other, but such deviations will at once arouse suspicion of some departure from the normal. When we come to consider the flow itself, we find here also considerable differences consistent with health, in the manner of its onset and its quantity, even in the same individual at different times. The same variability is seen in the premenstrual symptoms and signs, as they are exhibited in general lassitude, mental and physical fatigue or inaptitude, pain, pigmentary changes, and mammary sympathies, all of which may be completely absent.

The duration of the period is not as important clinically as the regularity, character and quantity of the discharge. The loss may be uniform from the commencement to the end, or it may be considerable for the first two days, and then gradually lessen. From the number of diapers used during a period we may in practice roughly estimate the loss, whether these be only wet, or saturated through; if they be ordinary linen napkins or thick "sanitary" towels. Any number over six or eight

points to excess, and more than a dozen is indicative of menorrhagia. The reappearance of discharge, or the occurrence of an intermenstrual menorrhagic flow, should always excite suspicion.

We thus find that in some break in the regularity of the catamenia, variability in their quantity and change in their character, the early indications of the approaching change in the sexual cycle are manifested. This refers only to the alteration in the menstrual flow itself, and it applies equally to any time of life at which the irregularity occurs. That time varies. In the majority of women it takes place between the ages of forty-seven and fifty, but in a considerable percentage it commences at forty-five, or may be delayed until the age of fifty-two. Further limits are reached, to the age of sixty and even beyond, but they are very exceptional, and most frequently there is some pathological abnormality present.

The women who have an early menopause—and we have known it to occur at the ages of thirty and thirty-five, at which times there are many instances on record—are the exceptions. Frequently there has been some antecedent scantiness or irregularity; or abrupt stoppage has been caused by some mental shock or accident. An obvious congenital abnormality of the uterus may be found on examination. Heredity plays a part in others. We have known an early climacteric occur in an unmarried girl with no untoward symptoms following, while, on the other hand, we have seen serious associated clinical consequences.

We include in these limitations the time of the first appearance of the signs of the approaching change, and apply the term "climacteric" to the time occupied from that date until the final cessation of the catamenia. The healthy menstrual fluid does not clot, the normal ratio between the amount of blood and its other constituents being relatively maintained. When that proportion is altered by excess or diminution in the blood or mucus constituents, clotting occurs, and it is, as a rule, an indication of some physiological or pathological error.

Histological Changes in the Genitalia.—It is necessary to remember that immediately antecedent to the menopause, and after its appearance, important histological alterations in structure have commenced in the genitalia. These may be briefly summed up under the heads of ovarian, tubal, uterine, and with those occurring in the vagina and external genitalia. There is a general shrinkage of the ovary due to atrophy and cirrhotic changes, with lessening of the number of the Graafian follicles, leading to their gradual disappearance. Atrophic changes appear in the tubal wall, which result in general shortening of the tube and contraction

of its lumen, accompanied by a disintegration and disappearance of the epithelium; atrophy of all the uterine tissues follows, resulting in general muscular and glandular degeneration, which ultimately lead to shrinking of the entire organ and narrowing, even to the point of obliteration, of the uterine canal and its utricular glands, with general thinning of the endometrium. In some instances the portio disappears, and the os uteri is found flush with the vaginal roof.

Contemporaneously we have characteristic departures from the normal in the vagina and external genitalia. The former is shortened, becomes narrower, and its walls lose their elasticity. This results in a general contraction of the canal. There is narrowing of the introitus, the labia become smaller, the adipose tissue decreases, and the mucous surfaces alter variously in appearance, owing to glandular atrophy, which leads to a greater dryness and change of colour.

Advent of the Menopause.—In exceptional instances the catamenia cease abruptly, or with only some slight irregularity, and the change is not marked by any clinical signs or symptoms. Such a fortunate transition, however, is not usual, and varies in degree in different individuals. The event is generally attended by some indications, which may be experienced only by the woman herself, and not be apparent to her friends. They are possibly not of sufficient moment to require medical advice, and hence such women are often looked upon as having had no disturbance during this transitional interval. Again, women vary greatly in their power of self-control in the presence of pain or mental distress, and in the concealment of their feelings and emotions. Many have an exaggerated sensitiveness in their dislike to attract attention to any aberration in their sexual functions. Others desire to put off the realization that the inevitable autumn period of life has arrived, and they refuse to accept the unwelcome evidences of its approach. Hence, complaints of erraticism in periodicity, in the persistence, character and quantity of the flow, with minor emotional agitations and passing psychic disturbances, are ignored or stifled. Consequently, a wrong interpretation is not infrequently put on the woman's acts or expressions, which have their explanation in morbid excitations of which those about her are in ignorance.

When complaints are made during this time they are generally confined to some manifest alteration in the quantity of blood lost, the stoppage of one or more periods, or the recurrence of discharge in the intervals. A slight leucorrhœal discharge may follow the period or persist through the interval. Associated

with these local signs come various subjective symptoms—slight attacks of giddiness, a sensation of fullness in the head, and transient noises in the ears; some difficulty, hitherto absent, in concentration of thought, in mental work or business capacity, with an acknowledged irritability of temper; morbid blushing on slight provocation, and even without such, is another most annoying symptom. Such complaints of heat and hot flushes are frequently alternated with feelings of icy coldness in the extremities or down the spine, and this is often attended by a sensation of numbness in the feet or hands. Pain radiating from the sacral and ovarian plexuses is often complained of; more rarely coccygodinia and anal pain may be present. Headache is very common, and when located over the brow or in the occipital region should call for investigation of the patient's refraction, while a continued tinnitus suggests an examination of the ear and naso-pharynx. Dyspeptic troubles in digestion, bowel irregularities and flatulence are not uncommon. Palpitations and "flutterings," attended by intermissions in the pulse-beat, distress the woman. A change in figure follows and there comes a tendency to increase of fat and general obesity. These, as various other symptoms, have their origin in a defective vasomotor control or an undue excitation.

As has been said, all these symptoms may be absent, and menstruation cease abruptly or after a few irregular and excessive periods; or the disturbances are so slight as not to demand any medical intervention. On the other hand, the irregularities may continue for months, and extend over a considerable time, during which the woman is more or less a sufferer from some of the symptoms already mentioned. These may be grouped under the head of minor disorders of menstruation, but in many cases they are aggravated, and, usually then, most seriously affect her health.

Graver Complications.—We may consider such graver conditions under these heads:—*Circulatory, Nervous, Visceral* (in which we include the digestive and genito-urinary organs), and *Local or Genital*.

Circulatory Disorders.—The more serious disorders of the circulation have frequently a dual cause for their source:—(1) The regulating effect of vasomotor vascular inhibition is weakened, and the normal correlation between the sympathetic control and the cerebro-spinal nervous supply is more or less lost; (2) alterations in the quality of the blood itself, shown either through its impoverishment in various phases of anæmia, brought about either by excessive losses or from the presence in it of abnormal elements, to which latter the term "toxic" may occasionally be rightly applied. These

defects we find to be constantly associated with digestive errors and changes in the urine, excess or diminution of the chlorides, and a faulty relation in the proportion of uric acid and urea to the other elements, occasionally associated with oxaluria, and, with the latter, nucleo-albumin or traces of albumin, some blood cells, and a low specific gravity. Interference with the cardiac rhythm reaching to attacks of tachycardia and dyspnoea and sensations of faintness which may be followed by actual syncope, are some of the more usual consequences. The milder vasomotor symptoms are aggravated, amongst which are a sensation of "bursting" in the head, constant tinnitus, retinal and conjunctival congestive conditions, and headache. Epistaxis, which is due to altered blood pressure and turbinal congestion, may occur; this is not, in the strict interpretation of the word, "vicarious," though the bleeding, as that which occasionally comes from the lungs and the bowel, appears at times to have a periodicity in recurrence and to synchronize with the menstrual epoch. We knew one such case, in which, for some months after the menstrual discharge stopped, periodical violent hæmoptysis occurred. All such hæmorrhages must be looked upon as pathological, and their cause investigated. In this, as in many other directions during the menopause, *no untoward symptom should be minimized and neglected, with the assurance to the patient that it is "due to the change of life."* Such an attitude is alike disastrous to the patient, and ultimately to the reputation of the practitioner, when, later on, some unlooked-for disease of an organ is discovered.

Nervous Affections.—The complexity of the symptoms which appear to have their origin in the nervous system during the menopause is in part due to the special hypersensitiveness of the woman, and her susceptibility during this time to various neuroses, visceral and other, many of which are reflex. It is often difficult to say at which end of the vicious circle the mischief begins; whether the disorder of function of the viscus is due to a local affection arising in the organ or part itself, consequent upon some organic or pathological condition, or to a neurosis which is induced by a reflex originating in the genitalia. Thus it may become well-nigh impossible to differentiate by the local signs and symptoms between the two. We learn the practical lesson that all affections, whether of one of the organs of special sense, the respiratory organs, or those of the digestive and urinary systems, to which a woman appears to be specially subject during this time demand careful investigation of the organ, viscus or local area so affected.

Misuse of Terms. Here, in passing, it may

not be amiss to enter a protest against the far too casual and indiscriminate use of the terms "psychasthenic," "neurasthenic," "neurotic" and "hysterical." This is true all through the years of menstrual life, but especially it applies to the time of its cessation. It is certain that more serious consequences have resulted from the misapplication of these terms than from any other ignorant generalization in diagnosis, under which convenient cloak we may also include gout, rheumatism, and heredity.

In the great majority of cases the symptoms which are thus roughly classed from want either of careful investigation or sufficient knowledge, are subjective evidence of some initial organic lesion or fault of function. They are phrases which a practitioner will do well to regard with a sceptical mind and hesitate to introduce into his routine vocabulary. The attitude of the friends of the neurotic or nervous woman is generally either openly to treat her complaints with contempt or to ridicule them behind her back; not infrequently they are unpleasantly roused to a sense of the reality of the suffering by the more active and pronounced evidence of some serious mental or physical development.

On the other hand, the sufferer whose condition is accurately defined as embraced in any one of these terms demands the same sympathy and careful management as the possibly more pitied though more fortunate victim of some organic defect which can be remedied by ordinary therapeutic or operative measures. It is well for the practitioner to always remember that a woman slighted usually means a man hated.

If, then, we class under the head of "nervous" only certain symptoms and phenomena, we do not thereby exclude the original part played by the nervous system in the initial stages of an affection, organic or functional, either of the sense-organs, viscera or the genitalia themselves. The interdependence and co-operation in action of the cerebro-spinal and sympathetic centres in maintaining and altering functions, and in inhibiting or exciting reflexes, makes this prevision and limitation evident. We enumerate here only those nervous states and disorders of the menopause with which it is more specially the province of the psychologist to deal.

Disorders of Mentalization. It is not possible to discuss here the different types of mental disorder which are more frequently met with in women, and particularly at the change of life. Any of these may be present, from such milder psychoses as obsessions, sensations of unreality, groundless apprehensions, insomnia, hypochondriacal fears and complaints, to the more serious conditions of melancholia, per-

sistent illusions and delusions, dementia, hysterical insanity and mania. The more exact differentiations between the different types of psychoses, which often partake of a phantasmagorical character and shade off one into the other, are of interest rather to the psychologist than the gynæcologist. It is, however, very necessary for the practitioner to recognize the earlier indications of mental disturbance.

Various Psychoses. These indications, which have frequently a definite periodical feature, are so slight in their incipency, and vary so in their character, that they are disregarded by relatives and friends in the daily domestic life of the woman. An expression of physical and mental inaptness and fatigue in a previously active-minded and energetic woman; an unusual excitability and irritability in one hitherto of an even and placid disposition; an obvious loss of interest in amusements, social pursuits and domestic occupations, which before had given pleasure; a proneness to constant complaints of pains, which are not justified by any local condition, in one who has usually been uncomplaining and self-restraining (such pains can be aroused by suggestion, and are of the type which is relieved by it); the unexplained and sudden dislikes to friends and even near relatives, where before there had been friendly and affectionate relationships; a brooding over trifles, depressing anticipations and apprehensions of imaginary losses appearing in a temperament which has always been hopeful and bright; these are the more generally occurring indications of some graver abnormal psychic change impending. The condition may not pass beyond this, and as the menopause terminates such psychic deviations may gradually cease and the individual revert to her normal mental attitude. In the instance of one in whose previous disposition and temperament any such mental inconsistencies have been habitually present these psychoses are likely to be more aggravated, though for that very reason they are less commented on by friends. If more pronounced psychic symptoms develop they show themselves in a variety of ways. Amongst these are persistent insomnia, sensations of unreality (often referred to an extremity) associated with ideas of de-personalization. Some particular "phobia" increases in magnitude and intensity. Obsessions, as "imperative ideas," conquer the patient; she cannot dismiss the belief that she has committed some crime, has been unchaste, or that her husband, if she be married, is unfaithful to her. It may take the form of an irremovable impression that she has some incurable disease of a certain organ. In short, the psychasthenic woman, with her fixed persistent obsession, becomes a hell to herself, and is ever looking for a "lower deep,"

to which "that from which she suffers seems a heaven." Hence arise the dread and horror of certain impulses, inciting to the commission of some revolting or criminal act which they fear may become irresistible, though it seldom does.

It is not difficult to understand how such psychasthenic states occasionally merge into the graver disorders of mentalization, such as apprehensive delusions, melancholia, suicidal or homicidal impulses, which come more particularly into the domain of the alienist to treat. There is an important practical fact to be borne in mind in regard to such patients, namely, the suddenness with which such impulses appear and may be acted upon. The apparently harmless psychasthenic whose morbid fears, beliefs and insane inclinations are considered dormant will suddenly, under some slight provocation, commit an act of which she had been thought incapable. The commencement of some necessary medical treatment or regimen, the proposal to perform or the carrying-out of an operation, may be sufficient to incite her to this. Consequently, such a case demands constant watchfulness and the presence of a nurse who is familiar with the management of this class of patient.

Hysteria.—The disorder may be of the true hysteria type. In this instance the foundation may have been and often has been laid in a transmitted predisposition, and the affection has been developed under accessory influences, such as depressing and gloomy surroundings, impoverishment of blood, and the associated effects of a slowly increasing anemia.

The term "hysterical," when applied to any disorder of the menopause, should be reserved for the symptoms which are due to true hysteria, as that disease is now understood. We have here only to consider its relation to the menopause.

When a woman at this period of her life becomes morbidly introspective, loses her will power, is subject to alternations of uncontrollable emotion, has lapses of memory of recent events, is ever on the watch for sympathy, consciously or unconsciously mimics some affection, as, for example, a paralysis of a limb, articular stiffness and pain (*not true spinal arthropathies*), we may suspect from the mental side of the picture that we are dealing with a case of hysteria. If there be added to these psychic phases hyperæsthesia, anæsthesia or analgesia in some sensory areas, and that evidence of involvement of a motor tract is shown in a monoplegia, paraplegia, hemiplegia, spasm or contracture, while the usual tests of the reflexes and muscular electrical irritability give normal responses, we shall be confirmed in our view. A throat symptom in some form of spasm,

aphonia or globus hystericus is a common accompaniment to the other manifestations. Such patients are easily hypnotized. Suggestion will often produce a symptom, and equally relieve one.—The graver forms of the affection are not very frequently seen in the British Isles. These include convulsive seizures, epilepsies, hystero-epilepsies, trances and catalepsies. There may be great difficulty in diagnosing the true nature of many of these conditions, and the practitioner must bring to his aid all the resources of the neurologist in applying tests for the presence of a cerebral, cerebro-spinal or spinal organic lesion, in order to exclude such before arriving at a conclusion. These differential diagnostic signs and tests are elsewhere described. The possible passage of the sufferer from hysteria into melancholia and insanity has to be remembered.

Hypochondria.—Quite distinct from hysteria, and in some form more frequently met with in women at this time of life, is hypochondria. The degree may vary from the apprehensive, nervous woman who comes complaining of pain in various situations, and has an unjustifiable dread of some fatal affection (generally cancer), to the confirmed nosophobic who suffers from a variety of sensations in this or that organ, and who is quite incredulous when assured that these organs are healthy. Such hypochondriacs may become melancholic, and hypochondriacism has its twin sister in melancholia. The hypochondriac is the ready prey of the charlatan and advertising impostor, for she is ever on the search for a new remedy to relieve her from the elusive sufferings of some disease which her obsessed imagination, on which he plays, conjures up. The pronounced melancholic, on the other hand, despairs of cure; the very hopelessness of her misery brings her to the borderland of insanity, and some fresh accident or misfortune carries her over it. Her apprehensive delusions prompt her to suicide, from which her weakened will and wavering indecision alone save her, or some maniacal outburst may compel supervision and asylum restraint.

Neuralgias.—As a nervous disorder, neuralgia in some part or organ is quite distinct in itself. It may occur in a woman who is neither neurasthenic nor psychasthenic; it may be present as an isolated feature of her menstrual transition. The psychic and physical symptoms and signs, usually correlated to the presence of neurotic pain, may be absent. We have known a woman, just past the time of the menopause, who was cured for an hæmorrhagic endometritis, otherwise in apparently perfect health and vigour, who suffered for some years from a lingual neuralgia, with intense sensitiveness of one side of the tongue. These pains may be trans-

mitted sensations (Dana) or true reflexes. They may be felt in any region and in any degree of severity. They often appear with startling suddenness, and may as suddenly cease. As, for instance, there is the cardiac pain attended by spasm and hurried respiration which closely resembles an attack of true angina pectoris. In most cases careful inquiry into the discharge of the digestive functions, the nature of the renal secretion, the health of the genitalia, and an examination of the condition of the teeth, the refraction of the eye, and the state of the naso-pharynx will throw light on the true causes of the pain. The regions more frequently complained of are the occiput, over the vertex or across the brows; the teeth, or some branch of the trigeminus; the left sub-mammary intercostal pain; right sub-scapular pain; the ovarian, the coccyx; the anus and up the rectum, and through bladder and urethra.

By these neuralgic pains sleep is often disturbed and partial insomnia induced. With associated menstrual losses, menorrhagic or metrorrhagic, which cause an anæmic condition, the power of endurance is diminished, psychoses appear, and the woman becomes neurasthenic. The caution is again necessary—not to regard or treat any pain as a simple neuralgia before a careful examination of the organ or part affected has excluded any organic change, functional fault, or reflected irritation. More especially should close inquiry be made into the discharge of the functions of the genito-urinary organs, kidneys, bladder, uterus and ovaries. In some one of these may be discovered the proximate cause of the pain.

Mental Responsibility and the Menopause.—Most important issues of a forensic and sociological nature occasionally arise, the answers to which involve the question of the mental balance and responsibility of a woman who is suffering from the menstrual irregularity of the menopause. So far the evidence that has been adduced (Marx, Salerni, and others), and which is in accordance with our own experience, tends to prove that during the ordinary menstrual epoch there is in many women either an exaltation with excitation of the mental functions, or, on the other hand, a corresponding lowering and depression of these. In some this influence is more marked in the pre-menstrual period, in others during the flow and the immediate post-menstrual time. Nor can there be any doubt that during these times of excitation or depression some women, who at other times are in every respect normal in their acts and social relationships, manifest abnormalities in their characters and in their mental attitudes, even to the extent of an inability to form a clear discernment of what is right or wrong. When the climacteric approaches, and while it lasts,

and for some time after menstruation has ceased, these mental effects are naturally aggravated through the more abrupt interference with, and the graver irregularities in, the appearance and nature of the act. Hence in the investigation of any criminal act committed during this time an important, indeed indispensable, element in apportioning responsibility must be the antecedent mental condition of the woman, and that present at the time of its committal. If acts quite inconsistent with her established character, erraticisms in conduct hitherto unknown, attitudes to friends and relatives out of harmony with her previous relationships have been observed and noted, then such facts would go far to justify a belief that she was not responsible in whole or part.

Dermatoses.—We include under the heading of “nervous” those affections of the skin which are of so common occurrence during the menopause. This does not negative their occasional origin from the presence of abnormal constituents in the blood. Some uterine disorder has brought in its train a gastric neurosis; possibly there is a coexistent uræmia, oxaluria or glycosuria, with a gouty diathesis. Digestive errors, increased by imprudent and faulty dietetic habits, are not infrequently present. Intestinal toxæmias and constipation still further aggravate the effects of these gastro-intestinal neuroses. Such conditions readily explain the local determinations of blood to the skin, which result in erythemas, inflammatory, papular and pustular eruptions. Heredity and diathesis play important parts in their causation. We have known psoriasis to appear at the menopause in members of a family through three generations. Recurrences of the eruptions of puberty point to the same predisposing cause; thus an acneform eruption at puberty may reappear at the menopause. Unhealthy states of the uterus, attended by endometritic suppurative discharges which have been neglected, causing cervical erosions, are other coincident causes. These latter must be cured in order to treat the skin affection successfully. In such cases the ovaries and tubes may be found involved. Prurigo and pruritus are two of the very common and most troublesome dermatoses of the change of life. The prurigo may be universal, and the patient become exhausted by the torture of the general itching and irritation.

Both of these affections are more frequently located in the neighbourhood of the buttocks and anus, the vulva and supra-pubic area, the flexures of the groins and insides of the thighs. A common and persistent cause of the vulvar pruritus which extends up the vagina is diabetes. The history of an antecedent syphilitic infection, and the evidences of “reminders” of a latent

specific taint, will account for many of these dermal neuroses of unusual obstinacy. The incipient changes which ultimately end in leucoplakia and kraurosis vulvæ often occur at the commencement of or during the climacteric. This also holds true of malignant growths, papilloma, carcinoma and sarcoma.

The teachings of experience with regard to these dermatoses enforce the rule that all such climacteric skin troubles demand a close inquiry into the previous history of the patient, and a careful search for any visceral neurosis, diathetic predisposition, or pathological exciting cause in the genitalia.

Visceral Disorders.—From the foregoing observations it is manifest that many of the visceral affections met with during the menopause have a nervous origin, and have to be regarded as neuroses, reflex or otherwise.

The affections of the digestive organs which we may regard as more especially incidental to the menopause may be classed under three heads—gastro-intestinal, intestinal and hepatic. The dyspeptic symptoms are attended by a distressing sense of nausea and over-distension after meals; there are complaints of flatulence, with flatulent pains, eructations and localised areas of tenderness when the abdomen is pressed on or palpated. Constipation is the common antecedent cause of these troubles, and on examination the cæcum and ascending colon, with part of the transverse colon, may be found tympanitic and distended with gas, while the remainder of the large intestine is loaded with fecal contents, and there is tenderness on pressure over both the ilio-cæcal and sigmoid regions. The associated signs may simulate those of pregnancy, in the stoppage of menstruation, sickness, gradual enlargement of the abdomen, intestinal movements (which are mistaken for foetal), and mammary sympathies. The rigidity of the recti muscles and the obese abdominal wall may render the differential diagnosis difficult. Anæsthesia will decide the presence of a phantom pregnancy. The possibility of appendiceal complications will call for a careful examination of the caecal region—McBurney's and Lanz's points.

We are not concerned here with the dispute as to whether hæmorrhage from the stomach following cessation of the menses is or is not "vicarious"; it probably is not vicarious menstruation in the strict sense of the term. It has, however, to be admitted that the hæmatemesis does occasionally and periodically follow such stoppage, and sometimes to an alarming extent. It is more likely to occur if there be an organic affection of the liver or spleen. A congenital or acquired splanchnoptosis may be detected, and in a remarkable case under our care, in which the hæmatemesis

was ascribed to an enlarged and loose kidney, it was found at operation to be due to hepatoptosis. Various biliary conditions and some ascites, with more or less œdema of the lower extremities, are sequences of hepatic engorgement and portal obstruction. Women who have lived in tropical climates, or have who been subject to malaria, are more liable to suffer from the effect of these hepatic and splenic congestions. Again we repeat that no symptoms or sign pointing to any of these collateral visceral disorders is to be casually regarded as due to the menopause. Its cause, and the limitations of its source, have to be carefully defined.

Urinary Organs.—Any complaint of pain in the bladder or the urethra before, during or after micturition, or of inability to retain the urine and increased frequency in passing it, should lead to a complete examination of all the genito-urinary organs. It is impossible to exaggerate the importance of the adoption of this universal practice during the period of life included in "the change." Example upon example could be adduced to prove the unfortunate consequences accruing to patient and practitioner by its neglect. *The pitfall of the unwary may be summed up as "the delusion of neuroses."* An ordinary examination may at once disclose the cause of the trouble, or it may only be found by a process of exclusion after an exhaustive search. To enforce the need for this caution, we will mention two examples at the climacteric out of the many which have occurred to us.

A lady came stating that she had for some time increased frequency and difficulty in passing water. This had been the only trouble of which she complained, or for which she had been treated. At the first examination five pints of urine were drawn off from a distended bladder which reached to the umbilicus, the result of the constant pressure of an extensive pelvic infiltration and a double pyosalpinx.

A patient mistaking a persistent hæmorrhagic discharge of two years' duration for a continuance of the change of life, not having had any pain, was forced by a sudden and alarming attack of hæmorrhage to seek advice. The only other symptom was incontinence of urine. Examination revealed extensive cervical carcinoma, and a fibroma of the ovary and a chronic cystitis with distended bladder.

A loose kidney, renal or ureteral calculus, hyperplasia or myoma of the uterus, exaggerated antelexion, retro-deviation, prolapsed and diseased ovaries, and an habitually loaded rectum are the extra-vesical causes most commonly met with. Cystocele with rectocele also are not unusual consequences of relaxed introitus and prolapse. In the bladder itself procidentia, cystitis, stone, growth, varicosity and hyper-

æmia of the trigone, and, in the urethra, urethritis, stricture, growth and caruncle, will explain either frequency of micturition or pain. Obviously the accurate diagnosis of several of these sources of urinary disorder demands a careful qualitative and quantitative, if not bacteriological examination of the urine, the administration of an anæsthetic, and radiography. All such organic conditions have to be excluded before we can pronounce the symptoms to be of a psychasthenic or neurasthenic nature.

The Genitalia.—As there is no organic change in any of the genital organs which may not occur during the menopause, we must limit our remarks to some general observations on the more important facts bearing on those conditions which, if present and undetected, must always be attended by serious consequences. The time has long passed since the ignorant idea widely prevailed that certain symptoms were to be explained by the "climacteric," and that these would subside when this had ended. On the contrary, we now know that the more serious pathological changes which have arisen antecedent to and during the menopause are more likely to persist after it has ceased, and that in many cases they assume a malignant type. This is *especially true of the development and growth of uterine myomata, and the various degenerations to which they are subject, as it is of inflammatory states of the endometrium and the cervical degenerations which are the precursors of malignancy.* Hæmorrhage during the menopause is occasionally due to the presence of an intra-uterine polypus, and this may be complicated by a suppurative discharge from the endometrium. Any suppurative discharge will suggest examination of the adnexa, in order to exclude pathological changes in the Fallopian tubes. *Hæmorrhage occurring in a woman after the menopause is over, whether attended by pain or not, is usually the result of malignant degeneration.*

During the natural menopause the ovarian neuroses may be aggravated. Hyperæsthesia and neuralgia of the ovaries are not infrequently present. Ovarian cystoma and adenoma are more liable to assume the malignant type. Other affections of the genitalia which are met with have been already referred to.

Therapeutics and General Management of the Menopause.—Necessarily from the wide range of affections incidental to the menopause we are restricted to a brief review of the general management of the woman during her passage through the critical time. The special therapeutics, *operative, medicinal or hygienic*, indicated by the particular affection or affections present require separate and distinct consideration. Viewing the subject from this triple aspect certain indications for practice stand prominently out. Under

the head of *operative* the one safe maxim to remember is—*given any organic affection of the genitalia curable by operative measures, and not capable of arrest and cure by other means, the safety of the woman demands early operation.* Unjustifiable expectancy or "masterly inactivity" have no place here. There are cases in which the surgeon has to decide from the extent of the disease or the general state of the patient as between the risk to life of interference or non-interference. In weighing the evidence on one side or the other, if the balance lean to the side of operation it is right to give the benefit of the doubt to the patient. Operative steps are unjustifiable if the lowered vital powers of the woman or the hopelessness of cure contra-indicate them. Modern surgery, however, has brought many a condition which would have been looked upon as hopeless a few years since within the reach of curative operative measures. Also, the surgeon is bound, even if he cannot promise absolute success in point of complete cure, to do that which will prolong life and relieve misery and suffering.

These remarks apply more especially to malignant conditions, whether they occur in the genitalia or elsewhere during the menopause.

General Therapeutic Remedies. The indications for these will be found in the clinical features of the case; whether the symptoms are due to a neurosis or a genuine neurasthenic or psychasthenic character; a reflex neurosis of some viscus, organ or part, or some organic change that is detected.

General Management.—Looking broadly at the general management of the menopause, the prominent and primary indication is to enforce first principles, so far as is possible. These mainly include the securing of a regular action of the bowel, ensuring a normal digestion, promoting a healthful correlative discharge of the functions of the skin and kidney, and the pursuit of a healthful mental occupation.

Constipation is the one evil of which women are most tolerant and neglectful. In most instances it complicates the other sexual disorders from which they suffer. It brings with it hepatic and local congestion, to which are added the local effects of pressure and straining at stool. It leads to adnexal and appendical complications, and in the rectum to hæmorrhoids, prolapse and other rectal diseases. In combating it, nothing is more important than insisting on a daily and habitual effort to move the bowel at a stated time. The pernicious custom of relying entirely on purgatives (chosen haphazard) and enemata has to be strongly deprecated. The normal peristalsis should be excited by abdominal massage and electrical treatment. This may be assisted by the use of various spa waters and a course of the Bourboule douche

treatment, which can now be had at all modern bath resorts and establishments. The application of the "three-phase current" with the three minor waves is an efficacious aid; one electrode is placed in the rectum, and the two flat electrodes are applied on either side of the abdomen. The strength and frequency of the current can be easily and accurately gauged by the "combination wave" apparatus known as "Lloyd's." The administration of psyllium seeds and an intestinal lubricant, as one of the paraffin preparations, and the use of soft food will assist this treatment. The main object is to obtain natural peristalsis and to prevent the habitual resort to purgatives, especially the various saline preparations and waters which are in common use. Among the least harmful vegetable preparations are cascara, American fig syrup, and senna pods. Of the saline waters, one of the best is Rubinat, which can be taken in small quantity with warm water the morning after a vegetable or calomel pill, and has no griping action.

Indigestion.—To ensure a normal digestion the diet has to be regulated. This requires not a little firmness on the part of the practitioner. It is just at this time of life that many women overfeed and take less or little exercise; motor-ing, carriage driving, and sitting indoors over trashy literature are responsible for much of this. The luxurious and sedentary life is the unhealthy one. Systematic open-air exercise, not taken to the point of physical fatigue, especially during a menstrual epoch; small meals at prescribed intervals; simple diet of easily digested articles of food which are not fat-producing; avoidance of alcoholic drinks and the over-use of tea and coffee; regulation of the times at which fluids are taken, and also of their quantity, are the most important directions to enforce. These may be supplemented by the administration of such digestive ferments as the various pepsine preparations, papaine, taka diastase, "digestin," and malt foods. A supervised course of lacto-bacillin treatment is a valuable adjunct.

The Skin and Kidneys.—To promote healthful correlative action of the skin and kidneys habitual attention to daily ablutions, with friction of the skin after the bath, is necessary. Due warmth of the body should be maintained by suitable clothing, and exposure of the extremities, now becoming more common in woman's dress, is to be strongly deprecated, the more so in the instance of those whose circulation is poor and languid. Side by side with such precautions the urinary secretion has to be systematically examined and the diet regulated accordingly.

Alcohol—Bromides—Morphia. The adminis-tration of alcoholic stimulants and the various

compounds which contain alcohol is a step to be taken reluctantly, and must always be carefully regulated, the precise nature and quantity of the stimulant being always prescribed. Routine employment of bromides is to be deprecated. If there be severe pain, and the administration of morphia is considered neces-sary, it has to be remembered, especially in those women of a psychasthenic type, that it is apt to engender a craving for its continuance which is not easily combated.

General Medication. Electricity of different kinds, static, galvanic, Faradic, or the high-frequency current, will often relieve pain. A Weir-Mitchell course with massage judiciously carried out, and adapted to the individual indications, is frequently of great benefit. Such a cure in an obstinate case may be supplemented by hypnotism or suggestion, and the neuras-thenic weaned from the need for hypnotics. Of the latter, a suppository of trional (preceded by a few doses of bromural) sodium-veronal, ure-thrane, and, as an opiate, "nepenthe," are among the simplest and best.

Of the valerian compounds, bornyval will be found very efficacious in nervous and phobic cases. The different ovarian extracts and lutein sometimes benefit and may be tried, but they are uncertain in their effects. Out-side such therapeutical remedies, modern pharmacy has richly added to the armament-arium of the practitioner a variety of elegant preparations of such drugs as arsenic, iron, quinine, the glycono-phosphates, lacto-phos-phates, formates and other tonics, where such are indicated. As hæmostatics, chloride of calcium, stypticine, muriate of hydrastia and hydrastinine, viburnum, ernutin and other preparations of ergot, pituitary extract, are the most reliable. The hot douche, to which liquid extract of hydrastis and tincture of matico have been added, may be tentatively tried, but its routine and continued employment is to be deprecated.

Undue obesity will require the adoption of a special dietary. Rarely is it necessary to administer thyroid preparations. Of these, particularly if there be any tendency to Graves's disease, "thyroidectin" and "rodagen" are very valuable and effective forms.

The Artificial Menopause.—A brief allusion to the cessation of menstruation brought about by removal of the adnexa is necessary. Such removal in a large number of women has but a slight effect, lasting only for a few months after operation. It is shown in the milder manifestations of the normal menopause, more generally in the various vasomotor disturb-ances usually present at the latter time. Any exaggeration of these or the presence of a persistently recurring pain, the appearance of

a sanguineous or other discharge or uterine hæmorrhage, will suggest an early bimanual examination. We have known severe pain, which continued for years after oöphorectomy, caused by a partially ablated tube which had formed adhesions to the uterus. The pain was permanently relieved by its complete removal. Hæmorrhage may be due to secondary uterine degeneration, as we have seen in three of our cases. In two there was diffuse adenoma of the fundus uteri; in another, fibrosis. On the other hand, the hæmorrhage may have its source in malignant change. The continuance of menstruation after oöphorectomy is, however, generally due to a portion of ovary which has escaped removal. More recent experiences prove that if hysterectomy is necessary in addition to oöphorectomy, the sub-total operation, which leaves part of the endometrium, is more desirable than the total, as having a salutary effect on the course of the artificial menopause. The pathological conditions present must necessarily decide this.

In the instance of premature menopause, the administration of lutein (Ellice McDonald and others) is in many instances followed by good results, the menstrual flow being increased in quantity and its regularity maintained, though these effects of its continued administration were absent in the menopause, the consequence of operations. There is the important question, not yet satisfactorily solved, as to how far the preservation of a portion of the uterus in hysterectomy contributes to the mitigation of the nervous symptoms that the operation induces. The weight of evidence would tend to prove that if an ovary or part of an ovary is left, the

sacrifice of the entire uterus is more prejudicial to the woman and more likely to be followed by unpleasant consequences than when a portion of it is left. Indeed, the trend of recent opinion lies in the direction of regarding the uterus and ovaries as having equally important correlations in their influence on menstruation and fecundity, as also on the general metabolism.

Pain as a consequence of sigmoid and appendical adhesions following after oöphorectomy is not uncommon. Many of these troubles of the artificial climacteric arise from too early a return to active life after an operation, and also through the departure from Lawson Tait's maxim—to secure complete removal of diseased appendages right up to the cornu of the uterus.

While the minor neuroses and psychasthenic symptoms of the natural menopause are occasionally present when it is artificially induced, the graver conditions are as a rule absent. When these do appear, it will generally be found that there has been from the time of puberty some mental instability present which has been more pronounced at the catamenial periods. The woman has had associated with her ovaralgia, dysmenorrhœa or uterine abnormality, a distinct personality in temperament and disposition, or some peculiarity or erraticism of conduct. This was so in the only case in which we have had distinct disorder of mentalization quickly following on oöphorectomy, and subsequently necessitating restraint. In women of this type, therefore, oöphorectomy for any reason must be a *dernier ressort*. The general management of the affections of the artificial menopause does not differ from that already outlined.

H. M. J.



PART IV.—SPECIAL REGIONS

I.—DISEASES OF THE EYE

REFRACTION OF THE EYE

SECTION I.—GENERAL OPTICS

RAYs of light entering the eye coming from any luminous point at a greater distance than six metres may be assumed, for all practical purposes, to be parallel.

Light is absorbed, refracted, or reflected.

Refraction of Light.—A ray of light passing from a rarer into a denser transparent medium, if it be perpendicular to the surface, and the boundaries of the medium be parallel, will pass out of the denser medium in the same straight line, the only effect upon it being a retardation. If the ray enter the denser medium other than perpendicularly, or if the boundaries of the medium be not parallel, the ray is bent or refracted.

A ray of light passing obliquely from a less dense into a denser transparent medium is refracted or bent *towards* the perpendicular, and when passing from a dense to a less dense medium is refracted *away* from the perpendicular.

Index of Refraction.—The index of refraction of a transparent substance is the number that denotes the refractive power of such substance compared with air, which is taken as the unit 1.

Prisms.—An ophthalmic prism is a wedge-shaped piece of glass having two of its sides, or plane surfaces, intersecting each other at the *apex*, and separated at the *base*, which is the thickest part of the prism.

A ray of light entering one of the sides of a prism is refracted or bent towards the base, and the amount of this refraction depends upon the strength of the prism and the refractive index of the prism substance.

The Strength of the Prism.—*The Numbering of Prisms.*—The power of a prism to deflect or refract light depends on the size of the angle at the apex formed by the two plane surfaces. This is called the *refracting angle*, and is written with the sign of a degree after the numeral—thus: 4° —which is scratched on the surface of the glass. This is the old, and even up to the present very general, method of numbering prisms.

Prentice has suggested the numbering of prisms on the metrical plan, and the *prism dioptré* is the unit designated by the sign Δ after the numeral.

A prism of the strength of 1 P.D. (1Δ) is a prism that, at a distance of one metre, apparently displaces an object one centimetre. In Fig. 1 E , being the observer, sees o at o' apparently displaced one centimetre, the

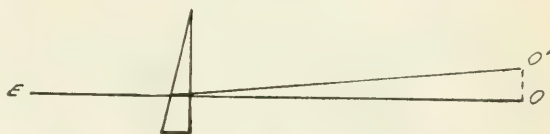


FIG. 1.—Diagram to explain the Prism Dioptré.

distance between o and the prism being one metre, and the prism 1Δ ; that is, the apparent displacement of an object looked at through a prism is one per cent. of the distance of the prism from the object, multiplied by the prism dioptré.

A prism 1Δ apparently displaces an object three metres off three centimetres, and a prism 3Δ displaces an object two metres off six centimetres, and so on.

The numbering by the angle of refraction and the prism dioptré is practically identical for weak prisms.

The Uses of Prisms.—

1. To remove diplopia.
2. To ease the muscles, and so prevent muscle strain and subsequent diplopia (see p. 1081).
3. To exercise *weak* muscles (see p. 1124).
4. To test the strength of the external ocular muscles.
5. To detect malingerers (see p. 1081).

In trial cases the prisms are usually cut circular, so that they can be used in a trial frame; the exact position of the base of the prism is usually marked by a line on the glass at right angles to the base.

Lenses.—If two prisms are placed with their bases in contact, we have roughly a bi-convex lens (Fig. 2, A), and rays of light passing through it are bent towards the base of the prisms—*i. e.* the centre of the lens; in other words, they converge. If the prisms have their apices in contact, we have a bi-concave lens (Fig. 2, B), and the rays are bent towards the bases—*i. e.* outwards—and diverge.

Spherical Lenses.—Besides the bi-convex (Fig. 2, A) and bi-concave lenses (B), there are plano-convex (C), plano-concave (D), converging concavo-convex or converging meniscus (E), and diverging concavo-convex or diverging meniscus (F). Rays of light passing obliquely through any of these forms of lenses are refracted

or bent towards the *thickest* part of the lens.

The principal axis is a line drawn through

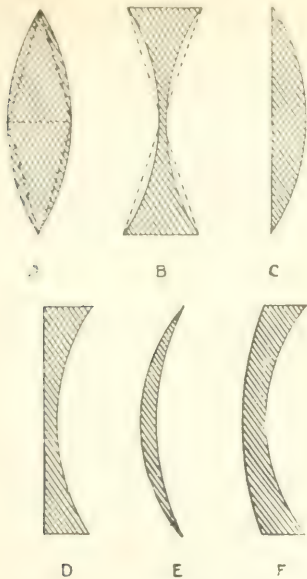


FIG. 2.—Varieties of Lenses.

the optical centre at right angles to the lens (Fig. 3, A o), and rays passing through this are not refracted; all other lines passing through

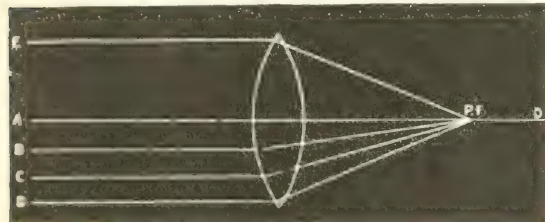


FIG. 3.—Parallel Rays passing through a Convex Lens.

the optical centre not at right angles to the lens are called “secondary axes” (Fig. 4, A a).

Rays passing along the secondary axes are

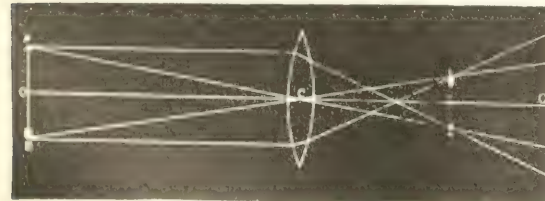


FIG. 4.—Formation of Image by rays passing through a Convex Lens.

refracted, but as the refraction in low-power lenses is very slight it can be ignored, and the rays assumed to pass along in a straight line.

Convex Lenses.—Parallel rays passing through a convex lens unite on the opposite side of the lens at a point called the “principal focus” (Fig. 3, P F).

At the principal focus an inverted real image of the object is formed. Let A B (Fig. 4) be an object at some considerable distance from the lens. Any ray passing from the point A through the optical centre of the lens C will be unrefracted (*vide supra*), and the image of A will be somewhere on this line on the other side of the

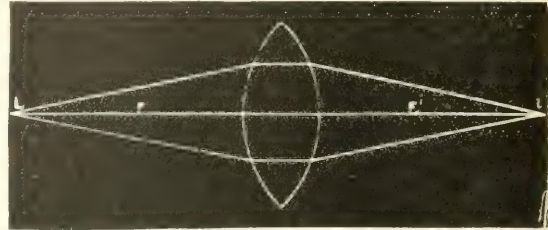


FIG. 5.—Diagram of Conjugate Foci.

lens—let it be at a; all other rays passing from A will be refracted on passing through the lens, and will focus at a. In the same manner an image of B is formed at b, and all other points between A and B will form an image between a and b, so that we get an inverted image a b of A B formed at the principal focus of the lens.

The distance between the principal focus and the optical centre is called the “principal focal distance”; it is positive, and convex lenses are known by the plus sign : +.

Rays passing from the principal focus (P F) through the lens emerge as parallel rays on the opposite side (Fig. 3).

Divergent rays from a point L (Fig. 5) beyond the principal focus F meet at a point l beyond the principal focus F' on the other side of the lens. These two points are called “conjugate foci.”

Concave Lenses.—Parallel rays passing through a concave lens diverge, and consequently never come to a focus; but these divergent

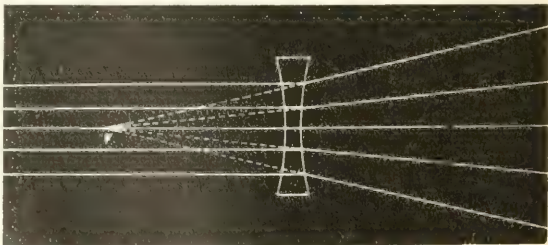


FIG. 6.—Rays passing through a Concave Lens.

rays, if prolonged backwards, will meet at a point F (Fig. 6).

This point is the (virtual) principal focus of a concave lens.

If an object be placed beyond the principal focus of a concave lens, an observer on the opposite side of the lens will see a virtual, erect, smaller image on the same side as the object.

Concave lenses have a negative focal distance and are denoted by the minus sign: —.

Cylindrical Lenses.—In addition to spherical lenses cylindrical lenses are required—these are lenses cut out of a cylinder; convex cylinders

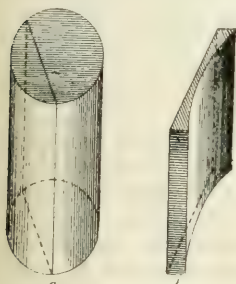


FIG. 7.—Diagram of Cylindrical Lenses.

are cut from a solid cylinder (Fig. 7, a), concave cylinders from a hollow cylinder (Fig. 7, b), which may be regarded as the mould of convex cylinders. Cylinders have the property of not refracting any rays that pass along their axis, but rays passing at right angles to the axis undergo the maximum refraction

corresponding to the strength of the lens. According to the angle at which the rays impinge upon the lens, they undergo more or less refraction, as this angle is farther away from, or nearer to, the axis of the cylinder. A cylinder has a line of foci parallel to its axis.

Cylindrical lenses are employed to correct regular astigmatism.

The axis of a cylindrical test lens is marked by a small line on the glass, or by making the sides of the lens, parallel to the axis, opaque.

Numeration of Lenses.—The lens whose focal distance is one metre is taken as a unit, and its refractive power is called one dioptre or dioptry ("D"). A lens of twice the power of this—viz. 2 D—has a focal distance of $\frac{100}{2}$ cm.; i. e. 50 cm.; a lens of half the power—viz. .5 D—has a focal length of two metres, and so on. The focal distance of a lens $nD = \frac{100}{n}$ cm.

Under the old system a lens whose focal distance was one inch was taken as the unit, and a lens whose focal length was ten inches was called $\frac{1}{10}$, thirty inches $\frac{1}{30}$, and so on. The great disadvantage of this method of numeration was the inability to make it international, because the inch is not an international measure.

To convert the old numeration into the new, divide the denominator into 40; thus, lens $\frac{1}{5}$ is $\frac{40}{5} = 8$ D, and, vice versa, to convert dioptries into inches, divide the dioptry into 40, and the result is the focal length in inches; thus, 4 D = $\frac{40}{4} = 10$ inches focal length, expressed as $\frac{1}{10}$.

To find the value of a lens neutralize with a lens of opposite kind or employ a *Geneva lens measure*.

The Combination of Lenses.—When spherical glasses are required it is usual to work half the

power on to each surface; thus, if + 4 is ordered the optician grinds each surface as + 2.

A favourite method is to order the glass in the form of a meniscus or *periscope* lens; thus, + 4 would be given by grinding + 7 on one surface and — 3 on the other (the surface next the eye), or if — 4 is required the surface of the glass next the eye is ground — 7 and the other + 3. Such glasses enlarge the field of distant vision and, moreover, are less likely to come into contact with the lashes.

When a cylinder is prescribed with a spherical lens it is usually ground on one side and the sphere on the other, but when a high power spherical lens is required, its strength should be divided between the two surfaces and the cylinder combined with one; thus, —14 sph. \ominus 2 cyl. is best given by making one surface —7 and the other —7 \ominus 2 cyl. These lenses are called *toric* and are very useful in high myopia and in aphakia.

When different lenses are required for distant and near vision they can be given in one glass as *bi-focals*, where the top part of the glass is for distance and the lower part for near vision. They may be a split glass (Franklin), or the reading addition can be balsamed on to the lower part (cemented bi-focals) (Fig. 8) or can be worked invisibly on to the lower part (invisible bi-focals). These latter are very superior to the other kinds but are more expensive.

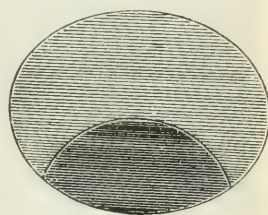


FIG. 8.—Cemented Bi-focal Lens.

EMMETROPIA AND AMETROPIA

The eye is constructed in the form of a photographic camera, and, as in the camera, there are two conditions which must exist in the eye: firstly, the media must be transparent; and, secondly, the focusing must be so arranged that a perfect image of the external object is formed on the retina—i. e. the principal focus of the eye must coincide with the retina.

All deviations from this latter condition are called errors of refraction and accommodation.

The perfect type of eye is that in which the retina coincides with the posterior principal focus, and is called the "emmetropic" eye (E, Fig. 9), and any deviation from this is called "ametropia."

If the posterior principal focus is beyond the retina the eye is too short, and parallel rays, when they meet the retina, have not yet come to a focus, and only convergent rays come to a focus. This is called "hyperopia" (H, Fig. 9).

If the principal focus is in front of the retina

the eye is too long; parallel rays focus in front of the retina, and only divergent rays focus on the retina. This condition is called "myopia" (M, Fig. 9).

The Visual Angle and Visual Acuity.—Rays of light, proceeding from the two extremes of an object into the eye, meet at the nodal point N (Fig. 10) before crossing and forming the inverted image on the retina, and the angle included at N is called the "visual angle." $\angle ANB$ is the visual angle of the object A B (Fig. 10).

The size of the visual angle depends on the

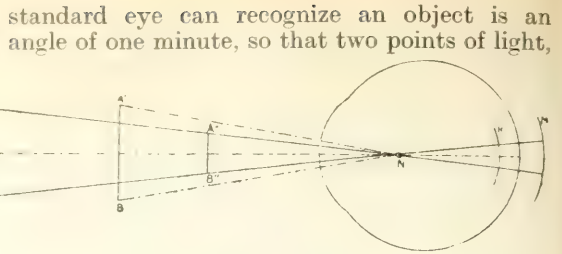


FIG. 10.—The Visual Angle.

such as two stars, separated by an angular interval of less than one minute would appear on the retina as only one point.

Test Types—Snellen has arranged test types on such a plan that each letter is made up of several parts, each of such a size that it subtends an angle of one minute vertically and horizontally, the whole letter subtending an angle of five minutes vertically and horizontally when read at the standard distance.

Thus, in Fig. 11, the F is made out of twenty-five squares, each subtending an angle of one minute (the whole letter subtending an angle of five minutes) when read by the normal eye at twelve metres; and the L, which is constructed on the same plan, subtends the same angle when read by the normal eye at six metres.

The numbers over the different-sized letters in Snellen's types represent the distance in metres at which the standard eye can read them; in other words, at that distance they subtend an angle of five minutes. For instance, the largest type, D=60, can be read by the normal eye at sixty metres, and it subtends the same angle as the type D=24 read at twenty-four metres, and D=6 read at six metres.

The acuteness of vision is represented by a fraction which has for its numerator the distance in metres at which the type is read, and for its denominator the distance at which it ought to be read. The line D=6 means that this type can be read by the normal eye at six metres, and if the patient under examination can read it at six metres, the fraction is $\frac{6}{6}$ —that is, normal vision. If the patient cannot see a smaller type than D=12 at six metres, his vision is $\frac{6}{12}$; if D=60 is the only letter that can be read at six metres, his vision is $\frac{6}{60}$ —i. e. one-tenth of the normal. If D=60 cannot be read at six metres,

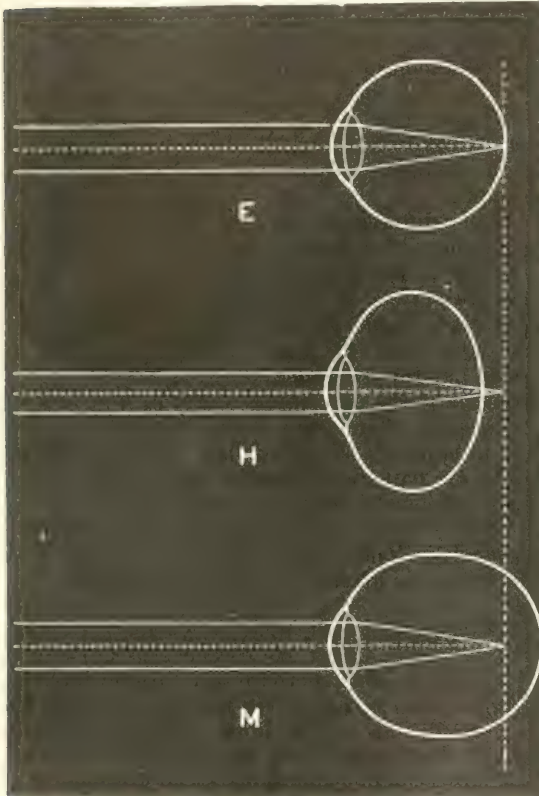


FIG. 9.—Diagrams of E, Emmetropia; H, Hyperopia; M, Myopia.

Showing parallel rays focused on the retina in emmetropia (E), behind the retina in hyperopia (H), and in front of the retina in myopia (M).

size of the object and its distance from the eye; thus, $A'B'$, which is the same size as A B, subtends a larger angle and the image is larger; and, again, $A''B''$ subtending the same visual angle as A B, would appear to be the same size, whereas it is much smaller.

The smallest visual angle in which the

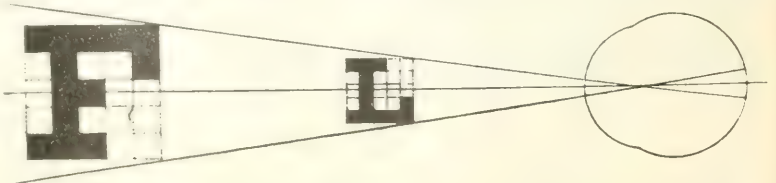


FIG. 11.—Diagram of Test Types.

the patient must be made to approach the type; if he can just read this letter at two metres, his

vision is $\frac{2}{60}$; he has only one-thirtieth of normal vision.

If the patient cannot see any letter at any distance we find whether he can count fingers and, if so, at what distance, and, failing this whether he can distinguish between black and white. If vision is even worse than this, we take him to the light and pass the hand in front of the eye—*i. e.* between the eye and the light; if movement is recognized, we find out whether he can distinguish the *direction* of the movement.

Finally, if he fails at all these tests, he should be taken into the dark room, and a strong beam of light should be directed on to the eye; if this is not perceived, vision = 0; if it is perceived, we ascertain whether he has good projection, by reflecting the light on to the eye from different positions, and ascertaining whether he can tell whence the light is coming.

Snellen's near-vision test type is arranged on the same principle as the distant type. Jaeger's near-vision type is more generally used and J2 is the equivalent of Snellen's .5.

SECTION II.—ACCOMMODATION

Accommodation.—The alteration of the eye by its focusing mechanism is called **accommodation**. The photographer focuses by lengthening or shortening the distance between the back of the camera and the lens, but he could also focus by adding a convex or concave lens to that he is already using.

It is in this latter way that the eye focuses; the eye cannot lengthen, but the lens can become more convex, which has the same result as adding a convex lens.

In the normal standard eye parallel rays, coming from a distance beyond six metres, are focused on the retina when the eye is at rest—*i. e.* when the apparatus of accommodation is not being used; but when the eye wishes to see clearly any object nearer than six metres, the lens must become more convex.

This increased convexity of the lens is produced by the action of the ciliary muscle. According to Helmholtz, when the ciliary muscle contracts it pulls forwards and inwards the capsule of the lens, and thereby the tension on the lens capsule is relaxed, and the lens, which has been in a state of compression, is allowed to assume a more convex form.

The other theory supported by Tscherning maintains that the action of the ciliary muscle is to *increase* the tension on the fibres of the suspensory ligament, and to alter the lens from a spherical to a hyperboloid form. The lens becomes more conical under accommodation, and the contraction of the pupil, that occurs at the same time, masks the increased aberration which results from the flattening of its periphery.

Amplitude of Accommodation.—At rest, the eye is adapted for the most distant point it can see distinctly—*viz.* its *punctum remotum* (R);

while the greatest possible contraction of the ciliary muscle adapts the eye to the nearest point it can see distinctly—*viz.* its *punctum*

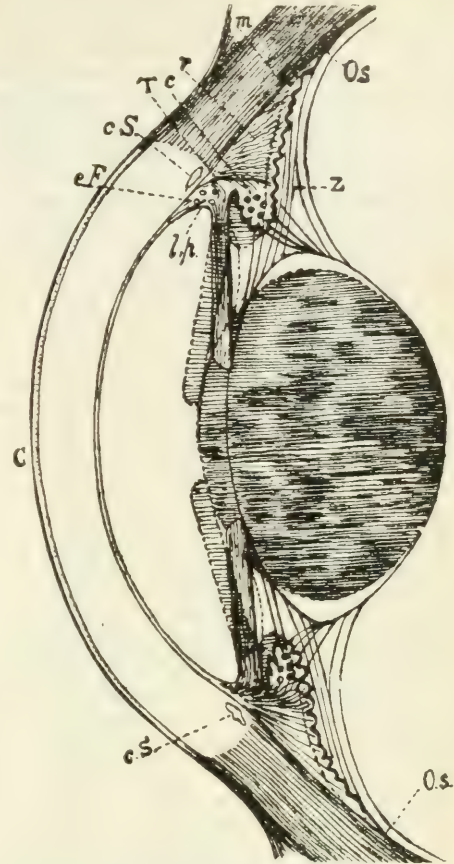


FIG. 12.—Diagrammatic Section of the Ciliary Region of the Eye.

C, cornea; cS, Schlemm's canal; Os, ora serrata; lp, pectinated ligament; eF, Fontana's space; T, tendinous ring; m, meridional fibres; r, radiating fibres; c, circular fibres of the ciliary muscle; Z, zone of Zinn.

The full lines indicate the lens, iris, and ciliary body at rest, and the dotted lines the same in a state of accommodation. (Reduced from Landolt.)

proximum (P), which represents the greatest possible contraction. The force required to change the eye from R to P is called the "amplitude of accommodation" (A), and is represented by the *difference* between the refraction of the eye at rest and the refraction when doing its utmost work.

The formula is $A = \frac{1}{P} - \frac{1}{R}$, or, expressed in dioptries, $a = p - r$.

R is represented by the refraction of the eye at rest. To find P, give the patient the near vision test card and tell him to read the finest print at the nearest point, measure the distance

in centimetres, which gives us P, and divide into a hundred to ascertain *p*. Thus if the nearest point at which J1 can be read is 20 cm., $p=5$.

If from any cause, such as presbyopia or high hyperopia, the patient's near point is so far that the above test cannot be employed, we place in front of the eye such a convex glass as will bring the punctum proximum (P) closer, and enable him to read D=5 or J1, such glass to be, of course, deducted afterwards. Thus, supposing a person with +2 can bring the test object up to 25 cm. and no nearer, dividing 25 into 100 gives us 4, and we subtract the +2 from this, which gives us $p=2$ —that is, P is 50 cm. off. If he is an emmetropic presbyope this represents his amplitude of accommodation.

Accommodation is spoken of as absolute, binocular, and relative.

Absolute accommodation is the full amount of accommodation of one eye, the other being excluded.

Binocular accommodation is the full amount of accommodation which both eyes, converging, can exert together.

Relative accommodation is the limit within which accommodation may be increased or decreased, the convergence remaining the same.

Binocular Vision.—Man has binocular vision—that is, the image from an object falls upon the retina of each eye simultaneously, and in normal binocular vision on exactly the same region of the retina; for if the images did not overlap, two images would be seen, and so-called "double vision" would be the result. The absence of double vision does not necessarily imply the presence of normal binocular vision with fusion of the two images, for one eye may be blind or its image suppressed by the brain (monocular vision). Many people use one eye only for years without discovering the fault. The best test for binocular vision is Snellen's "FRIEND" test (see p. 1083).

We must now consider the two eyes together as forming *one whole*, and on their proper associated movements must depend perfect binocular vision.

If binocular vision be impossible, through some great defect of the optical apparatus or the muscles, no attempt will be made to produce it, and no strain will follow. On the other hand, apparently normal binocular vision may exist; but to produce this, a demand in excess of the power is put upon a muscle or a set muscles, and the result is strain.

The Relation of the Two Eyes to Each Other in Normal Distant Vision.—In ideal binocular distant vision, the eyes being at rest and all the muscles in equilibrium with respect to each other, the visual axes are parallel.

Test for Latent Deviation of the Eyes for Distance. If a person with normal vision looks

at an object in the distance, and one eye be covered for twenty or thirty seconds, if there be any latent deviation it becomes (as a rule) manifest, and on uncovering the eye there will be diplopia for a brief space of time, the covered eye moving (in order to fuse the two images)—in, if there be latent divergence, and out, if convergence. A more accurate method of conducting this test is to destroy the possibility of binocular vision—*i. e.* fusion—by means of a prism, with its base up, placed before one eye, or, better still, by the apparatus suggested by Maddox, called the "glass rod test"; by which means we can not only at once detect concealed deviation, but can also measure the amount.

The Maddox Test.—A glass rod (Fig. 13, *a*) is arranged in a metal disc, which fits into the trial frame.¹ If this rod be placed before one eye, the other eye remaining uncovered, and a small flame be looked at from a distance of more than four metres, the eye in front of which the rod is placed sees the flame merely as a streak of light, and, the images of the two eyes being so dissimilar, there is no desire on the part of the brain to fuse them; consequently the two eyes assume their position of rest. If the rod be placed horizontally in front of the right eye there is a vertical streak of light, and if this streak coincide with the image of the candle seen by the left eye, the visual axes are parallel (orthophoria); but if it do not, then when the

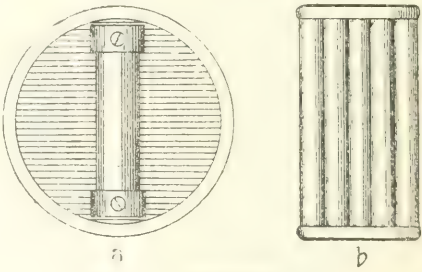


FIG. 13.—Maddox Rods.

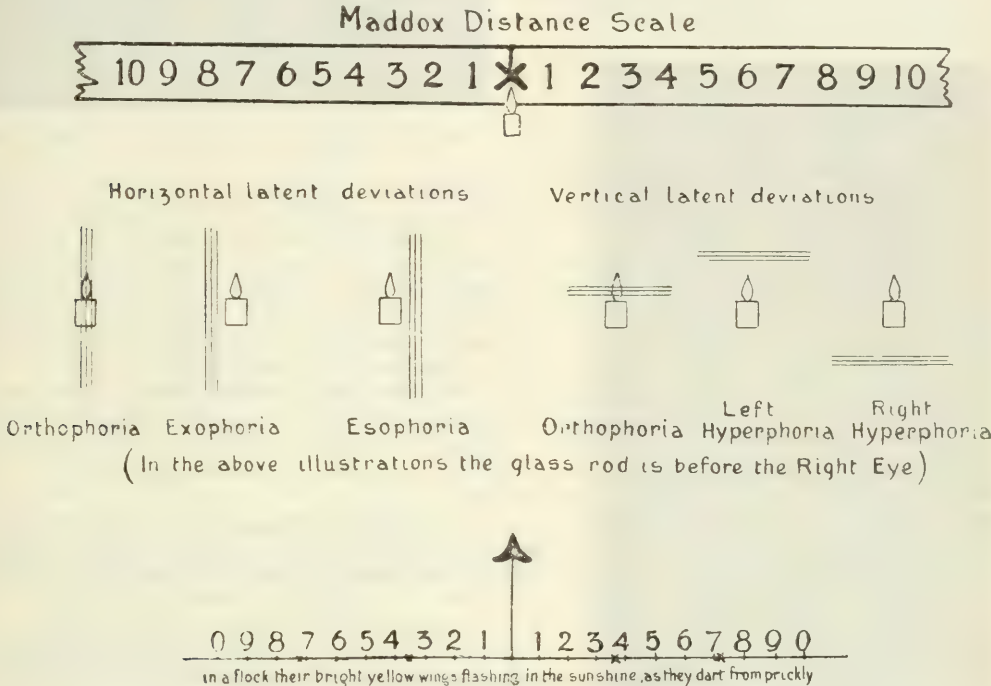
streak is on the same side as the rod (in this case the right side) there is latent convergence (homonymous diplopia), when on the other side there is latent divergence (crossed diplopia). If a scale be used as suggested by Maddox (see Fig. 14), the number on the scale through which the streak of light passes records the amount of diplopia; or prisms may be put up in front of the other eye. The weakest prism that causes the two images to coincide records the amount of diplopia. The Maddox distance scale is marked for five metres, and roughly every $3\frac{1}{2}^\circ$ represents a metre angle.

¹ Fig. 13, *b*, represents a simple form of this apparatus which can be made by uniting four or five glass rods with sealing-wax. This must be held before the eye, as it does not fit into a trial frame.

If we wish to measure vertical deviations we turn the rod vertically, and thus obtain a horizontal streak of light. If this streak pass through the middle of the flame there is no vertical deviation, but if it be above or below there is hyperphoria of that eye which sees the lower image—i. e. if the streak of light be lower there is a tendency to upward deviation (latent hyperphoria) of the eye in front of which the rod is placed. To measure the vertical deviation we must use a scale, similar to that in Fig. 14, placed vertically.

convergence. If the eyes converge to a point 50 cm. off, then $C = \frac{100}{50} = 2$ m.a.; if 20 cm. off, $C = \frac{100}{20} = 5$ m.a.; and if the object be 3 metres off, $C = \frac{1}{3} = .33$ m.a. In Fig 15 EE is the base line connecting the two eyes, and ER' and ER'' are two lines at right angles to this base, and therefore parallel. If the two eyes look at a point R , the angle $R'ER$ is the "metre angle," or, better still, as $R'ER$ is equal to $ER''R$, the latter may be called the "metre angle."

The metre angle of convergence corresponds



Maddox Scale for 1/4 Metre

FIG. 14.—Maddox Scales.

Before this test is applied any refractive defect must be corrected.

So much for what is called the "static equilibrium" of the ocular muscles. Now we proceed to examine the dynamic condition—that is, the relation of the muscles in binocular near vision; in other words, during *convergence*.

Convergence "is the direction that the eyes must give to their lines of fixation in order that they may be simultaneously directed toward the point of fixation." When both eyes are fixing an object six metres (or more) distant, they are parallel, and C (which represents convergence) = 0; when the eyes simultaneously fix an object one metre off in the median line, both internal recti contract and the eyes converge; convergence is then said to be one metre angle, $C = 1$ m.a. This metre angle is the unit of

to the dioptre of accommodation. Thus, an emmetrope who is fixing binocularly a point one metre off is using one dioptre of accommodation, and convergence is 1 m.a.; and if the point be 25 cm. off he is using four dioptres of accommodation, and his amount of convergence is $\frac{100}{25} = 4$ metre angles, and so on.

The Punctum Remotum of Convergence.—Just as the *punctum remotum* of accommodation is the expression of the refraction of the eye when completely at rest, so the *punctum remotum* of convergence is the expression of the position of the eyes when at rest—that is, when the impulse to fusion brought about by binocular vision is removed—so that to find R we must find the *latent position* of the eyes for distance. This we do by the Maddox test, and the number of metre angles read off on the scale gives us " r ."

When there is no latent deviation "r" = 0, when there is latent divergence "r" is negative, and when latent convergence it is positive.

To find "p," the maximum of convergence, we direct the person to fix binocularly a small test object held, say, one-third metre from the eyes, equidistant between them and on the horizontal plane of the eyes. The test object should be a fine hair or wire stretched vertically in a frame. When the test object is approached to such a distance that it appears double, we measure off the distance in centimetres, which gives us P, and dividing this into 100 we get the number of metre angles that "p" is equal to.

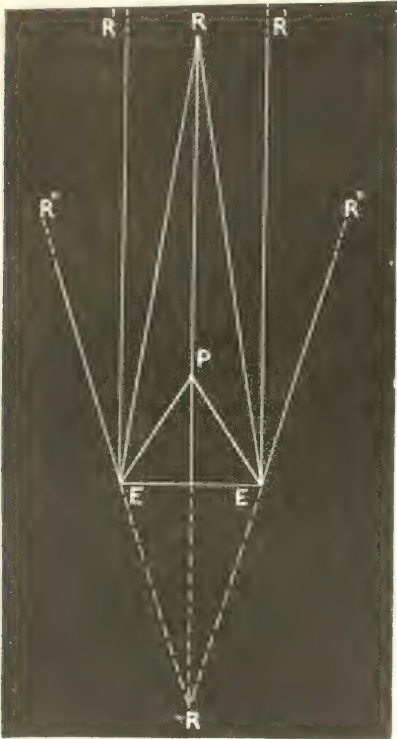


FIG. 15.—"The Metre Angle."

The Amplitude of Convergence.—The formula is the same as in accommodation, viz. $CA = \frac{1}{CP} - \frac{1}{CR}$, or, expressed in metre angles, $ca = \frac{1}{cp} - \frac{1}{cr}$.

The normal amplitude of convergence is about 10 m.a.

SECTION III.—THE OPHTHALMOSCOPE

Optics of Reflection—

1. When light falls on a plane mirror (Fig. 16, A B), the angle of incidence is equal to the angle of reflection.

The incident ray F D makes with the per-

pendicular P D an angle F D P, and the reflected ray D E also makes an angle E D P, and these two angles are equal to one another. Both

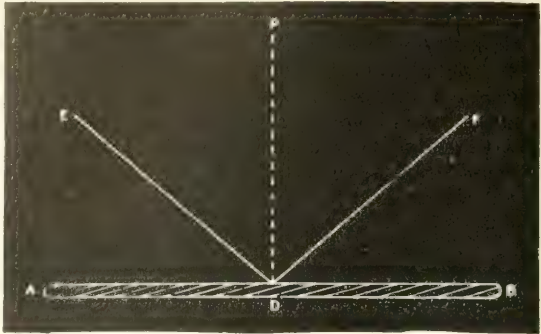


FIG. 16.—Rays of Light falling on a Plane Surface.

incident and reflected rays are in the same plane, which is perpendicular to the mirror.

2. When parallel rays of light (Fig. 17, A B and C D) fall on a concave mirror, they are reflected to a focus (F) in front of the mirror, and this principal focus is midway between the mirror and the centre of curvature of the mirror (o) and on the principal axis.

3. Rays of light coming from a point near the mirror, but beyond its centre, as at L (Fig. 17), come to a focus (f) between the centre and the principal focus, and the two points are conjugate foci.

The Ophthalmoscope.—If by some contrivance we can manage to send rays of light from a spot in front of our eye into another eye, we shall get some of those rays returning to our eye after being reflected from the retina of the observed eye, if the media be clear, and the pupil of the observed eye, instead of appearing black, will appear red.

This can be done in the simplest manner by a piece of glass plate. If *Obd* is the observed

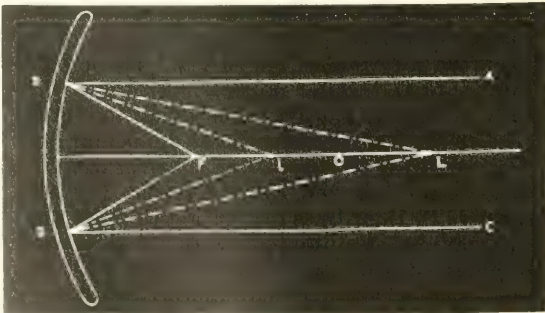


FIG. 17.—Rays of Light falling on a Concave Surface.

eye, and *Obr* the observer's eye (Fig. 18), in front of which is inclined a glass plate G L, the rays of light passing from L are reflected partly

at G L into *Obd*, return along the same path, passing through the plate, and enter the observer's eye.

This was the principle of Helmholtz's first ophthalmoscope. If, instead of the glass plate, we use a concave mirror with a central hole, and if the instrument is fitted with a series of lenses which can be turned into position in front of the sight-hole, we have the refraction ophthalmoscope.

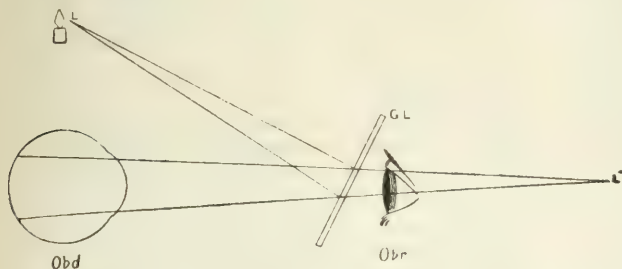


FIG. 18.—Diagram of the Ophthalmoscope.

Morton's ophthalmoscope (Fig. 19), though expensive, is the best and will last a lifetime. It has an oblique mirror and a "straight" one, either of which can be turned into position as required. The oblique mirror can be turned round to suit either eye and the "straight" mirror is reversible, being plane on one side and concave on the other.

Messrs. Curry and Paxton have introduced an

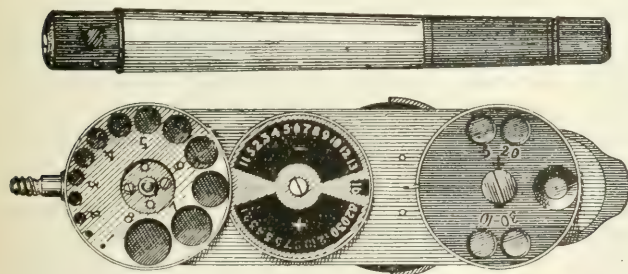


FIG. 19.—Morton's Ophthalmoscope.

The rotating wheel is made to serve as a pupillometer, the discs being numbered from 1 to 8 mm.

electric light attachment to Morton's ophthalmoscope.

The convex lens or focus-glass used in the "indirect" method should have a focus of about 8 cm.—*i. e.* be about 13 D—and should have a diameter of about 5 cm. The lens usually supplied with ophthalmoscopes is much too small. The glass should be kept clean and free from scratches.

The Different Methods of Examining the Eye with the Ophthalmoscope—

1. The indirect method.
2. The direct method.
3. The "shadow test," or retinoscopy.

The patient should be in a darkened room.

The light used should be on an adjustable bracket if possible; any kind of light will do if it has a broad, steady, white flame, but the electric light in a ground-glass globe is the best, as it gives off less heat.

Before commencing the ophthalmoscopic examination the eye should be thoroughly examined by the oblique or focal illumination. Put the light on a level with the patient's eye, on the same side as the eye to be examined, and about 12–15 inches from it, and with the focus-glass throw a luminous spot on the cornea. By moving the lens about the whole surface of the cornea, the anterior chamber, iris, and anterior surface of the crystalline lens can be examined. This examination is further aided by viewing the illuminated spot through a strong magnifying glass, and one of the best is Voigtlaender's. This preliminary examination gives valuable information as to the translucency of the media, etc.

The Indirect Method.—Place the light close to the patient's head and a little behind, use the "straight" concave mirror and hold it about fifteen inches from the eye. If opacities of the cornea, lens or vitreous are present they will be detected.

With the focus-glass held by the left index finger and thumb, rest the left hand on the patient's forehead, and an inverted picture of the fundus will be seen when the light is reflected from the mirror into the eye through the focus-glass. In emmetropia the image of the disc is the same size wherever the focus-glass is held. In hyperopia the disc appears larger than normal and diminishes in size on withdrawing the glass from the eye. In myopia it appears smaller and increases in size on withdrawing the focus-glass. In high hyperopia and high myopia an image of the disc is seen *without* the focus-glass, and in high myopia this image is inverted.

In astigmatism (unless small in amount) the disc appears oval and alters in shape on withdrawing the focus-glass.

In looking at the right disc the patient should be directed to look past the observer's right ear, and on looking at the left disc he should look past the left ear. The patient must look with the eye *not* being examined; therefore, in examining the left eye by this method, care should be taken not to obscure the right eye with the hand that is holding the focus-glass.

The Direct Method.—The light must be brought quite close to the patient's head and slightly behind, and on the same side as the eye to be examined. The observer sits (or

stands in a stooping position) close to the patient, and on the same side as the eye to be examined, using his right eye for the patient's right eye, and his left for the patient's left.

Use the refraction ophthalmoscope (without the focus-glass) and the oblique concave mirror. Holding the ophthalmoscope a few inches from the eye, reflect the light on to the eye and observe the red pupillary reflex through the central hole of the mirror, and then, without allowing the light to leave the eye, approach the eye as near as possible; in fact, the observer's forehead ought to touch the patient's forehead. The fault that most beginners make is not getting near enough to the eye. The observer must not accommodate, but look, as if trying to see through the patient's head, into distance. If the observer or patient have an error of refraction, the wheel of the ophthalmoscope must be turned until the suitable glass is found. To see the macula, the patient should be told to look horizontally, in front; if the disc is to be examined, he should look slightly to the nasal side.

Only a small portion of the fundus can be seen at one time, but this portion is considerably magnified (about fifteen diameters), and consequently the minutest details are visible.

The first duty of the observer—and most beginners find this very difficult—is to relax his accommodation. The person whose eye is being examined must also relax his accommodation, which can be done by directing him to look at some object five or six metres off with the other eye, or, better, by paralyzing the ciliary muscle with a cycloplegic. If both the observer's and the observed eye are emmetropic, all the details of the fundus will be clearly seen.

By this method the refraction of an eye can be roughly estimated. If the observer be emmetropic the weakest concave glass he requires to see the fundus clearly represents the amount of myopia, and the strongest convex glass the amount of hyperopia, of the observed eye.

If the observer have an error of refraction then the following rules will enable him to estimate the patient's error.

If he requires—

(1) A glass of the same kind as his own ametropia, but stronger, he must deduct the number of his own from that glass.

Example.—He has a myopia of 3, and requires -5 in the ophthalmoscope, then the error of the observed eye is -2 .

(2) A glass of the same kind, but from one to ten dioptries weaker than his own ametropia, then the eye that is being examined has an ametropia of from one to ten dioptries of the opposite kind.

Example.—He has a myopia of 6, and requires -5 ; the refractive defect of the observed eye is $+1$. If he require -4 , it is $+2$, and so on. He has hyperopia $+4$, and requires $+3$; then the refractive error of the observed eye is -1 .

(3) A glass neither of the same kind or strength, then the refraction of the observed eye is the opposite to that of the observer's, and the amount is equal to the addition of the number of dioptries of each.

Example.—He has myopia of 5, and requires $+3$; the refraction of the observed eye is $+8$. He has hyperopia of 3, and requires -2 ; the error is -5 .

In practice this method is rarely used for estimating errors of refraction.

The Estimation of the Refraction by the "Shadow Test"; Retinoscopy; Skiascopy.—Seated at a short distance from the patient in a dark room, if we throw the light on to the patient's eye by means of an ophthalmoscopic mirror, provided the pupil is normal and the media are clear, we observe the red reflex of the fundus; and if we gently rotate the mirror the red reflex disappears and darkness takes its place. The manner in which this darkness or shadow appears varies according to the refraction of the eye.

1. If the observer is seated beyond the patient's far point, that is, if he is seated one metre off a patient who has a myopia over 1 D the "shadow" moves *against* the rotation of the plane mirror and *with* the rotation of the concave mirror.

2. If the observer is seated within the patient's far point, that is, if he is seated one metre off a patient who is emmetropic, hyperopic, or myopic under 1 D, then the "shadow" moves *with* the rotation of a plane mirror and *against* that of a concave mirror.

3. If the observer is seated exactly at the patient's far point, that is, if he is seated one metre off a patient with 1 D of myopia, there is no shadow with either mirror. This is called the point of reversal, and the whole principle of retinoscopy is to find this point, that is, we place before the patient's eye such convex or concave glass as will make him myopic to the extent of 1 D at one metre.

Let us now examine a patient. The patient's eyes should (if possible) be under the influence of a cycloplegic, which not only gives us a dilated pupil and makes the retinoscopy easier, but ensures the relaxation of the ciliary muscle. The patient should be seated in the dark, with the light above or on one side of his head and slightly behind, so that no rays can reach the eye except from the mirror. Seated, say, one metre off the patient, we reflect the light by means of the *plane* mirror into the patient's eye, directing him to look at the sight-hole of the mirror. Suppose we are examining the

right eye, and rotate the mirror so that the light passes across from the patient's nose to the temple, and suppose we notice that as the light leaves the pupil a dark shadow takes its place, passing across in the same direction—*i. e.* from the nose to the temple—we know that we are *within* the patient's far point, and that we are dealing with a hyperope or emmetrope, or myope of less than 1. Let us place in the trial frame + 2: we find, say, that the shadow is still moving *with* the mirror; we are therefore dealing with hyperopia. Put up + 4: the shadow now moves against the mirror, which means we are outside the patient's far point; put up + 3, and we find on rotating the mirror that the pupil becomes suddenly dark, and there is no shadow following with the rotation or passing against it. This, then, is the point of reversal. We have found the point of reversal with a + 3 lens, seated one metre from the patient, which means that this meridian has a myopia of one with a + 3 lens in front, and, deducting 1 from 3, leaves us 2 as representing the hyperopia. If the patient had been emmetropic in this meridian a + 1 lens would have given us the point of reversal at one metre.

If the patient's eye have a myopia of over one when we are seated one metre off, we must be outside his far point, whatever the amount of myopia, and the shadow moves "against" the plane mirror, and that glass which gives us the point of reversal represents the amount of myopia of that meridian with - 1 added if we are seated one metre off (or - 2 added if seated 50 cm. off, or - 5 added if two metres off)—that is, if - 5 gives the point of reversal, - 6 is the amount of myopia. Some surgeons always aim at reversing the shadow—that is, they purposely go beyond the point of reversal, and slightly over-correct. This is quite safe if allowance be made for the over-correction.

In the examples we have been ascertaining the far point of one meridian only—*viz.* the horizontal; we must now proceed to examine the meridian at right angles—*viz.* the vertical, and if the same glass give us the point of reversal, we know that no astigmatism is present; but if there be a difference, that difference represents the astigmatism.

In oblique astigmatism, of course, the meridians are not vertical and horizontal, and when the astigmatism is marked the appearance of the shadow is very characteristic and a bright band is seen passing obliquely across the pupil, although we may be rotating the mirror horizontally or vertically.

Suppose we are dealing with oblique mixed astigmatism and rotating the mirror horizontally we observe a bright band followed by a "shadow" passing obliquely across the pupil *with* the plane mirror, we note the axis of this

bright band and also note that the meridian is *hyperopic*; if we then rotate the mirror at right angles to this bright band, we find that the "shadow" passes against the movement of the mirror, showing that the meridian is myopic. Suppose the point of reversal of the horizontal oblique meridian is obtained by + 3 and that of the vertical by - 1, then the total astigmatism is 4, and subtracting 1 because we are seated one metre off the patient, we say that the horizontal oblique meridian is + 2, and the vertical - 2.

The greater the ametropia, the nearer is the far point to the eye, and it is of great practical importance to remember that, the greater the ametropia, the less distinct is the shadow and the slower it moves; and as we approach the point of reversal by using correcting glasses, we obtain an increasingly defined shadow which moves more and more rapidly. We can thus, at once, make a rough estimate of the degree and kind of ametropia.

If the observer be not emmetropic, he should wear his correcting glass. This, of course, especially applies if he be myopic. If he be hyperopic, he may correct his defect by accommodation if he choose. The point to be remembered is, that to practise retinoscopy accurately the observer requires a normal acuity of vision. He may accommodate as much as he likes, as it does not affect the result.

SECTION IV.—HYPEROPIA

Hyperopia or Hypermetropia.—The hyperopic eye is the undeveloped eye in which, with accommodation at rest, parallel rays come to a focus beyond the retina (Fig. 9, H), and only convergent rays focus on the retina; but as in nature all rays are either parallel or divergent, it follows that the hyperopic eye at rest sees everything indistinctly.

Rays coming from a point on the retina diverge, and, on passing through the dioptric system, emerge from the normal eye as parallel rays. In hyperopia, although they are not so divergent as they were before refraction, they still diverge if the eye be at rest, and therefore never come to a focus in front of the eye; but when prolonged backwards, they will meet at a point behind the eye—the *punctum remotum*. This punctum remotum of the hyperope is therefore not the actual focus of the distant rays, but the virtual focus, and is represented by the negative sign - R (Fig. 20).

It will be seen from Fig. 20 that the more divergent the rays are in front of the eye, the nearer will their "backward prolongation" focus; hence the nearer - R is to the eye, the higher will be the hyperopia.

This is the same as in myopia—*viz.* the higher

the myopia, the nearer is R to the eye; but the difference is that in myopia R is in front of the eye, and in hyperopia it is an imaginary point behind the eye.

Thus the degree of hyperopia is in inverse ratio to the distance of the punctum remotum.

Suppose the punctum remotum of a hyperope is 33 cm. behind the retina. We have seen that a convex lens whose focal point is 33 cm.

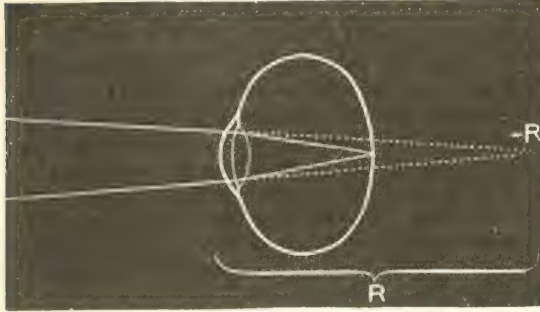


FIG. 20.—Showing the Punctum Remotum of a Hyperopic Eye.

is 3 D—that is, such a lens has the power of converging parallel rays to a point 33 cm. on the other side of the lens, and, conversely, rays diverging from a point 33 cm. in front of such a lens become parallel on passing through. If this lens be put in front of the eye of this hyperope, it will so act that, assisted by the dioptric system of the eye, it will cause parallel

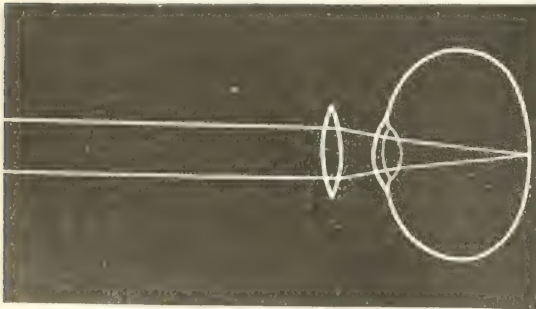


FIG. 21.—Showing Parallel Rays focused on the retina of a Hyperopic Eye by means of a Convex Lens.

rays to focus on the retina. Hence the measurement of hyperopia is that convex lens which enables the hyperopic eye, at rest, to see distinctly objects at a distance, and the focal length of such a lens represents the distance of the virtual far point from the eye. In the above example it was found that +3 was this lens, and we accordingly say that this eye has a hyperopia of 3.

A hyperope differs from a myope in that he

can correct his defect up to a certain point; he can by accommodation produce the same effect on parallel rays as if a convex glass were placed in front of the eye. This apparent advantage brings with it many disadvantages—viz. all the troubles incident to eyestrain.

The hyperopic eye is never at rest; it has to accommodate for distant as well as for near objects. The emmetrope's ciliary muscle is at rest when he is looking at any object twenty feet off, or beyond, but the hyperope's eye is never at rest if he attempt to see distinctly; and, moreover, when he wishes to look at a near object he starts with a deficit, which deficit is the amount of accommodation he required for distant vision. A hyperope of four dioptries, with five dioptries of accommodation, can focus distant objects clearly, but then he has only one dioptre left for near vision; this will only bring his near point to one metre from the eyes. Again, take a hyperope of two dioptries, with five dioptries of accommodation: he has only three dioptries available for accommodation of near objects; this brings his near point to 33 cm., but he is using the whole of his accommodative power for this, and it is impossible for him to do this for long without fatigue, and so we get all the symptoms of eyestrain.

As in hyperopia " R " is negative the formula for accommodation is $a = p - (-r) = p + r$. Therefore $p = a - r$; in other words, the available amount of accommodation is represented by the total accommodation less the amount required to correct the defect, so that although age for age the hyperope has the same total accommodative power as the emmetrope, he has less to use for near vision if his defect is uncorrected.

The Varieties of Hyperopia.—The hyperopia which is at once recognized, the patient confessing to improved vision with a convex glass, is called manifest, and this manifest hyperopia (H_m) is expressed in amount by the *strongest* convex glass the patient accepts. For instance, a patient sees $\frac{6}{6}$, but with +1 in front of the eye $\frac{6}{6}$: +1.5 makes the letters hazy, then +1 = H_m .

Again, when the defect is hidden by the patient using his accommodation and obtaining perfect distant vision, hyperopia is present if he accepts a convex glass, and the total manifest hyperopia is represented by the strongest convex glass with which he can see equally well as with the unaided eye. (It should be noted that neither the emmetrope nor the myope will, under any circumstances, accept even the weakest convex glass for distance.)

The latent hyperopia is the additional hyperopia which shows itself when the accommodation has been paralysed by a cycloplegic.

Total Hyperopia (Ht)	Latent H. (Hl)	Only revealed under a cycloplegic.
	Manifest H. (Hm)	<p><i>Absolute</i> (Hma), which no amount of accommodation can correct, represented by the weakest convex glass.</p> <p><i>Facultative</i> (Hmf), when distant objects can be clearly seen with or without convex glasses, represented by the difference between the strongest and weakest convex glass</p>

The want of harmony between the accommodation and the convergence is a constant cause of eyestrain in uncorrected hyperopia. A hyperope of 2, when looking at a point 33 cm. off, is using $\frac{1.00}{3.3}$ —i. e. 3, added to the correction of his hyperopia—viz. $3 + 2 = 5$; but he is only converging three metre angles instead of five, consequently he is using 2 of accommodation in excess of convergence.

Many hyperopes can increase their accommodation, to a certain extent, without varying their convergence. The same thing occurs in myopia, only in that case it is the convergence that is used in excess of the accommodation. There is a minimum amount of effort when convergence and accommodation work harmoniously together, as it were supporting each other; but when one is used in excess of the other it has to work unaided and alone, and strain is liable to ensue.

Many hyperopes cannot use their accommodation in excess of convergence; they lose binocular vision, and squint. A hyperope, under these circumstances, finds himself in the following dilemma: if he wishes to see binocularly, he must use less accommodation than he requires to see distinctly; or, if he wishes to see distinctly, he must sacrifice binocular vision, which ends in squint. He must choose between distinct vision and binocular vision. Distinct vision is more craved for, and more useful, than binocular vision, especially if the latter be not quite perfect, owing to one eye being more defective than the other; consequently he sacrifices binocular vision, and squints, and the eyestrain ceases (see *Strabismus*, p. 1081).

Axial Hyperopia, with which we are now concerned, is due to a shortening of the antero-posterior diameter of the eye. It is an arrest of growth, and is the condition of almost all eyes at birth.

Symptoms of Hyperopia—

1. The most prevalent and most marked are those of eyestrain (see *Eyestrain*).
2. Spasm of the ciliary muscle, which often renders the patient artificially myopic.

3. Sudden failure of vision—obscurations—due to fatigue of the ciliary muscle.
4. Convergent Strabismus.
5. Eye flatter than normal and cornea smaller.

One or more of these symptoms may be present, but they may all be absent.

Diagnosis of Hyperopia by examination—

1. Vision is improved by, or is as good with, convex glasses.
2. Retinoscopy gives a shadow moving "with" with a plane mirror, and a reverse shadow with a concave mirror, and the more defined the shadow and the quicker its movement, the lower the hyperopia.
3. The indirect ophthalmoscopic examination shows an image of the disc larger than normal, and diminishing on withdrawing the lens from the eye.
4. In the direct ophthalmoscope examination, if the observer's accommodation be relaxed, a convex glass is required in the ophthalmoscope to obtain a clear image of the fundus. If the hyperopia be high, the mirror alone, a short distance from the eye, shows an *erect* image of the fundus moving *with* the observer.

Treatment. Up to six years of age atropine should be applied to the eyes for at least three days—preferably a week—twice a day before the examination.

During this period of life the eye has not fully developed, most children have a certain amount of hyperopia, which should only be corrected if high in amount, or if *strabismus* be present.

As the examination before the type at this age is of no practical value, the surgeon has to depend on the result of his retinoscopy.

The glasses ordered should be at least 2 D weaker than the atropine estimate, and when the error is greater even more must be deducted.

When the amplitude of accommodation is great, the patient will probably prefer a weaker glass than we wish to give, and vice versa. When the hyperopia is small in amount, and equal in the two eyes, and there is no strabismus, it is unwise to order any glass.

From ages six to fifteen the atropine should be applied to the eyes twice daily for at least two days, and preferably three days, before examination. The hyperopia should be corrected unless very *small* in amount, and even then when associated with astigmatism.

At this period we must recognize the "personal equation." Some patients will stand a fuller correction of their defect than others.

After ascertaining the amount of error under atropine, we must, whenever possible, arrange

for a final examination before the test types, when the effects of the cycloplegic have passed off. We should prescribe the fullest correction of the error the patient will accept, consistent with good vision. For instance, under atropine a child of twelve years reads $\frac{6}{6}$ with +3. When the effects of the atropine have passed off, deducting +1 for the atropine, we find that +2 gives $\frac{6}{6}$ hazily, and that it is only when we reach +1.25 that $\frac{6}{6}$ is clearly read. This is the correction we order, with a cylinder correcting the astigmatism, if present. Such a patient did not come to us for improvement in vision; he probably read $\frac{6}{6}$ quite well, and if we insist on his wearing a correction which makes his distant vision worse, he will seize every opportunity of *not* wearing the glasses.

When the hyperopia is slight (say only 1.75 or 2 under atropine), equal in the two eyes, unassociated with astigmatism or strabismus, glasses are not necessary.

From ages fifteen to twenty-five or thirty atropine is the best cycloplegic, but in a large number of cases we have to be content with homatropine, because atropine necessitates too long a period of rest from work. Glasses should not be prescribed until the patient has recovered from the effects of the cycloplegic, and then the fullest correction of the error that the patient will accept, consistent with clear vision, should be ordered to be worn always.¹

In high hyperopia, especially in cases where the patient will only accept a very partial correction of the error, it is advisable to give the full atropine correction, as special near-work glasses, for use by artificial light.

From ages thirty to forty-five homatropine should be used as the cycloplegic, and in the case of patients with high hyperopia, or when the smallest fear of glaucoma is present, one drop of eserine (two grains to the ounce) should be put into the eyes when the examination is finished.

The treatment is the same as for younger patients.

A larger proportion of the correction will be accepted, and the older the patient, the more necessary is it to give the full cycloplegic correction for near work.

Over age forty-five no cycloplegic is necessary, as all the hyperopia has by this time become manifest.

The strongest convex glass the patient will

¹ When the patient cannot return for a final visit, glasses correcting the whole of the manifest, and about one-third of the latent hyperopia, may safely be prescribed. (Manifest hyperopia is expressed in amount by the strongest convex glass the patient accepts when not under atropine. Latent hyperopia is the additional hyperopia which is revealed under atropine.)

accept must be prescribed, and as the presbyopic period has arrived, a still stronger glass will be required for reading, and the two are best prescribed in one glass in the form of invisible bi-focals (see *Presbyopia*, p. 1076).

As hyperopia in children tends to become less, they should be re-examined at least once a year.

SECTION V.—MYOPIA

Myopia, or short-sight, is a condition of the eye in which the retina is situated behind the principal focus (Fig. 9, M), and only divergent rays from a near point (Fig. 22), or parallel rays made divergent by a concave glass (Fig. 23), can come to a focus on the retina.

The retina of a myopic eye is the conjugate focus of an object situated at a short distance in front of the eye, or, in other words, the

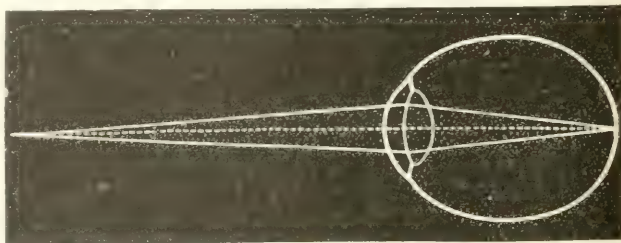


FIG. 22.—Divergent Rays focused on the Retina of a Myopic Eye.

punctum remotum of a myope is always at a definite distance (less than six metres), the distance being measured by the amount of myopia. Thus, a myope of 1 has his far point one metre from the eye, a myope of 2 has his far point half a metre, or 50 cm., and a myope of 5, 20 cm., from the eye.

A myopic eye sees distinctly distant objects (when accommodation is relaxed) with that concave glass whose focal length is equal to the distance of the far point from the eye, and the converse is true: the measurement of myopia is that concave glass with which the myopic eye sees distinctly objects at a distance, and its focal length is equal to the distance of the myope's far point from the eye. If the accommodation be relaxed, the strongest concave glass is the measure of the myopia.

We can ascertain the punctum remotum of a myope directly by measuring the farthest distance at which he can see objects distinctly; thus, if such a spot be two metres from the eye, this is R, and its expression in dioptres is $r = \frac{1}{2}$ or .5, hence the myopia = -.5.

Myopia may be produced in the following ways—

1. By elongation of the axis of the eye—**axial myopia**. This may be due to—

- (a) General elongation of the eye—**typical myopia**.
- (b) Localised protrusion of the sclerotic, particularly at the posterior pole—**staphyloma**.
2. By increase of the refractive power of the eye—**refractive myopia**. This may be due to—
 - (a) Increase in curvature of the cornea, as in myopic astigmatism.
 - (b) Increase in the curvature of the lens—
 - (a) In spasm of the accommodation.
 - (β) In luxation of the lens.
 - (c) Increase of the density of the lens, as at the beginning of senile cataract.
3. A combination of 1 and 2, as in **conical cornea**.

Every dioptré of myopia represents a lengthening of the axis by about $\frac{1}{3}$ mm.

The Relation between Accommodation and Convergence.—A myope of 5 D can see a point

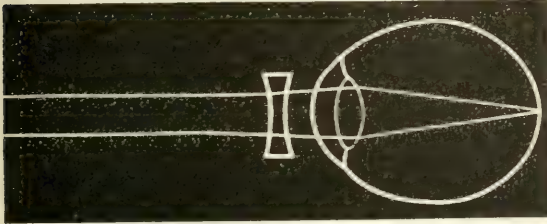


FIG. 23.—Parallel Rays focused by a Concave Lens on the Retina of a Myopic Eye.

20 cm. from the eye without using his accommodation, but he must converge to 5 m.a. in order to see binocularly. As a compensation for the visual defect, most myopes have the power of using their convergence in excess of their accommodation, just as a hyperope has often the power of using his accommodation in excess of his convergence; but they both have to pay a penalty for this, the liability to strain always being greater when either effort is used in excess of the other. The "fusion supplement" must be greater than in emmetropia, and the greater the "fusion supplement" the greater the fatigue to the internal recti; the fatigue leads to "insufficiency" of the muscles, and matters are made worse. But it is not only the excess of convergence, but the excessive convergence that tends to produce strain and fatigue of the internal recti.

It is undue convergence that is the chief cause of myopia. Myopia is hereditary but rarely congenital. It generally first appears between the ages of eight and ten and is specially likely to occur in children of myopic parents. A bad habit of reading with the book too near

the eyes from bad illumination or corneal nebulæ will start the defect, and so long as excessive convergence is maintained so long will the myopia tend to increase.

Symptoms and Diagnosis of Myopia—

1. Distant objects are seen indistinctly.
2. Near objects seen distinctly and the near point nearer than normal.
3. Acuteness of vision often lowered, especially in high myopia.
4. Latent divergence often becoming a divergent strabismus.
5. Muscle strain.
6. Eyeballs sometimes very prominent.
7. Muscæ volitantes complained of.
8. Vitreous opacities often present, especially in high myopia.

Sometimes the only symptom present is indistinct distant vision, and this, very often, is not recognized by the patient as a defect.

The Diagnosis of Myopia by Examination—

Objective Examination. The Ophthalmoscope:

(1) The Indirect Method.—The disc appears smaller and becomes larger on withdrawing the focus-glass. In high myopia the fundus is seen (inverted) without the focus-glass.

(2) Direct Method.—The fundus is only seen clearly when concave glasses are rotated in front of the sight hole.

Retinoscopy. With a plane mirror the shadow moves "against," and with a concave mirror "with," if the observer be beyond the patient's far point. With the observer seated one metre from the patient, the measure of myopia is that concave lens which gives the point of reversal, with -1 D added.

Examination with Lenses before the Test Types. When a cycloplegic is used the patient may require a slightly stronger lens than the objective examination indicated. Thus, if retinoscopy at a metre from the patient gives us the point of reversal with -5 , we call the amount of defect -6 , and before the types the patient may prefer -6.5 .

Note the *weakest* lens that gives the most distinct vision with each eye separately, and then try the glasses *binocularly* when binocular vision exists, as sometimes the patient will accept and prefer a slightly weaker glass.

TREATMENT OF MYOPIA

Early Life. Chiefly preventive in early life. Apparent myopia may show itself

- (a) Due to ciliary spasm.
- (b) In high hyperopia.

- (c) From a bad habit of holding near work too close to the eyes, sometimes due to defective vision caused by disease, such as corneal nebulae and cataract.

In all these cases the true error is revealed by atropine, which should always be used in young patients.

The preventive treatment consists in stopping excessive or prolonged convergence. Teaching the young should be done mostly by demonstrations. The seats and desks should be adjustable, and the windows of the schoolroom should be on the left of the scholars. No near work should be done by artificial light.

Even in the nursery the toys should be large—a large box of plain bricks is one of the best toys. Threading beads and all small close work should be forbidden, and *no child under seven who has one or both parents myopic should be allowed to learn to write or draw.*

Having ascertained the concave glass that corrects the myopia of each eye under atropine, in quite young patients order such glasses for constant use; in those over puberty delay prescribing until the effects of the atropine have passed off—not only because an increase of $\cdot 5$ may very distinctly improve vision, but because it is important to try the glasses binocularly when the eye is in the normal state. It is too often forgotten that the eyes are not single optical instruments, and we often find that a *weaker* pair of concave glasses give as good vision as a stronger glass used monocularly.

The only certain method of arresting the progress of myopia is to establish a normal state, in which the ciliary muscle is strengthened by being forced to work, the excess of convergence over accommodation stopped, and excessive convergence made impossible, and this can only be achieved by insisting upon the *constant* use of the glasses, and *refusing to give weaker ones for near work.* The patient can see his near work so much better *without glasses* that we may have some trouble at first in enforcing this treatment.

Of course the precaution must be taken of removing the glasses when rough games are being played.

Adult Life. In adults the treatment of myopia should be carried out in the same manner, substituting homatropine for atropine in those who cannot afford the time from work that the latter entails.

If the myopia be somewhat high, say 6 or over, and has never been fully corrected, we may have to give glasses for near work 1·5 or 2 weaker, but the patient should be strongly advised only to wear these on special occasions when fine work is being done, or by artificial light.

The older the patient and the higher the

myopia the more difficult will it be for him to use the distance glasses for near work, because his accommodation has been so long idle that the ciliary muscle is considerably atrophied.

In patients of thirty years of age and up to forty, homatropine should be used when practicable. Over forty no cycloplegic is required. If the patient has never had the full correction he will at this age be unable to read with his distance glasses, and weaker ones must be given, preferably in the form of bi-focals. All the more will this be the case when he arrives at forty or forty-five, the emmetrope's presbyopic period. No rigid rule should be observed, but each case should be treated according to its requirements.

After carefully testing the patient we should find his working near point, and keep more accommodation in reserve than would be required in the emmetrope, because the ciliary muscle is weaker (see *Presbyopia*, p. 1076).

Some adults with a small amount of myopia obstinately refuse to wear the constant correction: ladies will wear lorgnettes at the theatre, etc.; men will wear a monocle. If no astigmatism be present, this may be allowed, so long as no increase in the myopia takes place, but only on the condition that the patient is re-examined at frequent intervals.

High Myopia. In most myopes a white crescent—the myopic crescent—is observable on the temporal side of the disc, although it may not be limited to this part. In high myopia it often spreads on the outer side towards the macula. It is very often limited by a ring of pigment. This crescent, which is a localised atrophy of the choroid, is brought about by the stretching of the tunics in the formation of the posterior bulging or staphyloma posticum of the eyeball, and by the tilting of the disc. The dragged or tilted disc is very characteristic, and becomes deeply cupped in some cases. This cupping is quite distinct from glaucomatous cupping, in that it is most marked on the nasal side, the vessels rising up and dipping down over the tilted edge in a very characteristic fashion, and it does not occupy the whole area of the disc.

If the myopia progress the changes may become general, and after a time white patches of choroidal atrophy, with masses of black pigment forming their boundary, are scattered all over the fundus. These changes extend to the vitreous, causing liquefaction of that body and subsequent shrinking, and the consequent loss of support to the retina may end in detachment of that membrane. Unfortunately, very often some of the most serious changes occur at the macula, as this is the region of the bulging, and hæmorrhages and consequent atrophy lead to a result as disastrous as the detachment.

Some cases of high myopia have been termed "malignant," and it is very probable that many of them ought not to be classed under myopia at all, but that the myopia is only a symptom of a disease attacking the eye.

In the *treatment* of high myopia the following special points should be observed.

If the patient does not "accept" the full correction do not enforce it, but give a weaker glass and hope to increase the strength later.

For instance, — 20 is the full correction, but the strongest glass the patient will accept is perhaps — 17.

When recent fundus changes are present in young patients the eyes should be kept under atropine for a long period, the correcting glasses should be well tinted, and a country, open-air life should be ordered, with complete cessation of all close work while the changes are active; older patients should be warned against stooping or straining, and should be strongly advised to do little, if any, near work. In all these cases so much depends on the general health that it is wise for the surgeon to place them under the care of a physician.

When any fear exists as to the possibility of detachment of the retina ensuing, the patient should be especially warned against riding on horseback, jumping, or doing any act which may jar the body.

In very high myopia discission of the lens is sometimes beneficial.

SECTION VI.—ASTIGMATISM

Regular Astigmatism.—So far we have been concerned with errors of refraction that were due to an alteration in the shape of the eye as a whole, the antero-posterior axis being too short or too long—*axial ametropia*. Astigmatism is an error due to alteration in the curvature of the cornea or lens, that is, it is an *ametropia of curvature*.

If a stenopaic slit (Fig. 24) be placed before an eye that has marked astigmatism, and if it be rotated, there will be one position in which vision is most distinct and another position at right angles to the first where vision is worst. In regular astigmatism the meridians of greatest and least curvature—the principal meridians—are always at right angles to each other; the meridians in between these have a greater or less curvature, according

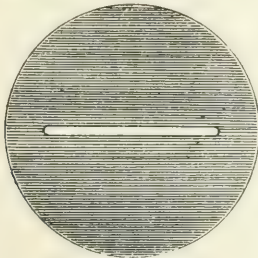


FIG. 24.—Disc with Slit Aperture.

as they are nearer to the former or to the latter. The meridian exactly between the two (corresponding to an angle of 45° if the meridians of greatest and least curvature are vertical and horizontal) has its focus point exactly between

that of the greatest and that of the least curvature.

The bowl of a spoon is an exaggerated example of an astigmatic surface, the curve from side to side being much greater than that from the handle to the tip of the spoon.

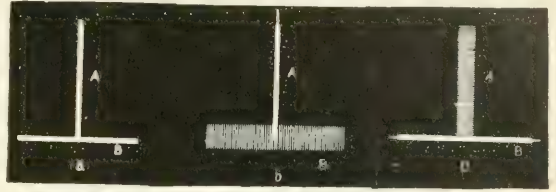


FIG. 25.—Diagram of lines at right angles to each other seen by Astigmatic Eye.

If two lines A and B (Fig. 25, a) are looked at by an eye with marked astigmatism they cannot both be distinct. If the vertical meridian is the defective one, A will appear clear and defined because the "spreading out" of the line vertically does not affect its definition, but B will appear blurred because it is "spread out" vertically. If the horizontal meridian

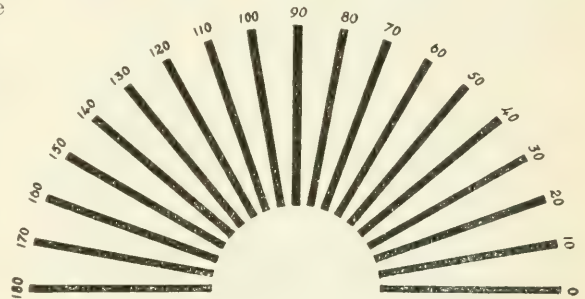


FIG. 26.—Astigmatic Fan.

is the defective one, the lines appear as in c.

Thus if the "Rising Sun," or Fan or Clock Face (Fig. 26) be looked at by an astigmatic eye the lines seen most distinctly correspond to the meridian that is most defective.

In all the examples in Fig. 27 the horizontal meridian H is the least curved, consequently its focus H' is behind V', the focus of the vertical meridian. The interval between V' and H', *i. e.* between the focal points of the principal meridians—is called the "focal interval of Sturm," and represents the amount of astigmatism.

When the horizontal meridian is the least curved, as in Fig. 27, the astigmatism is called "*direct*" (or astigmatism according to the rule). When the horizontal meridian is the most curved the astigmatism is styled "*inverse*" (or astigmatism against the rule).

The vision of an astigmatic person, when the

astigmatism is sufficiently high to cause a defect of vision, is different from that of the defective vision of the hyperope or myope. Objects may not appear blurred generally, but only in parts; lines are lengthened or broadened, and circles appear elliptical. He may be able to read some letter in $\frac{6}{6}$, but even in line $\frac{6}{18}$ he may not read all correctly; he supplies the visual deficiency by guessing.

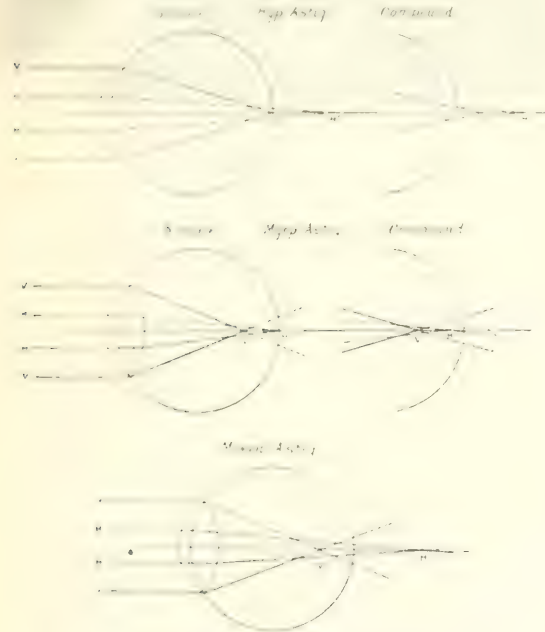


FIG. 27.—Diagrams of varieties of Astigmatism.

V, Rays passing through the vertical meridian; H, rays passing through the horizontal meridian.

Varieties of Regular Astigmatism (Fig. 27):

Variety of Astigmatism.	Refraction of the Principal Meridians.	Position of the Principal Focus.
1. HYPEROPIC ASTIGMATISM.—		
(a) Simple.	Emmetropic. Hyperopic.	On the retina. Behind the retina.
(b) Compound.	Both hyperopic.	Both behind the retina, one being nearer than the other.
2. MYOPIC ASTIGMATISM.—		
(a) Simple.	Emmetropic. Myopic.	On the retina. In front of the retina.
(b) Compound.	Both myopic.	Both in front of the retina, one nearer than the other.
3. MIXED ASTIGMATISM.		
	Hyperopic. Myopic.	Behind the retina. In front of the retina.

When the meridians are exactly oblique—i. e. at an angle of 45° or 135° —this is called “oblique astigmatism.”

Symmetric Astigmatism is when the axis of the principal meridian in each eye is identical; and *Asymmetric Astigmatism* is the reverse.

Homonymous Astigmatism is when the axes of the principal meridians in each eye are more or less parallel.

The Seat of Astigmatism.—In regular astigmatism the seat is chiefly in the cornea, due (1) to congenital malformation of the cornea, often traced to heredity; or (2) to acquired alteration in the curves of the cornea, produced by operations or inflammation of the cornea; or (3) to pressure from tumours in the lid.

Transient astigmatism can be produced by pressure on the eye with the finger, or by contraction of the lids or the extra-ocular muscles. Congenital corneal astigmatism is, more or less, stationary through life; acquired astigmatism is reduced by time.

Even in the normal eye there is a certain amount of “physiological” astigmatism, but so small that it can be ignored.

The *lens* may also be the seat of astigmatism, which may be “static” or “dynamic.”

The static lenticular astigmatism is generally small in amount, and, being in the same meridian, adds itself to that of the cornea, increasing the total astigmatism of the eye; occasionally it is the reverse of that of the cornea, and so corrects it.

Dynamic Lenticular Astigmatism is nearly always corrective, and is the opposite of that of the cornea. It is produced by an unequal contraction of the ciliary muscle, and is a most potent factor in causing eyestrain.

This lenticular astigmatism is very small, probably rarely higher than $\cdot 5$, so that it can only neutralize a low degree of astigmatism of the cornea. When astigmatism is pronounced, the ciliary muscle does not attempt to correct it, consequently acuity of vision is below normal and radiating lines are not all seen with equal distinctness, but this is probably the only *symptom*. On the other hand, when the astigmatism is quite small in amount (and this is the commonest condition) vision appears to be perfectly normal, even better than normal in some cases; but this patient suffers from some complaint—very often quite remote from the eyes—and this complaint, which is a *manifestation of eyestrain*, may take the form of any functional trouble and is the result of this *meridional asymmetrical accommodation*. It naturally follows that low errors of astigmatism can only be diagnosed by employing a cycloplegic, and therefore this latter method should never be omitted in any case where the presence of astigmatism is suspected. It practically

comes to this, that no report on any case under forty-five is of any value to the physician if a cycloplegic has not been used (see Eyestrain).

The *Measurement of Astigmatism* is now generally made by: (1) Retinoscopy, (2) the final trial of spherical and cylindrical glasses on the patient placed six metres from the type. (The ophthalmometer, which is especially useful in measuring small errors of astigmatism, is an expensive instrument and consequently not much in general use. The best model is that made by Meyrowitz.)

The estimation of astigmatism by direct ophthalmoscopy is not to be depended on for low errors and is rarely used.

Retinoscopy is especially helpful in mixed astigmatism.

The patient should, if possible, be under the influence of a cycloplegic; in fact there is no refractive error in which cycloplegics are of such paramount importance as in astigmatism of a small amount. The ciliary muscle has formed a bad habit (of which the patient is often quite unconscious), and only gives up this habit when forced to do so by being paralyzed.

Cylindrical lenses correct regular astigmatism of the cornea, and when the error is small do the work that the ciliary muscle has been doing at so great a cost to the nervous system.

Armed with the knowledge of the refraction of the principal meridians and the direction of the axes, the final test is very easy.

In hyperopic and myopic astigmatism the difference between the two meridians represents the strength of the cylinder, and the spherical glass is represented by the refraction of the weakest meridian. The axis of the cylinder is in the direction of the meridian of least refraction. Thus, when the horizontal meridian is -4 , and the vertical -6 , we take a cylinder -2 , place its axis to correspond with the least ametropic meridian—that is, horizontal—and combine it with a spherical glass -4 .

In *mixed* astigmatism the selection of the glasses is a little more complicated. The difference in refraction of the two meridians equals the amount of astigmatism. Supposing the horizontal is $+3$, and the vertical -2 , the amount of the astigmatism is 5. We can use either a concave cylinder and convex sphere or vice versa, and sometimes it is as well to try both kinds, as one may be preferred. Let us in this case take a -5 cylinder, and place it in the trial frames with the axis horizontal (*i. e.* at right angles to the myopic meridian), and correct the hyperopia with a $+3$ sphere. When the patient recovers from the cycloplegic this sphere will have to be reduced to $+2$, or even $+1.5$. As a general rule it is best to choose the cylinder that corrects the most defective

meridian. For instance, the vertical meridian is -1 , and the horizontal $+4$. Here select a $+5$ cylinder, set vertically, combined with a -1 sphere, which may have to be strengthened to -1.5 , when the cycloplegic has passed off.

The optician should be instructed to set the concave glass next the eye, in order to obtain a periscopic effect.

The rule in mixed astigmatism is: The cylinder represents the difference between the two meridians, with its axis at right angles to the meridian whose sign it corresponds to, and the spherical glass should be the value of the meridian whose sign is the opposite of the cylinder.

Sometimes in a difficult case the stenopaic slit (Fig. 24) is useful. When placed in the trial frame, the other eye being excluded, the patient when looking through this slit sees only rays passing through the meridian corresponding to the slit; all other rays are excluded, and the glass in front of this slit that gives the best vision represents the refraction of this meridian. The slit is then turned round at right angles, and the refraction of the other meridian is taken. The difference between the two meridians is the amount of astigmatism, and the value of the cylinder that will have to be employed to correct the defect.

Treatment. In testing the patient under a cycloplegic six metres from Snellen's type with the trial glasses, we may have to alter the various glasses, sphericals or cylindricals we expected to employ, to get the best result, and the best position of the axis of the cylinder may be a few degrees different from what the retinoscopy or the ophthalmometer indicated; but we must remember that the subjective examination must always have the "last word," the objective examination being our guide, and never our master.

The astigmatism should always be fully corrected, and when the patient has recovered from the cycloplegic neither the power nor the axis of the cylinder should be altered, although we may have to deduct from or add to the spherical lens. The exceptions to this rule are few, and are as follows: (1) In children under seven years of age, when the astigmatism is less than $.5$, no cylinder need be ordered if no symptom of eyestrain be present; (2) in patients over, say, forty years of age, who have never had their astigmatism corrected and who require a high cylinder, as this latter may give discomfort at first a slight reduction may be made in the power, but the full correction should be given as soon as possible later.

In examining patients for astigmatism, atropine should be previously used up to the age of twenty-five, and even up to the age of thirty-five, if a low error is suspected; homatropine

is sufficient for older patients; after fifty no cycloplegic is necessary.

In ordering cylinders be careful to indicate accurately the axis. If this is done by simply

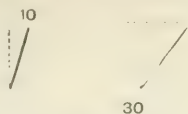


FIG. 28.—Method of marking Axes of Cylinders.

writing down the degrees a mistake may occur, as there is no uniformity at present in the numbering of the trial frames or prescription forms. (The International Ophthalmic Congress at Naples, 1909, suggested that the nasal extremities of the horizontal line should be zero, the temporal extremities 180° , and the vertical line 90° , but this has not yet been universally adopted.) The simplest method is to indicate the axis in degrees from the vertical or the horizontal, as in Fig. 28, or on an optician's form, or, better still, on a form engraved or stamped on the paper, as in Fig. 29.

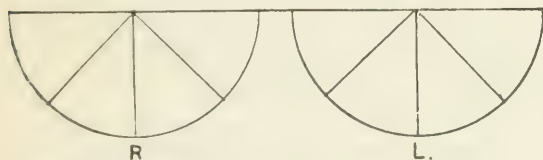


FIG. 29.—Form for marking Axes of Cylinders.

NOTE.—So important is it, when treating small errors of astigmatism, to correct even the smallest amount, that the trial case should be fitted with cylinders representing fractions of .12 up to 1 D—i. e. in addition to .25, .50, .75, there should also be .12, .37, .62, and .87 cylinders.

Irregular Astigmatism.—Physiological irregular astigmatism is present in all lenses. It is due to separate sectors of the lens having a different refractive power, and is infinitesimal in amount. It is this condition which causes a bright star to appear as a radiating figure instead of a bright point.

Sometimes the refractive power of the separate sectors of the lens is so great that several images of a point are formed, and it is in this way we get monocular polyopia in incipient cataract.

Irregular Astigmatism in the Cornea may be considerable, and is generally the result of disease, such as ulcers, nebulae, wounds, and conical cornea. It is due to a difference in curvature in different parts of the same meridian, and often produces distortion of objects, which regular astigmatism rarely does.

With retinoscopy there is no definite shadow, or, if it be present, it behaves in an

irregular manner, and glasses produce no definite and regular effect.

Treatment. Place before the eye in a trial frame an opaque disc with a small central opening, shift the position of the opening, and also place up different lenses. If vision be improved, prescribe stenopaic spectacles, with the lens if indicated; and if the opening be eccentric, specify the amount of decentring.

In conical cornea this treatment is sometimes beneficial, but, unfortunately, in most cases the spectacle treatment of irregular astigmatism is useless.

SECTION VII.—PRESBYOPIA

The Influence of Age upon the Accommodation.—

Presbyopia. The amplitude of accommodation diminishes with age.

At the age of ten years the average emmetrope's near point is 7 cm. from the eye, and his far

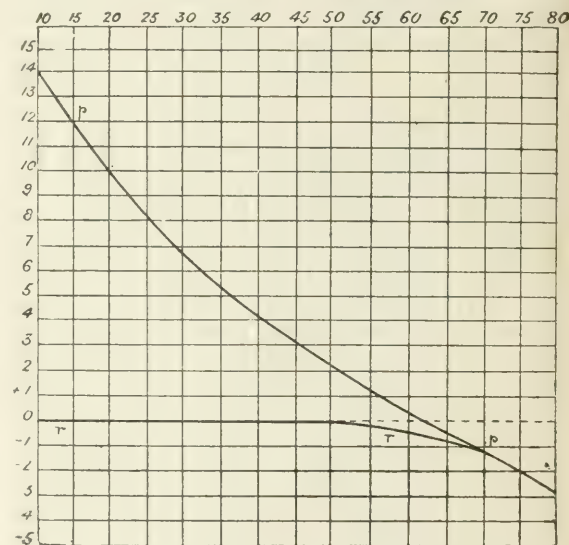


FIG. 30.—Showing the range of accommodation of an Emmetrope at different ages (Donders).

point being at "infinity," his amplitude of accommodation is 14 D (in Fig. 30, in the first column on the left, there are fourteen divisions between *p* and *r*), whereas at the age of thirty his near point has receded to 14 cm., and his amplitude of accommodation is then only 7—that is, in twenty years he has lost half of his accommodative power.

At the age of forty his near point has receded to 22 cm. according to the above diagram, but Donders rather over-estimated the amount of decrease, and the average age for *p* to recede to 22 cm. is forty-five.

These remarks are good for whatever the static refraction of the eye may be if the error

is corrected before ascertaining p . In all cases r remains stationary until about the age of fifty-five, when it begins to move downwards, and this is called *acquired hyperopia*. The loss of accommodation is due to diminished elasticity of the lens and in later years is accompanied by a loss of homogeneousness and transparency both of the lens and vitreous. As the lens reflects more light it often gives a false idea of cataract.

An individual may be said to have arrived at the presbyopic period when he finds that he cannot do his near work for any length of time without discomfort or some symptom of strain. A long-armed man who does very little near work may not require glasses until the age of fifty, whereas a seamstress, with the same refraction and of the same age, may have had to take to glasses five years earlier.

The recognition of presbyopia is not difficult. The patient has to hold his book, when reading, farther away than he has been accustomed to, especially by artificial light, the figures 3, 5 and 8 become confused, n and u are difficult to distinguish, and in most cases distant vision is unaltered.

When a patient whose near point has receded, say, to 33 cm., attempts to read or work at that distance for any length of time, symptoms of eyestrain will be sure to supervene.

"Obscurements," that is a fading away of the print while reading, due to fatigue of the ciliary muscle, is a very common symptom.

Treatment. A cycloplegic is rarely necessary (except in isolated cases where our results are unsatisfactory or we wish to examine the lens for cataract). We first ascertain the distant correction, and then the near point of distinct vision and the most comfortable distance for reading or working. Suppose distant vision is normal and the punctum proximum is 28 cm., and the distance at which the patient wishes to read is 33 cm., his amplitude of accommodation is $\frac{100}{28} = 3.5$; to avoid fatigue he must not use the whole of this, but must keep about one-third in reserve. Let him have 1.5 in reserve; this leaves him 2 available accommodative power, and, as he requires 3, we supply the deficit by giving him +1 glasses.

The treatment, simple as it appears, is not always successful, because the accommodative power varies with the individual, and when it is weak a greater reserve has to be left. We generally find that an emmetrope of about forty-eight requires a reading glass of +1, and an additional +1 for every five years.

When ametropia is present the distance correction must be ascertained, and the presbyopic glasses added to it; thus if the distance glass is +2, and an addition of +1.5 is required for reading, the reading glass is +3.5;

if the distance correction is -4, and an addition of +2 is required for reading, the reading glass is -2. When astigmatism is present the correcting cylinder must, of course, be added.

In such cases, as glasses are required both for distance and reading they are best prescribed in the form of bi-focals (see below). Whatever the age of the patient it is rarely necessary to add more than 3 to the distance glass. Should the patient require a stronger reading glass for evening use, they may be given as separate reading glasses.

Bi-focals should be prescribed for all patients who have the slightest error of refraction in addition to their presbyopia, if they show any sign of eyestrain or nerve waste. On the other hand, those who live an open-air life, whose distant vision is practically normal, and who enjoy good health, may be allowed to have reading glasses only.

As an alternative to bi-focals, the reading "addition" may be mounted in pince-nez or "hook fronts," to be worn in front of the distance glasses when reading.

When so-called "music" glasses for near work at arm's length are required, they should be +1 or +1.5 weaker than the reading glasses.

SECTION VIII.—ANISOMETROPIA AND APHAKIA

Anisometropia is a condition in which the refraction of the two eyes is different. A difference in refraction in the two eyes is more often met with than absolute equality, and in astigmatism it is very common to find a difference of .25 or .50 between them.

Every possible combination may exist—

1. One eye may be emmetropic, and the other ametropic.

2. Both eyes may be ametropic—

- (a) The same variety of ametropia, but unequal in degree;
- (b) Different varieties of ametropia, one eye myopic, and the other hyperopic; this variety is sometimes called "antimetropia."

Except when it is the consequence of an operation, loss of lens, etc., anisometropia may be regarded as congenital, and attributable to the unequal development of the eyes.

The difference in the refraction of the two eyes may be very great, and is then often associated with marked asymmetry of the face; a difference of 10 dioptres has been recorded.

Varieties of Anisometropia.—There are three varieties of anisometropia—

1. Simultaneous binocular vision exists.
2. The eyes are used alternately.
3. One of the eyes is permanently excluded.

Treatment. Anisometropia is a very prolific cause of eyestrain and when small in amount should always be corrected.

1. Where *binocular vision exists* the treatment varies considerably. In quite young patients, unless the difference between the eyes is very great, the full correction of each eye should be ordered. In older patients we must try the binocular effect before prescribing glasses. The full correction in each eye is especially indicated when marked symptoms of eyestrain exist, and in these cases, although the treatment may be complained of at first, the discomfort often disappears in a few weeks and eventually the symptoms of eyestrain disappear. On the other hand, patients who have lived many years without having their anisometropia corrected have become so accustomed to the condition that the removal of it is irksome.

Place the proper correction in front of each eye, and try the binocular effect; if this is unsatisfactory, take off a little from the stronger glass or add a little to the weaker, or do both. Sometimes the patient prefers the same correction in both eyes, and this correction is weaker than that required by the more ametropic eye. For instance, suppose the right eye is emmetropic and the left hyperopic to the extent of 2 D, we try first a plane glass in front of the right and + 2 in front of the left; if this causes discomfort we may try a + .5 in front of the right and + 1.5 in front of the left. If this is still uncomfortable we try + 1 in front of both eyes. No definite rule can be laid down; each case should be treated according to its requirements and the patient's sensations.

When the correction has been found under a cycloplegic deduct a little more from the more ametropic eye and a little less from the other.

2. *When the eyes are used alternately* if eyestrain be not present, glasses may not be needed. Although binocular vision is absent, advantages are present, and sometimes neither accommodation nor convergence are necessary.

If eyestrain is present both eyes must be corrected. If both eyes are hyperopic prescribe for both the stronger glass, and if both are myopic give the weaker for both. Never alter the cylinder unless it be very high in one eye, in which case a slight reduction may be made.

3. *One eye is permanently excluded*:—When the difference between the eyes is great, the more defective eye is little used, and tends to become amblyopic, if it is not so already. In such cases we must give each eye its proper correction, and instruct the patient to practise the amblyopic eye by totally excluding vision with the good eye by covering it with a patch for a certain time every day. In "amblyopia ex anopsia" occurring in young patients with

convergent strabismus, this treatment is often most satisfactory.

Monocles may be prescribed if astigmatism is absent.

Presbyopia and Anisometropia.—When presbyopia is present with anisometropia we should, whenever possible, prescribe bi-focal glasses. The lower or reading section must be found by the same kind of trial as we made for the distant correction. It does not follow that the same addition is given to each eye. For instance, one eye has a hyperopia of 2 and the other of 4, and the patient is fifty-two; we should try + 4 and + 6 for reading, or, if this be not comfortable, + 4.5 and + 5.5, or + 5 in both eyes.

When the patient has only one eye and glasses are required for distance and reading, they may be prescribed in the form of *reversible pince-nez* or spectacles, the distant correction being on one side and the reading on the other.

Aphakia.—This is a condition of the eye in which rays of light entering the eye do not pass through the lens (on account of its dislocation or removal).

If the eye were originally emmetropic, + 11 or + 12 placed in front of it should supply the place of the lens.

When the eye is ametropic the approximate glass required is half the original error added to + 11. (For instance, before losing the lens the patient had a myopia of 6; $-\frac{6}{2} + 11 = 8$.) If the refraction of the eye before removal of the lens was - 22 probably no glass is required afterwards.

As all the accommodation is lost through the removal of the lens, the convex glass has to be increased in strength for near work, according to the distance of the near work from the eye; thus, if 33 cm. is the spot required at which to read, + 3 must be added; and if 25 cm. is the distance, + 4 must be added. After cataract extraction there is almost always a large amount of inverse astigmatism, and a + cylinder of 1 to 2 D, placed horizontally, or nearly horizontally, will probably be required. This inverse astigmatism is generally fairly high immediately after the operation, and gradually diminishes during a period of two or three months.

SECTION IX.—EYESTRAIN

Eyestrain may be defined as a symptom or group of symptoms produced by the correction or attempt at correction by the ciliary muscle of an error of refraction, or as a want of balance between the external muscles of the eye. Where gross errors exist, either in the refraction or in the muscular equilibrium, the patient cannot correct, and consequently makes no

attempt to correct, the defect, and eyestrain is not produced. The smaller the error, the more likely is eyestrain to be present, and also, unfortunately for the patient, the more likely is it to be overlooked.

The symptoms of eyestrain may be grouped under three headings—

1. Manifestations on the eye and lids.
2. Peripheral irritation.
3. Nerve exhaustion.

1. Manifestation of eyestrain on the eye and lids.—Eyestrain renders the parts specially receptive to infective germs, consequently blepharitis, ulcers, iritis and cyclitis, may have eyestrain as a predisposing cause. Glaucoma and cataract have also been traced to eyestrain.

2. Peripheral Irritation—

- (a) *With pain*:—Any form of headache, migraine or neuralgia may be traced to eyestrain, headaches being quite the commonest manifestation.
- (b) *Without pain*:—Epileptiform attacks and choreiform movements of the facial muscles are often cured by removing eyestrain.

3. Nerve-waste, Neurasthenia, "Brain-fag."—

A person with a low degree of astigmatism, or with anisometropia, or want of balance of the ocular muscles, during all his waking hours is sending down impulses to the eye to correct the defect, and when he starts on near work he starts with a big deficit, and further strain results. This must mean great waste of nervous energy. Almost any functional nerve trouble may be due to eyestrain.

Insomnia is a common symptom.

The nerve-waste may lead to the alcoholic or drug habit, while if taken in time may be cured by removal of the eyestrain.

The chief reason why the eyes are so seldom suspected of being the cause of neurasthenia, brain-fag and the different varieties of functional nervous troubles, is that the majority of patients have either good sight or they are already wearing glasses which only partially correct their refractive errors.

SECTION X.—HETEROPHORIA

In ideal binocular vision the visual axes are parallel when the eyes are at rest (Fig. 31 A), and when the eyes accommodate for a point P (Fig. 31 A) both eyes converge to that point. In normal vision if we destroy the possibility of fusion, convergence lags behind accommodation, and, instead of converging for P, the visual axes are in the direction E A (Fig. 31 B) the difference between A and P being the "fusion supplement." If the position of rest is one of diver-

gence (Fig. 31 C), A is further removed from P and the fusion supplement is larger. This divergence at rest means that the internal recti are insufficient to produce parallelism without active muscular contraction which the demand for binocular vision necessitates during all the waking hours; hence the muscles are never at rest, and when the necessity for convergence arises, the interni start with a deficit of power. The constant using up of part of the convergence power fatigues the internal recti muscles, and the positive part of the amplitude of convergence will be found very much diminished.

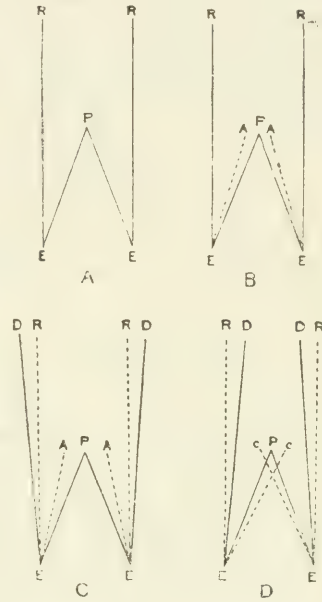


FIG. 31.—Diagram showing the positions of the Visual Axes at rest and during convergence.

The amplitude of convergence may be quite up to the average, but if the positive part of it is too small, this indicates the presence of insufficiency of the internal recti and the liability to eyestrain.

"Insufficiency" of a muscle implies that the muscle is relatively weaker than its opponent, so that in static and dynamic vision extra impulses have to pass to that muscle in order to produce perfect fusion.

An insufficient muscle is not necessarily weak. Absolute weakness of a muscle is termed "inefficiency."

Insufficiency may be present in any of the muscles. If the visual axes at rest are convergent, the external recti muscles are insufficient to produce parallelism (Fig. 31 D). If one muscle by spasm or preponderance over its opponent prevents the eyes from assuming the normal position when at rest, there is liability to fatigue and eyestrain; whether it manifests

itself or not (there are a large number of cases of insufficiency which never produce any symptoms) depends entirely on the amount of insufficiency and the nervous condition of the individual.

Varieties of Heterophoria.—

Orthophoria = visual axes parallel, and lying in the same horizontal plane.

Heterophoria = visual axes not parallel or not in the same horizontal plane; divided into :

1. Exophoria. The eyes tend to turn out; insufficiency of the interni.
2. Esophoria. The eyes tend to turn in; insufficiency of externi.
3. Hyperphoria. One eye tends to be on a higher level than the other, due to insufficiency of the superior or inferior rectus.
4. Insufficiency of the oblique muscles—
 - (a) Hyperesophoria, a tendency up and in.
 - (b) Hyperexophoria, a tendency up and out.
5. Cyclophoria.

The test for all these forms is the Maddox test (see p. 1062).

1. **Exophoria** (*Insufficiency of the Internal Recti—Convergence Strain*).—"Convergence Insufficiency" is a latent external squint, overcome for the time by the strong desire for single vision. It is generally associated with Myopia.

Treatment.—In the majority of cases, when the want of muscle balance is small, the correction of the error and the *constant wearing* of the glasses will in a short time remove the exophoria.

The advantages of wearing concave glasses for near work are less strain on the convergence and restoration of the harmony between accommodation and convergence.

If exophoria still persists after some months of this treatment, a prism, *base in*, should be prescribed with the glasses, or, if the concave glass is fairly strong, the prism effect may be obtained by decentring the glass out.

2. **Esophoria** (*Insufficiency of the External Recti*).—Latent convergence.—It is fairly frequent and rarely causes any symptoms—generally associated with hyperopia.

Treatment. By putting the hyperope into glasses we re-establish the harmony between convergence and accommodation, remove the spasm of the internal recti, and consequently also the insufficiency of the externi, restoring the balance of all the muscles.

It is very seldom that we have to resort to prisms in the treatment of esophoria, but, should it be found necessary, the prism must be placed

base out, and if decentring is substituted, convex glasses must be decentred *outwards*.

3. **Hyperphoria** (*Insufficiency of the Superior or Inferior Rectus*).

Treatment. A small amount is often present where an error of refraction is present, and generally disappears in a few weeks, after correction. It is generally associated with astigmatism and anisometropia.

If prisms have to be resorted to, they must be placed base up or down, according to the condition existing.

4. **Hyperexophoria** — **Hyperesophoria** (*Insufficiency of the Oblique Muscles*).—This is the result of the superior oblique of either eye being too strong for its inferior, or *vice versa*.

Treatment. We must hope that the correction of the refractive error will remove the want of balance, and, if necessary, we must use prisms set obliquely; but some cases, unfortunately, appear to be incurable.

5. **Cyclophoria**.—This is a rare form of heterophoria, and is due to the turning of one or both eyes round an antero-posterior axis. If the Maddox rods in a frame are placed exactly horizontal before one eye, and the streak of light is seen by the patient as being more or less sloping, instead of perfectly vertical, cyclophoria is present. When present, it is generally found associated with oblique astigmatism.

Treatment. Extreme care should be taken to correct completely the errors of refraction, and very special care should be taken in ascertaining the exact angle for the cylinder, and also in ascertaining that the optician has rigidly carried out instructions. As a rule, this suffices to remove the trouble. Prisms are of no use.

Heterophoria may occur without any error of refraction being present and is due to excessive convergence, enfeebled muscles associated with general debility after illness, or congenital defect of the muscles.

Orthoptic training or gymnastic exercises can be, with very great benefit, extended to the extrinsic muscles. For strengthening the internal recti we employ properly regulated convergence for a short time at different periods of the day, the time to be gradually increased. For strengthening the external recti we must employ prisms with their base in. Provide the patient with a square prism—say 2°—and tell him to practise fusion several times a day; and when this is accomplished with ease, gradually increase the strength of the prism until the "insufficiency" disappears.

Treatment by Tenotomy. In a few special cases tenotomy has succeeded when the milder treatment has failed. The cases where it is likely to be beneficial are patients with marked exophoria possessing an ample range of convergence. A tenotomy of one or both external

recti, and in bad cases advancement of an internal rectus, will remove the exophoria; and by thus setting free the whole of the convergence power, by turning the "negative" convergence into "positive," the symptoms of eyestrain are removed.

When prisms are ordered, never give the full correction. Suppose, for instance, the patient shows an exophoria with the Maddox distance test which is corrected by a 4° prism, base in, before one eye, if we give a 2° prism, base in, before each eye, we shall be helping the muscle *too much*, and give the patient no chance of improving; we should in this case prescribe a 1° prism, base in, before each eye.¹

It should never be forgotten that the prism treatment is *not* a curative treatment; we are treating the symptom, and not helping the condition to disappear.

Even when prisms are ordered, the patient should be enjoined to use them as *special* glasses to be worn only for NEAR work.

NOTE.—*Method of finding the Amount of Decentring necessary to produce the Effect of a given Prism in a given Lens* (Ward Holden).—Take 8.7 mm. as the distance a lens of 1 D must be moved to produce the effect of a prism 1° , as the unit, multiply 8.7 mm. by the number of the prism whose effect is required, and divide the product by the number of the lens in dioptries. Thus the effect of a prism 3° in a lens of 7 D is obtained by decentring that lens to the extent of $\frac{8.7 \div 3}{7}$ mm. = 3.7 mm.

Malingering is detected by—

1. *The Prism Test.* If a 6° prism is placed before the "blind" eye base out, this eye will move in, at the moment of placing the prism, in order to avoid diplopia, if it is *not* blind.

2. *Snellen's "FRIEND" Test* (see p. 1083). The malingerer does not know that with this test he can read only half the letters with one eye. If he reads the whole word, he is detected.

3. *Bishop Harman's Diaphragm Test.* This instrument is not only useful for detecting malingering, but it is also a very ready test of binocular vision and its defects.

SECTION XI.—STRABISMUS

Squint.—A heterophoria, or latent squint, may at any time become heterotropia, or manifest squint, if the necessary muscular effort to preserve parallelism cannot be made or maintained.

Varieties of Squint.—(1) *Concomitant*, in which the squinting eye moves with its fellow, and

always deviates to the same degree from the correct position.

(2) *Paralytic*, when the movement of the squinting eye is restricted by paralysis of the muscle.

We shall deal in these pages only with the first variety.

Forms of Concomitant Squint—

1. *Convergent.*—Internal squint (esotropia).

If the squinting eye is not amblyopic, there is homonymous diplopia.

2. *Divergent strabismus.*—External squint (exotropia).

If the squinting eye is not amblyopic, there is heteronymous or crossed diplopia.

3. *Vertical strabismus* (hypertropia), in which the visual axis of one eye is deviated upwards.

These three different forms of concomitant squint may be—

1. *Constant*, in which one eye is always the squinting eye. This condition is also called *monolateral*.

2. *Alternating*, in which either eye can fix, the fellow squinting; in these cases the vision of both eyes is generally equally good.

Squints may also be *periodic* or *intermittent*.

When the breadth of diplopia is greater than the breadth of fusion power, no effort can unite the images, and we get (1) a constant squint. When they are almost equal, the images may be united by a great effort for a short time; this is (2) a periodic squint. When the breadth of diplopia is considerably less than the breadth of fusion power, the images are easily united, and this is (3) a latent squint (heterophoria). The difference between the three is merely a question of degree.

The Causes of Concomitant Squint—

Any cause which reduces the visual acuity of one eye tends to develop a squint, especially if a heterophoria or latent disturbance of equilibrium pre-exist.

1. *The Accommodation Theory.* We have already seen how, in hyperopia (p. 1069), when the patient has to use his accommodation in excess of his convergence, a convergent squint is developed, if he cannot dissociate the two.

Again, in myopia he has to use his convergence in excess of his accommodation; "insufficiency" of the interni develops, and in time an external squint is manifest.

2. *Anatomical Peculiarities—The Muscle Theory.* The recti may be inserted too far forwards or too far back—the interpupillary distance may be too great.

3. *Non-Development of the Fusion Sense.*

The Diagnosis and Measurement of Concomitant Squint.—Make the patient fix an object, say, a couple of metres from the eyes, taking care

¹ The use of prisms is limited to about 4° in front of each eye, as any stronger prism would make the glasses too heavy.

to place the object midway between the two eyes. Let us suppose that the left eye fixes the object and the right eye squints inwards: we note the external margin of the cornea of both eyes by making a small ink spot on the lower lid; let s be this mark on the right eye (Fig. 32) and n' on the left. We now cover the left eye with a screen, and tell the patient to fix the object again; this he does with the right eye, and we notice a marked excursion of this eye; we now note the position of the external margin of the cornea N . The distance Ns is the **primary deviation**.

When the left eye is covered and the patient is fixing with the right eye, if we look behind the screen we notice that the left eye makes a

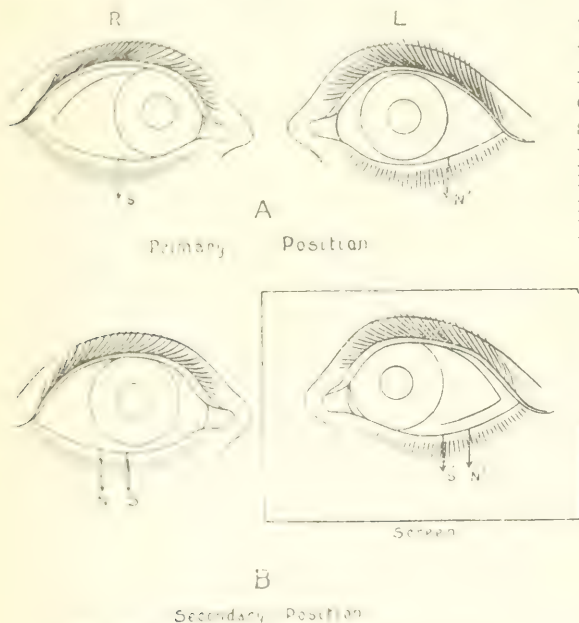


FIG. 32.—Measurement of Concomitant Squint.

distinct incursion; and if we mark on the lid the two positions of this eye we get the distance $s'N'$ as representing the **secondary deviation**, which is equal to the primary deviation. (In paralytic squint the secondary deviation is always very much greater than the primary.) We measure a divergent squint in the same manner.

When the squinting eye is blind we must use a strabismometer (Fig. 33), and read off on the scale the amount of the squint in millimetres.

A much more reliable method is to measure the amount of squint by the perimeter.

Treatment. 1. The correction of the error of refraction.

2. The education of the fusion sense.
3. The education of the amblyopic eye.
4. The readjustment of the muscles by operation.

Convergent Strabismus.—Almost eighty per cent. of patients suffering from convergent strabismus are hyperopes, and the defect is manifested very early in life—in fact, when the child begins to use his eyes for near vision, looking at picture-books, etc.; the majority of such patients develop a squint *about the age of three*.

The squint always develops slowly. The first treatment is to put the eyes under atropine for at least a week, and in slight cases the squint entirely disappears when the eyes are fully under a cycloplegic. While under the atropine the refraction of the eyes is estimated by retinoscopy and the correction ordered in large oval or circular spectacles to be worn *always* (see *Hyperopia*, p. 1067). About every six months the examination under atropine must be repeated, and, if necessary, weaker glasses ordered as the hyperopia tends to decrease.

If the squinting eye is amblyopic the child should be made to practise it by having the *good* or fixing eye bandaged up or put under atropine. In this way the amblyopic eye is forced to work. Never put atropine in *both* eyes except for examination.

As an essential cause of convergent squint may be a defective development of the fusion faculty, the orthoptic training is very important and cannot be begun too early. The best method of doing this is by means of Worth's Amblyoscope. Where no improvement takes place with the above treatment, and especially if the amblyopia is increasing, we must operate.

Squint operations are always best done under cocaine and adrenalin, because when the patient is conscious we are able to judge accurately the amount of adjustment necessary; but when we have to operate on quite young children a general anæsthetic is necessary.

In slight convergent strabismus division of the internal rectus may be sufficient; if not, we must advance the external rectus of the same eye; and lastly, in rare cases, division of the other internal rectus may be necessary.

Divergent Strabismus.—This condition is rarely seen before puberty. Slight cases may be cured at the onset by putting the patient into glasses; but it is very uncertain, and in the majority of cases, when once the "insufficiency" has passed into a squint, nothing short of an operation is any good. This consists in dividing the external rectus, and, when this is not sufficient, in advancing the internal rectus.



FIG. 33.—Strabismometer.

Training the eye, and so trying to reduce the amblyopia, should also be resorted to. When the squint is not very marked, give the glasses and the orthoptic training a fair trial of, say, six months before resorting to operation.

After squint operation it is most important for the patient to continue to wear the correction, and also to persevere with the stereoscopic training. He should be warned that, unless this is done, there is a danger of further trouble—for instance, a convergent strabismus that has been corrected may develop into a divergent strabismus, etc.

SECTION XII.—METHODS OF EXAMINATION— NOTE-TAKING—SPECTACLES

Methods of Examination. The room should, if possible, be sufficiently long to allow the patient to be seated six metres, or twenty feet, from the type. When this length is not obtainable (even diagonally), reversed types must be used and hung over the patient's head behind him, and opposite should be a mirror, on which the type is reflected. The distance should be so arranged that the distance between the patient and the mirror and between the mirror and the type together measure six metres.

Apparatus Required. The *distant type* should be Snellen's type, and several boards, with a different arrangement of letters, should be used, and changed as necessity arises, or they may be arranged in a box form and rotated by a cord by the surgeon from where he is standing.

The type must be well and evenly illuminated, preferably by artificial light, and, if possible, in a dark part of the room, so that the difference between a bright and dark day has little or no effect on the record.

A dark room, although desirable, is not absolutely necessary; the whole consulting-room can be darkened with a blind or curtain, or a dark corner can be curtained off. *Absolute darkness* is not a *sine qua non*.

The lighting should, if possible, be electric, and ground-glass lamps should be used, or the special high-candle-power lamp made for eye or throat work, which is ground glass with a small portion clear. Failing the electric light, the "incandescent" is, perhaps, the best form of gas illumination.

The *reading type* should be kept clean in a cover.

The Trial Case. Messrs. Hamblin (50 New Cavendish Street) supply a very good set of glasses, as under.

Spherical, convex and concave, thirty pairs each, from $\cdot 12$ to 20 .

Cylindricals, convex and concave, eighteen pairs each, from $\cdot 12$ to 6 .

Prisms from 1° – 12° .

The lenses are all thin and mounted. The case also contains neutral-tinted glasses—steno-païc discs, etc., and a good adjustable *trial frame* (with screw to rotate the cylinders).

The price of the complete case is seven guineas.

The ophthalmometer, mirrors, focus-glass and Maddox glass rod test, all of which are essential, have already been referred to.

Snellen's "FRIEND" test—

This consists of a frame containing six transparent letters alternately red and green, the FIN are red and the RED are green. This is placed in the window and the patient is made to look at it through a red glass in front of one eye and a green glass in front of the other (the glasses must correspond with those in the frame). Only the red letters can be seen through the red glass and the green letters through the green. When both eyes are being used the whole word is read, but if, say, FIN are only read we know that the eye with the red glass in front of it is only being used. It is a very good test for malingering.

Cycloplegics.—The only ones needed are atropine and homatropine, and are best used in the tabloid form—tabloid "B" (Burroughs Wellcome & Co.) $\frac{1}{200}$ gr. each of atropine hydrobromide and cocaine hydrochloride, and tabloid "W," $\frac{1}{50}$ gr. each of the hydrochloride of homatropine and cocaine.

The effect of atropine takes about a week to pass off, that of homatropine a few hours only.

The atropine should be put into the eyes morning and evening by the patient for two or three days as ordered.

Homatropine is applied by the surgeon about one or one and a quarter hours before the examination.

Note-making. The ophthalmic case-book made by Pulman, Thayer Street, W., is the best.

The Systematic Examination of the Patient. After recording name, age, history, and symptoms, the patient is placed in the chair opposite the type, and the trial frame is adjusted. With one eye blocked, the visual acuity of each eye is separately recorded, and also roughly the effect of concave or convex glasses. There is no necessity to waste much time over the first examination if a cycloplegic is going to be used. On the patient's return under atropine or homatropine, take him straight into the dark room, examine carefully with the ophthalmoscope, and then ascertain the refraction by retinoscopy. (If you have an ophthalmometer, measure the astigmatism.) Then take the patient back to the type examination, find out the glass or combination of glasses that give best vision, record this, and let him return for a final visit when the effect of the cycloplegic has passed off, when you order the correction.

Of course, when a cycloplegic is not used the examination is completed in one visit.

Remember that in old patients hyperopia is often present and absolute, and a weak convex glass will often improve vision from $\frac{6}{60}$ to $\frac{6}{6}$.

Always note and record the spectacles that have been previously worn.

Spectacles. The optical centre of the glass should coincide with the visual axis. Distance glasses should be centred for distance, and near-work glasses for the point at which they are intended to be used. Glasses for constant use should be centred for a point between these two.

The plane of the glasses should be perpendicular to the visual axis when in use, hence reading glasses should be tilted forwards.

The best form of *bridge* is the saddle-bridge; it should be flat in order not to indent the nose, and should fit the nose accurately.

The glasses should be as near the eyes as the lashes will permit; 13 to 14 mm. is the average distance. It is most important to remember that the lashes must not touch the glass; when the lashes are very long, periscopic lenses should be ordered.

Concave glasses are weakened and convex glasses strengthened by removing them farther from the eyes, and vice versa.

The sides of the frame should touch the temples and pass behind the ears in all spectacles made for children, and preferably in every case where the glasses are to be worn always. The portion behind the ear should fit comfortably, so that the wearer is hardly conscious of it.

Under no circumstances should anyone but an emmetropic presbyope be allowed to wear folders. Folders never fit, are rarely correctly centred, and tend to become bent, so that one or both glasses are oblique to the plane of the eyes, and one is often nearer the eye than the other.

Pince-nez should be rigid and light. The clips which keep pince-nez in position on the nose should be made of malleable material, so that they can be shaped to the sides of the nose, and the surface next the nose should be rough. It is most important that all glasses should "sit" horizontally; especially is this the case when cylinders are worn.

Monocles may be allowed in cases of monocular amblyopia (see p. 1078).

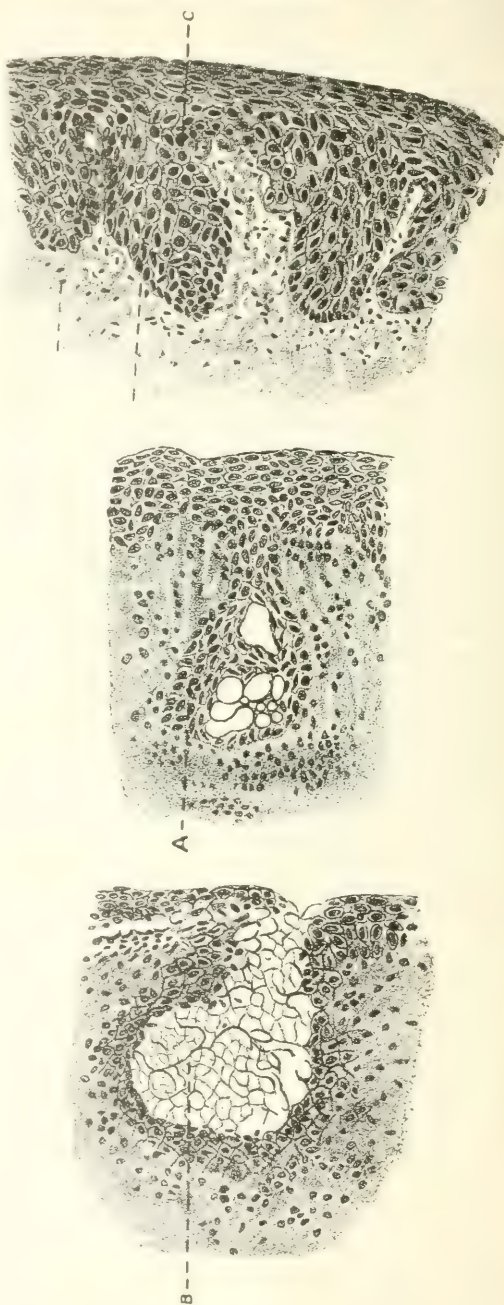
Children should always have spectacles, and not pince-nez, and the frames ought to be strong and light.

Final Note. Patients ought always to be reminded that the treatment of their error of refraction is by no means permanent. Changes will take place. Young patients should be re-examined at least once a year; older ones every two or three years.

E. C

CONJUNCTIVITIS

Conjunctivitis is classified according to the pathogenic organism; diagnosis depending upon bacteriological examination. Whilst most



FIGS. 1, 2, 3.—Showing the process of New Gland Formation in the Conjunctiva.

Fig. 1, Papillary formation, C; Fig. 2, Commencing mucoid change in epithelium, A; Fig. 3, New gland formed by complete mucoid change in the epithelium, B.

cases can be recognized clinically, in atypical cases resort must be had to examination of the discharge. As a rule examination of smear preparations suffices; but in rare cases a more thorough bacteriological or cytological examination may be necessary.

Conjunctival infection may be general, of the whole membrane, or local. In the latter it is usually confined to the deeper layers and is known as phlyctenular. Both affections may be present simultaneously.

The normal conjunctiva is never sterile, but the organisms are not virulent, and can be made to disappear by cleansing for several days with mild antiseptics. The most common organisms are the so-called *xerosis bacillus* and *staphylococcus albus*. The conjunctiva undergoes considerable alteration with age and after inflammation. In the new-born child it is smooth and contains no lymphoid tissue or mucoid glands. The epithelium is thinner, and there is no layer of lymphoid tissue—facts which render it more liable to infection (*e. g.* ophthalmia neonatorum). The lymphoid tissue appears in the conjunctiva in from three to six weeks after birth, according to the amount of irritation it receives. In old age and after inflammation the tarsal conjunctiva becomes velvety in appearance, from the formation of papillæ, and there is increased mucoid degeneration in the folds formed between these papillæ, definite new mucous glands being formed. These glands may get blocked at their mouth, and small cysts are formed; these resemble millet seeds and often undergo calcareous change.

Conjunctival inflammation leads to great increase in the lymphoid tissue, first in the

palpebral conjunctiva and then in the bulbar conjunctiva at the limbus. This results in the formation of lymphoid follicles identical with those found in lymphatic glands. These follicles are first formed in the fornices, but vary in situation with the cause of inflammation. Thus in trachoma they are found chiefly in the upper fornix, whilst after other forms of inflammation,



FIG. 4.—Follicular formation in the lower fornix from a case of Chronic Conjunctivitis.

such as Koch-Weeks', diplo-bacillary or staphylococcal conjunctivitis, they are found in the lower fornix. Formerly they were all known as *follicular conjunctivitis* (Fig. 4).

In children follicles seem more prone to form

as the result of irritation than in adults. This is probably due to the fact that all lymphoid tissue is much more active in children (*e. g.* adenoids and tonsils, etc.).

Organisms commonly found in conjunctivitis—

1. *Cocci*, staphylococcus, streptococcus, pneumococcus, gonococcus. 2. *Bacilli*, B. Morax-Axenfeld, B. Koch-Weeks, B. Klebs-Loeffler, B. tubercle; more rarely—B. leprosy, B. coli communis, B. Friedländer (pneumobacillus), B. Ducrey (soft sore). 3. *Protozoa*, spirochæte pallida. 4. The cause of the inflammation in the following diseases is not known—Trachoma, spring catarrh, vaccinia, pemphigus.

1. Cocci.

Staphylococcal Conjunctivitis occurs at all ages, and varies clinically very considerably, depending on the virulence of the strain which has caused the infection. An abrasion of the epithelium seems necessary for the organisms to grow in the tissue. Usually a muco-purulent conjunctivitis is set up which is frequently accompanied by phlyctenulæ and follicles in the fornices towards the end of the attack.

Treatment consists in constantly washing away the discharge with boric lotion and in painting the lids daily with a ten per cent. solution of protargol, boric ointment being applied to the lids.

A more *chronic form* of recurrent conjunctivitis is associated with staphylococcal infection of the glands of the lid margin, manifesting itself by a semi-purulent discharge from the mouths of the Meibomian glands, or by chalazia or styes. This condition may last for years and lead to chronic blepharitis and conjunctivitis. Phlyctenulæ and corneal ulceration are not infrequent complications.

Treatment in the early stages consists in squeezing out the secretion from the Meibomian glands, and incising chalazia or styes if present. Staphylococcal vaccine is of great service and general health should be improved.

Staphylococci are often found in *Parinaud's disease*, which is characterized by the formation of large follicles all over the palpebral conjunctiva and in the fornices. Purulent discharge is usually present with enlargement of the preauricular gland, which in rare cases suppurates. It should be treated as described above. The symptoms usually subside in two to three weeks.

Streptococcal Conjunctivitis.—Infection of the conjunctiva by the streptococcus varies considerably in severity. In mild cases a muco-purulent conjunctivitis is produced, phlyctenulæ and corneal ulceration often being present. It is frequently associated with impetigo of the face. For treatment see *Koch-Weeks' Conjunctivitis*, p. 1088.

In severe cases there is membranous conjunctivitis, which may be more virulent than that caused by the Klebs-Loeffler bacillus. In the early stages there is intense chemosis and swelling of the eyelids with comparatively little discharge; the cornea frequently becomes ulcerated and destroyed and panophthalmitis ensues. Streptococcus vaccine is of service in these cases.

In the most acute form there is pyrexia with general symptoms of fever; orbital cellulitis, thrombosis of the cavernous sinus and death from pyæmia are possible sequelæ.

Treatment. In mild cases treatment should be carried out as described under *Koch-Weeks' Conjunctivitis* (see p. 1088). In the severe cases antistreptococcal serum together with small doses of streptococcal vaccine should be given.

Pneumococcal Conjunctivitis is frequently sufficiently characteristic to render a diagnosis possible; the incubation period is about forty-eight hours (Fig. 5).

Symptoms. There is muco-purulent discharge and much lachrymation. There is little or no chemosis, but a bright red injection of the vessels of the ocular conjunctiva,

both superficial and deep. Frequently, the ciliary vessels are engorged, which sometimes makes the diagnosis from iritis somewhat difficult. Indeed this organism is the cause of the only form of conjunctivitis which can give rise to an iritis by absorption of toxins into the anterior chamber without involving the cornea. Hæmorrhages and phlyctenulæ are rare. Frequently the affection is confined to one eye. The disease terminates by crisis, the organism and frequently the discharge disappearing in forty-eight hours. This rapid termination accounts for the fact that follicles are rarely formed. In exceptional cases, especially in young badly nourished children, a membrane is formed.

Treatment is as described under *Koch-Weeks' Conjunctivitis*.

Atropine should be used if iritis be present.

Complications. The cornea is rarely affected in pneumococcal conjunctivitis, as the toxins seem to have little effect on the corneal epithelium, the organism being unable to gain an entrance to the substantia propria unless it is abraded.

Gonorrhæal Conjunctivitis exists in two forms—

(a) In the new-born (ophthalmia neonatorum);
(b) In adults. Although due to the same organism, the clinical appearance and prognosis of the two forms of the disease differ. The incubation period is about seventy hours. In

both forms the gonococcus is easily found (Fig. 6).

(a) *Ophthalmia Neonatorum*.—No ocular disease causes more blindness. It is the cause

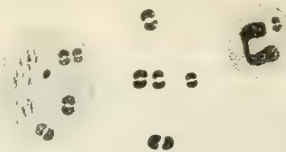


FIG. 6.—Gonococci in the conjunctival discharge from a case of *Ophthalmia Neonatorum*.

in twenty-seven per cent. of cases admitted to the blind schools of England; a very high proportion for a disease which is both preventable and curable.

Etiology. The gonococcus is the cause of sixty per cent. of the cases, and indeed, practically the only cause when the affection is of such severity as to give rise to corneal complications. The remaining forty per cent. are due to the staphylococcus, bacillus Morax-Axenfeld, and, more rarely, bacillus coli communis, streptococcus, pneumococcus, bacillus Klebs-Loeffler, and bacillus Koch-Weeks.

Infection of the infant's eyes from the vaginal discharge of the mother may take place:—

(i) In utero—children having been born with fully developed ophthalmia neonatorum and ulceration of the cornea.

(ii) During or immediately after birth—the most common time at which infection takes place.

(iii) Some time after birth (secondary infection)—from the discharge on towels, etc.

Diagnosis. There is one condition for which it may be mistaken, viz. congenital lachrymal obstruction with a large purulent mucocele. In these cases usually one eye only is filled with pus. As a rule there is no swelling to be seen over the lachrymal area, but pressure over the lachrymal sac will cause regurgitation of pus into the eye.

Symptoms. The eyelids are red and swollen, and there is a thick creamy discharge, usually from both eyes, coming on most frequently about the third day after birth.

The greatest care should be exercised in the separation of the lids, since any undue pressure on the globe may lead to the rupture of an ulcer which is on the point of perforating.

The baby should be held by a nurse, the head being placed on or between the knees of the surgeon, who should wear protective glasses.

The cornea should be first examined; if found to be clear a good prognosis may be given. The palpebral conjunctiva in severe cases is red and swollen, and its surface papillated. Occasionally in mild cases there is much follicular

formation, especially in the lower fold. The ocular conjunctiva as a rule is less affected, and gonorrhœal cases in infants, unlike those in the adult, show practically no chemosis, owing to the fact that the eyes are always closed, whilst in the adult the ocular conjunctiva in the palpebral fissure is principally cedematous, due to constriction by the swollen lids.

If a case shows profuse, thick, creamy discharge which in the later stages becomes flocculent with a very little mucus in it, it is almost certainly gonorrhœal, more especially if the cornea is affected.

If, however, a case comes with slight discharge and red lid margins, the skin around the lids being involved, the infection is probably due to the Morax-Axenfeld bacillus, which is usually associated with the staphylococcus albus, and the discharge is often slightly purulent.

Conjunctival false membranes are not at all infrequent in infants, and are not necessarily of diphtheritic origin.

Treatment. Prophylaxis plays a most important part in the prevention of ophthalmia neonatorum. The method consists in wiping the eyelids directly the child's head is born, then as soon after birth as possible washing the eyes out with a solution of 1 in 3000 perchloride of mercury. If the mother has had a vaginal discharge, douches should be given before rupture of the membranes, and silver nitrate, two per cent., should be instilled into the eyes, being subsequently neutralized with salt solution, as infants at birth have no lachrymal secretion.

The sheet anchor of treatment is nitrate of silver. In severe cases a two per cent. solution is painted once daily over the lids and fornices. In mild cases protargol, ten per cent. solution, can be used as drops at home. In the intervals the conjunctival sac should be washed out every hour with a solution of 1 in 6000 perchloride of mercury, used cold, or even iced, as cold inhibits the growth of the gonococcus. In painting, wool mops on the end of glass rods are used. The nitrate of silver should be rubbed into the conjunctiva of the tarsus and fornix, so that the drug may reach the bottom of the papillæ, which are very marked in the gonococcal form of the disease, the excess of silver being neutralized with salt solution; the greatest care must be taken not to damage the corneal epithelium. Great care must be exercised against transmission of infection. If only one eye be affected care should be exercised in order to prevent the spread of infection to the other. The sound eye should be covered by a Buller's shield, or by cyanide gauze sealed down on the nasal side by flexile collodion or strapping. It should be inspected for the first few days to see that infection has not taken place. The

treatment should be continued with the lotion for at least a month after all the discharge has ceased, since the gonococcus has been found in the conjunctival sacs twenty-eight days after the discharge has subsided.

The duration of treatment varies considerably, according to whether the case is severe or mild. If mild, the case is usually free from discharge by the end of the second week of treatment; if severe, as in the gonococcal form, the average duration of treatment is about six weeks.

(b) In the *adult form* of gonorrhœal ophthalmia infection of the conjunctiva is usually directly from the urethra, but may arise indirectly from using towels, etc., of infected persons.

The symptoms come on in from one to three days. The eyelids look red, hot and swollen, and the conjunctiva shows intense oedema, with the formation of a sulcus around the limbus in which discharge may collect and lead to infection of the cornea. The secretion at first is thin, blood-stained serum, followed in about forty-eight hours by a purulent discharge; in about three weeks this discharge gradually diminishes, then disappears. A good prognosis cannot always be given, as the cornea is much more liable to be infected. The structural difference of the adult cornea from that of the child probably renders it less able to withstand the infection.

Treatment. All persons suffering from gonorrhœa should be warned of the danger of infection of the eyes.

Silver nitrate, two per cent., should be applied daily to the conjunctiva; the discharge washed away by 1 in 6000 perchloride of mercury every hour. Similar precautions should be ordered during treatment as for ophthalmia neonatorum.

2. Bacilli.

Diplobacillary Conjunctivitis, or *angular conjunctivitis*, is an inflammation set up by the Morax-Axenfeld bacillus; the organism is easily found in the discharge. It is a large bacillus found in pairs, end to end, staining readily with methylene blue and decolorized by Gram's method (Fig. 7).

Etiology. The disease is extremely contagious; it is carried in dust, and hence is frequently seen amongst hospital porters and scrubbers. The infection is not infrequently carried by towels, sponges, water, etc.; indeed, it may occur in epidemic form amongst schools, asylums, etc.

Symptoms are those of the condition which used to be known as "catarrhal ophthalmia." The patient complains of gritty, itching or burning sensations in the eyes, and in the morning on waking the eyelids are often gummed together with secretion.

Diagnosis. The appearance of the patient is characteristic. The conjunctiva, especially the palpebral, is red, often slightly swollen and, if

in the discharge in the early stages; in the later it tends to disappear. This bacillus is the commonest cause of purulent ophthalmia (Fig. 9).

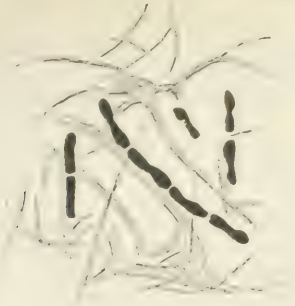


FIG. 7.—Diplobacilli from a case of Angular Conjunctivitis.

the condition has lasted some time, there may be a few follicles in the lower fornix. But the most characteristic features are the red angles to the eyelids, the whole palpebral margin being sometimes affected—hence the term “angular conjunctivitis,” which has been applied to this condition. The secretion is greyish-white in colour and is *non-purulent*, that is unless pyogenic organisms are also present, mixed infection being very frequent.

Course and Complications. Without treatment the disease becomes chronic. This organism, usually associated with the staphylococcus, is the principal cause of the chronic blepharitis and conjunctivitis so frequently seen amongst children of the lower classes. Small grey marginal ulcers are a not infrequent complication.

Treatment. Precautions should be taken to prevent the spread of this complaint. The specific for it is sulphate of zinc, which can be given as a lotion, 1 to 3 gr. to the ounce, with



FIG. 8.—An Eye Bath.

10 gr. of boric acid, to be used six times a day (Fig. 8). A little boric ointment should be smeared along the lid margins at night time to prevent gumming of the lids. It usually takes from three to six weeks to get well, depending on the length of time it has existed.

Koch-Weeks' Conjunctivitis is of moderate severity, caused by a small bacillus closely allied to the influenza bacillus, which is found



FIG. 9.—Koch-Weeks' Bacilli from a case of Purulent Conjunctivitis.

Etiology. It is the cause of nearly all the outbreaks of epidemic ophthalmia in this country, its spread being conveyed by contagion.

Symptoms. The disease almost always affects both eyes, though one may be affected before the other. There is a profuse purulent discharge, with intense injection of both ocular and palpebral conjunctivæ, and practically no chemosis, except in young children who are out of health. One of the main characteristics is the occurrence of hæmorrhages which are visible in the ocular conjunctiva. Phlyctenulæ are very frequently present. Towards the end of the attack follicles appear in large number in the lower fornix, and remain a considerable time after the discharge has ceased.

Diagnosis can usually be made from the clinical appearance, but microscopic examination will settle the point, although the organisms are difficult to find.

Course. If left alone the disease will get well of itself. If one eye only be affected it almost always spreads to the other, owing to its great infectivity. Although it is perhaps the most common cause of phlyctenulæ it is rare for the cornea to become involved.

Treatment. Constant washing away of the discharge with boric lotion and smearing unguentum boracis along the lid margins to prevent them sticking together, combined with the use of protargol ten per cent. as drops twice a day, is usually effectual in bringing about a cessation of the discharge in seven to ten days.

Tubercle of the conjunctiva is very rare as a primary condition, less so as a secondary.

Symptoms. It may assume several different appearances, the chief of which are—

(a) *Follicles*, which form and caseate, with the production of small ulcers. These cases are usually primary.

(b) *Cockscomb excrescences*, which spring from the fornices and may become pedunculated. They form the most frequent appearances of

tubercle in the conjunctiva and are often secondary to disease of the lachrymal sac.

(c) *Large ulcers* with prominent granulations are seen in advanced stages of the disease.

Enlargement of the preauricular gland is common.

Diagnosis is usually easy from the associated condition (lupus of face, lachrymal sac, etc.). The cockscomb excrescences are most liable to be mistaken for sarcoma, but can be distinguished microscopically and by inoculation.

Treatment is to remove as much of the diseased areas as possible by forceps and scissors. Cauterizing, scraping, and rubbing with iodoform, are useful for advanced cases. The administration of tuberculin is very satisfactory in these cases, and should be carried out. The prognosis to the conjunctiva is on the whole good.

B. coli communis has been found in cases of ophthalmia neonatorum of moderate severity. It is best treated as described under that disease (see p. 1087).

Friedländer's Pneumobacillus has been found in some cases of purulent conjunctivitis of moderate severity. It is best treated as described under *Koch-Weeks' Conjunctivitis*.

Soft Sore (*B. Ducrey*) usually involves the conjunctiva in the neighbourhood of the lid margins. It is best treated by the actual cautery and subsequently by constantly cleansing the eye with boric lotion.

3. Protozoa.

Syphilis (*Spirochæte pallida*). Syphilis of the conjunctiva is a rare disease. Primary chancres occur as the result of removal of foreign bodies with the tongue—a practice common amongst the lower classes.

Diagnosis. It is most liable to be mistaken for sarcoma or vaccinia. The diagnosis depends upon the rapid onset and glandular enlargement, rash and sore throat. Failing this a microscopic examination of the tissues or the finding of the spirochæte pallida, and the presence of the Wassermann reaction, will help.

Secondary and tertiary syphilis usually take the form of ulcers about the conjunctiva, but are very rare.

Treatment. Local. Lot. hydrarg. perchlor. and calomel dusted on the lesion. General treatment with salvarsan and mercury should also be administered.

4. Inflammatory Diseases of the Conjunctiva the Cause of which is not known.

Trachoma is a disease carried by direct contagion. It is characterized by the formation of follicles and infiltration of the conjunctiva, with subsequent cicatrization.

Etiology. It is found principally where people congregate, and is particularly prevalent amongst the emigrant Jews. It also varies in

geographical distribution, being very prevalent in Egypt and Arabia, but absent in high parts of Switzerland. The disease as it is found in England is by no means so severe as the type found amongst the Polish Jews and in Egypt.

Symptoms. Slight discharge, photophobia, or drooping of the lid, the subjective symptoms in the early stages often being very slight. Later on, some defect of vision is noticed, caused by the development of pannus (Fig. 10).

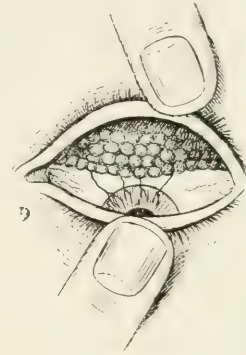


FIG. 10.—Trachoma with pannus.

The disease usually appears in the upper fornix with the formation of follicles, which may remain for a long time, and reach a large size, without giving rise to symptoms. At other times a muco-purulent discharge is set up. This discharge does not occur in all cases, nor at the same period of any particular case. Pyogenic organisms are always found in the secretion, and indeed the purulent discharge in these cases may be looked upon as a result of septic infection of the conjunctiva as well as

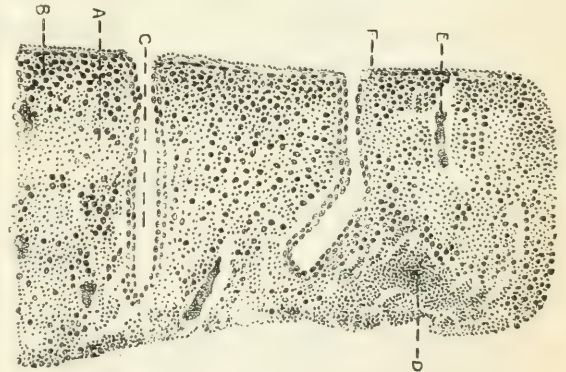


FIG. 11.—Papillary Formation in early Trachoma.

A, Papilla; B, Plasma cells; C, Crypt; D, Portion of a trachomatous lymph follicle; E, Blood vessel; F, Epithelium.

of trachoma, which doubtless lowers the vitality of the tissue. This muco-purulent conjunctivitis may cause extension of the disease, as in the most virulent cases, or it may bring about

its cure, as in cases of trachoma which have been infected with gonorrhœal ophthalmia.

Pathology. No specific micro-organism has been identified, although one probably exists. The essential change is necrosis, both in the follicles and in the infiltrated area of the conjunctiva; this leads to the scarring so characteristic of the disease. In the early stages, papillary hypertrophy is often very marked, masking the follicles (papillary trachoma). When the follicles are well developed it is known as *follicular trachoma*. When cicatrization is taking place, and the infiltration is

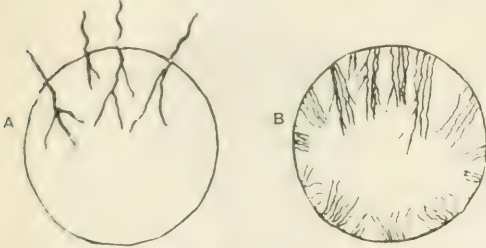


FIG. 12.—Showing the types of new vessels in Trachoma and Interstitial Keratitis.

A, Trachoma—large branched vessels derived from the conjunctival vessels; B, Interstitial keratitis—fine unbranched vessels derived from the ciliary circulation.

undergoing hyaline change, a brawny condition is produced (Stelwag's brawny œdema).

Constant contact of the follicles in the upper lid with the limbus and upper part of the cornea leads to follicular formation at the limbus spreading to the cornea, which become hazy and vascular (pannus). Small grey ulcers may appear, and the whole cornea become affected. Under treatment this often clears considerably, but almost always leaves some opacity.

When the disease has reached its height, and cicatrization takes place, it leads to—

- (a) Obliteration of the conjunctival fornices.
- (b) Formation of bands and cicatrices, one of which is always found in the sulcus subtarsalis as a white line—a point often of great diagnostic value.
- (c) Contraction and buckling of the tarsal plate with trichiasis or entropion.
- (d) Epithelial cysts, from obliteration of the mouths of the new formed glands.
- (e) Secondary xerosis, due to keratinization of the epithelium, secondary to the absence of secretion.

Diagnosis. In the stage of early follicular formation this is often difficult and even impossible unless the patient is kept under careful observation. The following are the principal distinguishing features—

(a) The follicles in follicular conjunctivitis are found principally in the lower fornix, whilst those of trachoma are in the upper. Follicles occur on the tarsus in trachoma.

(b) Scarring is absent in follicular conjunctivitis.

(c) Pannus is absent in follicular conjunctivitis.

(d) Follicular conjunctivitis occurs principally in children, trachoma commonly, though not invariably, in adults.

Treatment. The aim is to eradicate it with the least destruction to the conjunctiva by (a) operative measures; (b) phagocytosis.

(a) *Operative Measures.*

Expression. This form of treatment is most satisfactory in the case of follicular enlargements. Unfortunately we have no means at the present time of distinguishing between infected and uninfected follicles. Expression first gets rid of the foci of disease in the follicles, and allows the cavities from which they are evacuated to become septic, producing an increased polymorphonuclear phagocytosis.

The operation may be performed under cocaine and adrenalin, a little solid cocaine being rubbed into the area to be expressed. In severe cases, in which both eyes are affected, and in small children, a general anæsthetic may be necessary.

The best, and certainly the least painful instrument is Graddy's forceps. The upper lid is first everted, one blade of the forceps being passed into the fornix, the other being placed over the upper surface of the everted lid. A

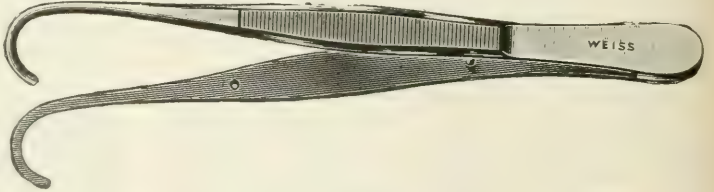


FIG. 13.—Graddy's Forceps.

gentle steady pressure is applied, and the lid drawn out between the blades. In this way as much of the conjunctiva is gone over as is necessary. The lower fornix is best expressed by picking up the loose folds with fixation forceps and then expressing by Graddy's.

If only one or two follicles be present they can be picked up with fine dissecting forceps and expressed; but when situated on the tarsus the follicles are best enucleated by a spud. A little orthoform subsequently rubbed over the palpebral conjunctiva relieves the subsequent pain. Afterwards the lids may be treated as described later.

(b) *Phagocytosis.*

(i) *Chemical.* Solid copper sulphate in the form of a smooth pencil is most frequently used,

as with it a certain amount of friction can be applied. It should be applied daily in severe cases; the pain generally lasts from three to four hours, and may be alleviated by using cocaine at the time, adding orthoform to the copper stick, and bathing the eyelids directly afterwards with iced water.

Fluid corrosive sublimate. 1 in 50, in glycerine and water, applied to the lids with a wool mop, is less satisfactory than the former drug, but is useful after expression.

Silver nitrate has the great drawback that it stains the conjunctiva (argyrosis). It is especially valuable with copious discharge, and where injection of the lids remains after the disappearance of the follicles.

(ii) *Jequirity* is prepared as an infusion from the seeds of the *Abrus precatorius*. When inoculated into the conjunctival sac it produces a muco-purulent conjunctivitis, which cannot be regulated and is therefore dangerous.

The toxin has been isolated and is called jequiról; it is standardized in three strengths, and produces a similar reaction to that caused by the infusion, but one which can partly be regulated. It is usually applied by painting over the surface of the lids two or three times in half-an-hour, and then waiting for the reaction. It is especially useful in pannus, and its effect, if too severe, can be stopped by the use of the antitoxin.

(iii) *Ultra-violet Radiation*. Exposure to X-rays three times a week for five

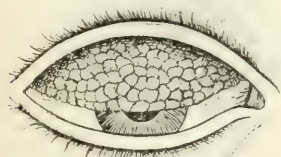


FIG. 14.—Spring Catarrh.

minutes (8 amp. 3-inch spark gap) is extremely useful, especially where there is a large amount of pannus; this must be applied to the everted lids. The treatment is painless, and is best alternated with the use of copper sulphate. Cures have

also been reported from the use of radium and high frequency currents.



FIG. 15.—Section of one of the Papillæ from a case of Vernal Catarrh. A, Epithelium; B, Eosinophiles; C, Fibrous tissue; D, Erosions of the epithelium.

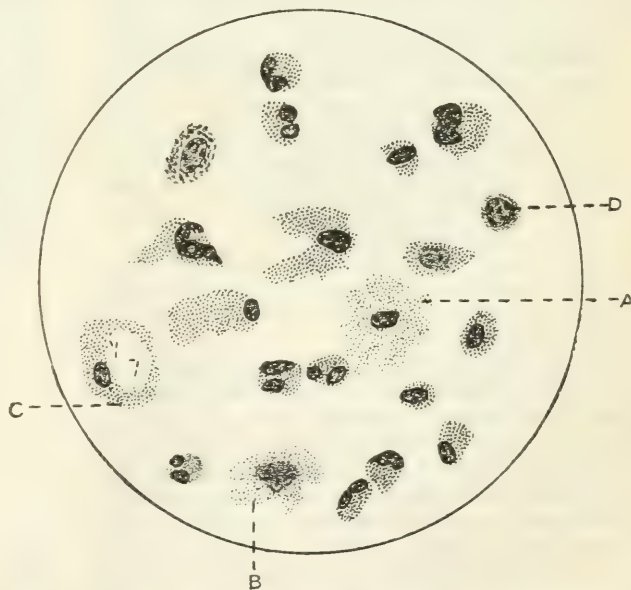


FIG. 16.—Discharge from a case of Vernal Catarrh, showing Eosinophiles.

A, B, C, Eosinophiles; D, Lymphocytes.

(iv) *Carbon dioxide snow* has been used successfully in some cases.

Spring Catarrh—a rare condition—is unlike that which occurs in the nose. It is a chronic disease with exacerbation in the spring and summer (Fig. 14).

Symptoms. In winter the patients are well, but in spring their eyes become irritable and itching, with photophobia and lachrymation, which begin to disappear in the autumn. The upper tarsal conjunctiva is injected, and covered with large papillæ with flat tops, on the surface of which there is a bluish-white film of secretion. The papillæ are composed of fibrous tissue and contain large numbers of eosinophiles. Similarly the secretion consists almost entirely of these cells—which facilitates the diagnosis from trachoma by making a smear preparation and staining with Leishman's stain. The limbus is affected in some cases by raised semi-translucent masses.

Treatment consists in the application of radium to the everted lid, locally bathing with 1 in 100 carbolic lotion, and the use of adrenalin drops during the acute stages. The removal of the papillæ, if large, is often useful in allaying symptoms, but they are apt to recur. General constitutional treatment with iron and arsenic is often useful.

Vaccinia.—The source of infection is usually from the arm of a baby. The whole conjunctiva becomes intensely œdematous, a pustule forming usually about the lid margins. The preauricular gland is enlarged. Treatment consists in keeping the eye clean with boric lotion. The cornea is rarely affected.

Pemphigus is a rare disease of the conjunctiva. It may occur with or without the skin lesion. The patient is usually very ill during its onset. There is intense photophobia and pain with the eruption of the vesicles, leading finally to much scarring and formation of bands in the conjunctiva, with secondary xerosis. Cysts are a very frequent result.

Treatment. Atropine and bathing in the early stages locally, with arsenic internally. Vaseline should be used in the later stages to prevent xerosis.

Simple Chronic Conjunctivitis may result from an acute attack and is frequently associated with blepharitis, especially when due to the Morax-Axenfeld bacillus or the staphylococcus albus, which are often present together. The untreated discharge from the eyes in measles, influenza, constant exposure to cold (e.g. in coachmen), local injuries associated with purulent dacryocystitis, inflammation of the Meibomian glands, entropion, error of refraction causing hyperæmia, are all common causes.

The subjective symptoms of this chronic conjunctivitis are often the most marked feature of the disease.

In mild cases there is a gritty, dry, itching or burning feeling or heaviness of the lids, usually worse towards the end of the day, or feeling of a foreign body in the eye, due to mucus in the conjunctival sac. Objective symptoms are frequently slight, with little or no discharge, except perhaps on waking. White beaten-up Meibomian secretion, from constant blinking, is often found at the angle of the eyelids. In the more severe cases in children discharge can be found adherent to the lashes, styes are frequent, and the lashes fall out. The conjunctiva in early cases is smooth and hyperæmic; after a time it becomes papillated, a common appearance amongst Jews. In children follicles are frequently present in the lower fornix, and even in the upper. Epithelial cysts, as the result of blocking of the mouths of the newly formed glands, are not infrequent.

Complications. Ectropion and eversion of the lower punctum is liable to occur, especially in old people with lax lids, owing to constant wiping away of discharge, and in children with blepharitis from the swelling and cicatrization of the lid margins.

Phlyctenulæ frequently accompany the disease from infection of the deeper layers of the conjunctiva, and *corneal ulceration* from infection of the cornea.

Treatment. The first step is to remove the cause, by correction of refraction errors and protection with glasses from the wind. Frequent use of boric lotion, or in Morax infection zinc lotion, is indicated; when the eyelid margins are affected, ung. hydrg. nit. dil. or ung. hydrg. ox. flav. dil. should be smeared on them. The treatment should be continued for some months.

Phlyctenula.—In its simplest form, a phlyctenula is a small red eminence, about the size of a millet seed, usually in the ocular conjunctiva near the limbus, with a leash of vessels leading up to it. As a rule the epithelium on the

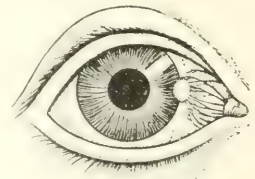


FIG. 17.—A Phlyctenula.

surface of the eminence gives way, with extrusion of the contents and the formation of a greyish looking ulcer which rapidly heals. Occasionally these nodules disappear without the formation of an ulcer. Almost invariably the disease is preceded by some other form of conjunctivitis (Fig. 17).

The position of the phlyctenula is by no means

limited to the limbus; it occurs on other parts of the bulbar and even on the palpebral conjunctiva.

Finally, phlyctenulæ may involve the cornea



FIG. 18.—Phlyctenula from the Lid. Early stage, before rupture.

A, Epithelium; B and C, Cellular exudation; D, Cavity containing pus.

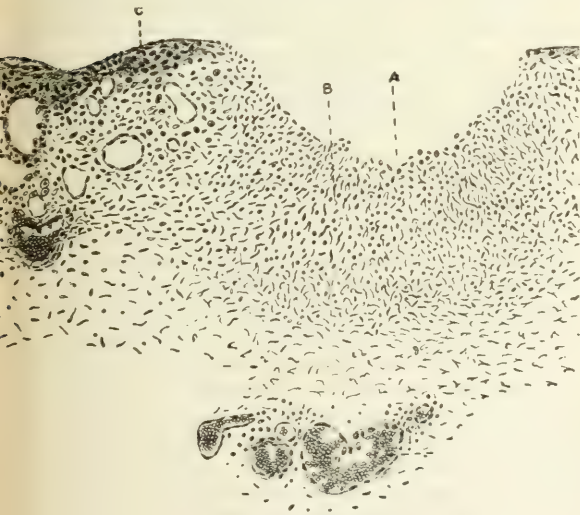


FIG. 19.—Phlyctenula after rupture.

A, Base of the ulcer; B, Cellular exudation; C, Epithelium.

and, when lasting for some time, become vascularized.

The number of phlyctenulæ varies from only one or two to a large number, the conjunctiva near the limbus being covered with very small nodules which do not usually break down into ulcers, but resolve. When the

ventor discharge runs down over the face pustules are formed in the skin from direct infection.

The patients are usually children in bad health. It is stated that these cases are always tuberculous, but this theory is not supported by the pathological evidence. Phlyctenulæ are apt to recur until health is re-established.

Pathology. Histology shows that phlyctenules are minute abscesses in the deep layers of the conjunctiva, which rupture through the surface with the formation of an ulcer. The most common organisms associated with this disease are the Koch-Weeks' bacillus and staphylococcus.

Treatment. Locally, the eye must be kept clean by mild antiseptics, 1 in 6000 hydrarg. perchlor. or lot. boric. Protargol ten per cent. as drops may be used locally to decrease the discharge. When the disease is subsiding ung. hyd. ox. flav. dil. may be applied. If the cornea is involved atropine should be substituted for the protargol.

General tonic treatment must also be administered, together with plenty of fresh air or the seaside.

Degenerative Changes in the Conjunctiva frequently secondary to Inflammation

A **Pinguecula** is a small mass of hypertrophied yellow elastic tissue seen at the limbus, in the palpebral aperture usually, in eyes subject to much exposure. It can be removed if causing annoyance from its appearance.



FIG. 20.—Pterygium.

A **Pterygium** is a triangular fold of conjunctiva in the same situation as a pinguecula, but involving the cornea. It is usually described as having a head adherent to the cornea, a neck at the limbus, and a body passing into the conjunctiva; it is red and vascular, and may spread across the cornea and so affect the sight. It occurs principally in old people and those liable to exposure. Around the head a grey area of degenerating cornea is seen. It is probably due to degeneration in the corneal epithelium, which is replaced by the conjunctiva. If spreading it had better be removed. The base is divided and is carefully dissected up to the cornea, from which it is then

torn off. The wound must be carefully sewn together, or it will recur.

Symblepharon is the adherence of the lid to the globe. It is generally the result of burns, operation or ulcers. Obliteration of the fornices, as in trachoma, is known as *symblepharon posterior*, for which little can be done. Adhesion of the lid near the margin to the globe is known as *symblepharon anterior*. The condition, when due to injuries, can often be alleviated by some form of plastic operation with or without grafting of mucous membrane.

Xerosis is essentially a drying of the conjunctiva with keratinization of the epithelium and adherence to it of Meibomian secretion containing the so-called xerosis bacillus (pseudo-diphtheritic bacillus) which is a saprophyte growing in the Meibomian secretion, and has no relation to the disease.

It is divided into (1) primary and (2) secondary.

Primary Xerosis may either affect the bulbar conjunctiva in the palpebral aperture, or the whole conjunctiva; in the latter condition it is often associated with kerato-malacia. The disease is always associated with defective health, and is especially prevalent in the spring during the hot dry winds. Night blindness is frequently complained of, and this, together with the deficient lachrymal secretion, possesses a common cause, namely, malnutrition. The disease is practically limited to children and sailors.

Secondary Xerosis following on pemphigus and the cicatrization stage of trachoma; in the latter it is principally limited to the scar tissue.

Treatment. In the primary cases this consists in improving the health of the child, plenty of green vegetables being desirable. Locally the use of oil prevents the formation of the patches and renders the cornea less liable to infection.

M. S. M.

DISEASES OF THE SCLEROTIC AND CORNEA

Diseases of the Sclerotic

The sclerotic is comparatively seldom inflamed and its diseases are few; the commonest, **Episcleritis**, gives rise to a raised red patch, usually not far from the cornea, underlying the conjunctiva, though the conjunctival vessels over it are engorged; there is tenderness and pain of a dull aching character; less commonly the pain may be acute. The course of the disease is very chronic and relapses are frequent. The subjects are often rheumatic.

Treatment. Bathing with hot boric acid lotion, and massage with very dilute yellow oxide of mercury ointment (0.5 per cent.), will

gradually cause a return to normal. Internally some form of salicylate is useful.

A similar but less severe disease is **Episcleritis fugax**, or "red eye;" the red patch persists only a few hours or days and subsides to recur immediately in another region of the eye.

Deep Scleritis is usually seen as a complication of cyclitis; the redness is deeper and more purple than in the other forms, and commonly a larger area is attacked. Often, as a result of the inflammation, the sclera is thinned and a permanent slate-coloured patch remains where the dark uveal pigment shows through. Similar patches are seen when the superficial form has been very chronic. Sometimes the sclerotic gives way over these areas and one variety of staphyloma forms.

Treatment. Pain may be relieved by heat and leeches; for the cyclitis we give atropine if the intraocular tension does not rise too high. If it occasions alarm, purgation and sweating by hot-air baths are often useful.

Injuries of the Sclerotic.—Rupture of the sclerotic occurs as the result of severe blows; it is often complicated by extrusion of the lens. If the rupture be sub-conjunctival and the conjunctiva remain unturned, the prognosis is not very unfavourable. The eye may even retain a certain amount of vision. If, on the other hand, the conjunctiva has given way, the eye will usually be lost; there is great risk of the intraocular contents becoming infected.

Treatment. The difference is the same as that between a simple and a compound fracture. Therefore nothing must be done in "simple rupture" which will make it "compound." It is very tempting to see the lens just under the conjunctiva, but it should be left there and no attempt made to remove it. The only treatment required is rest in bed with a pad and bandage over the injured eye, or preferably at first over both eyes. Atropine may be instilled; heat, applied by a muff-warmer, and leeches will be valuable if the eye remains long irritable.

Wounds of the sclerotic are always among the most serious of ocular conditions with which the practitioner will have to deal. They are dangerous not only to the eye injured, but also, by involvement of the ciliary body, they are liable to give rise to sympathetic ophthalmia, and thus to destruction of both eyes. Therefore, whenever from the great extent of damage, grave wound or escape of the lens, or loss of any large quantity of vitreous, it is practically certain that the eye cannot retain more than a small fraction of vision (the other eye being approximately normal), the surgeon must recommend excision as soon as possible. If the wound is clean cut, the lens has escaped injury and the loss of vitreous is small, the surgeon may attempt to save the eye.

The cut in the sclerotic must be closed by interrupted sutures; each suture must be doubly armed and one needle passed on each side of the wound through the sclerotic from within outwards; if the conjunctiva be sutured separately, the deep sutures should be of some absorbable material.

As the wound is being closed by tying the sutures, the ciliary body, the iris base, etc., must be pushed back inside the globe with a repositor, so that the edges of the scleral wound may come into direct contact without any intervening prolapse. If all goes well the eye will quiet down and the course of the recovery be like that of an operation wound.

If the ciliary body has been injured, and becomes inflamed, there will be much injection, but so long as there is no deposit of keratitis punctata (commonly called K.P.: *vide infra*), the surgeon may feel at rest as regards the risk of sympathetic ophthalmia. If K.P. appear, the question of removal must again be faced.

After-treatment is that of any serious eye operation. Both eyes should be bandaged and atropine used freely in the damaged eye to keep the ciliary body and iris at rest.

Naturally, if the patient have already lost one eye (since the risk of sympathetic ophthalmia is absent), there can be no question of excision, and all attempts must be made to save, even though the eye looks at first sight hopelessly lost.

Diseases of the Cornea

The cornea partakes in character both of the sclerotic and the conjunctiva; the epithelium covering the surface is the direct continuation of the latter, and the substantia propria is but little altered sclera. The diseases of the cornea fall into two groups according to the structure affected. Thus there is a large group of superficial diseases of the cornea which are in essence conjunctival inflammations, and a second of parenchymatous inflammations affecting the scleral portion of the membrane.

The reduction of the conjunctival elements in the cornea—the absence of subconjunctival tissue and of blood-vessels—causes a variation in the form of the conjunctival disease as manifested in the region of the cornea. Most superficial inflammations of the cornea tend to ulcerate; only in a few, such, for example, as pannus, which is the representative of trachoma and is accompanied by great formation of new vessels, are the other symptoms more important than ulceration.

In parenchymatous inflammation there is rarely ulceration; and the disease tends to a diminution in transparency of the membrane, with the formation of new vessels.

The anatomy of the cornea has an important

bearing on treatment. Owing to absence of blood-vessels it is little resistant to the attacks of micro-organisms, and is liable to injury from any powerful germicide. We are therefore unable to apply efficient antiseptics, for fear of increasing the damage. On the other hand, the lymph channels of the cornea absorb certain drugs very readily; thus the alkaloids are passed into the anterior chamber.

As far as *symptoms* are concerned, we can usually treat them fairly efficiently; pain can be controlled by cocaine, dionin, etc.; vascularity can be reduced or increased by adrenalin or dionin; an injured surface can be partly protected by the application of some ointment; but in many cases we are powerless to stop an inflammatory process before it has impaired the transparency of the cornea, and when an opacity has once appeared we can do little to promote its removal.

Diagnosis depends chiefly on the differentiation of the conditions of the cornea; a sketch of the changes seen in it is therefore essential to the recognition of the various diseases. We have to note the condition of the surface and of the general transparency of the membrane. The normal cornea is smooth, bright, regularly curved and almost perfectly transparent.

The condition of the surface may be altered in several ways; there may be a definite loss of substance, a wound or an ulcer, or the surface may be roughened without loss of substance; in the latter case we may be dealing with œdema of the cornea, as in case of increased tension; with inflammatory swelling, as in interstitial keratitis (in these two conditions the appearance of the surface is almost identical). Or we may find the surface irregular from the presence of superficial vessels raising up the epithelium and running on the membrane of Bowman (pannus and vascular ulcer), or from larger elevations from hyperplasia of the corneal tissue (nodular keratitis); lastly, the epithelium may be raised into bullæ, and these may show as clear dark patches against the rest of the epithelium, which is made to look grey by œdema.

Alteration of the curvature of the cornea to such a degree that it is recognizable to the naked eye is rare; it is called conical cornea; yielding of a scar to intraocular pressure gives rise to staphyloma.

Opacities of the cornea follow many varieties of inflammation or degeneration.

One which is so common that it is almost physiological, called arcus senilis, appears as a fine white semicircular line, almost at the margin of the cornea and concentric with it. It is the result of a colloid degeneration of the superficial layers of the cornea. It never interferes with vision and has no importance.

All ulcers which extend below the epithelium

are followed by more or less dense opacity. These opacities, "nebulæ," are usually irregularly circular or comet-shaped, with a tail containing the remains of old vessels, running to the margin of the cornea and connecting with the vessels of the conjunctiva. The surface of all recent scars is faceted; there is no clear corneal tissue over them; the image of the fundus seen through the scar is distorted, and the visual acuity is reduced in proportion.

Sometimes after the improper use of lead lotions one may find lead salts deposited in the scar, forming dense opaque rough scales which cause much irritation. Deposits of other metals are very rare. The uncomplicated scars clear slowly (in infancy much more rapidly and completely than in adult life). Often the clearing is definitely greater along the vessels, and thus the scar becomes divided by fine lines, which eventually may give an appearance of regularity of pattern.

The nebulæ which follow parenchymatous keratitis are more diffuse and interfere less with the regularity of curvature, and therefore with vision, than do the scars of ulcers. It is often surprising to note how great an acuity is preserved to the sufferers from severe interstitial keratitis. These nebulæ can be distinguished from those following ulcer by their depth below the surface, their regular diffusion, and by the presence of deep vessels which can be seen to have no connection with the conjunctival system, and often form a bundle of parallel twigs.

The image of the retina seen through them is blurred, but not distorted.

Sometimes a calcareous band runs across the cornea from side to side, usually rather below the centre. This, zonular keratitis, is most frequent in eyes that have been blind for a long time, but is occasionally found in eyes that appear otherwise healthy.

The lime salts are deposited in the epithelium and the most superficial layers of the cornea.

It has been found possible sometimes to scrape away the deposit and to restore useful vision.

Lastly, among opacities of the cornea, must be mentioned the so-called keratitis punctata. ("K.P."). This shows itself as a number of circular dots of varying size, often arranged by gravity in a more or less triangular figure on the lower half of the back of the cornea. The dots are really masses of exudate adhering to the posterior surface, and are the result and sometimes the only obvious evidence of cyclitis.

Superficial Diseases of the Cornea

Corneal Ulcer.—The simplest form of ulcer follows a slight injury of the cornea. Very superficial forms, in which the epithelium only is scratched, are sometimes known as abrasions.

There is pain, often compared to "hot sand" in the eye, of a superficial character, the surface of the cornea has lost its regular reflex over the disturbed surface, and there is usually some ciliary redness. The exact extent of the abrasion may readily be ascertained by dropping a minute quantity of an alkaline solution of fluorescein (0.5 per cent.) into the eye. The dye temporarily stains the corneal tissue wherever it is exposed by the removal of the superficial epithelium.

These abrasions heal rapidly and leave no scar.

If the injury have penetrated more deeply into the cornea, the floor of the ulcer is often rough and greyish. A permanent scar will follow.

Treatment consists in removing any mechanical cause of irritation, *e.g.* a foreign body or inverted eyelash, in keeping the eye at rest, and in preventing as far as possible any infection. We prescribe atropine ointment, 0.5 per cent., and put a pad and bandage on the eye, also some antiseptic ointment which covers the raw surface and, acting as a lubricant, prevents friction.

If the ulcer becomes septic (infected ulcer), the pain is almost always severe; the eye is very red, the surface of the ulcer is more sloughy and yellow in colour, the surrounding tissues of the cornea are infiltrated and have lost their bright transparency. The pupil is small, the iris appears muddy green, showing the presence of iritis and a turbid aqueous humour. This condition demands immediate care; the patient must be put to bed and the ulcer disinfected. If the condition is not very acute we may use a solution of quinine neutral sulphate and atropine sulphate (āā grs. iv ad oz. i) dropped into the eye every three hours; often it will be necessary to disinfect the ulcer more efficiently with pure carbolic (ninety per cent.) or the actual cautery.

If the former is used, the eye must be cocaineized and the floor of the ulcer cleaned by scraping gently with a small sharp spoon, so that all sloughs are cleared away; if there are undermined edges they must be cut away with scissors. Then, after lavage with a quantity of boracic acid lotion, the surface of the ulcer must be carefully dried with sharp triangles of clean blotting-paper, and the carbolic applied. A sharp wooden point or a very tiny camel's hair brush should be moistened with the carbolic, and used to stipple the whole surface. The greatest care must be taken that no excess of acid falls on to the cornea; the wooden point or brush must be allowed to drain before it touches the cornea. Any accidental excess must be at once dried up with blotting-paper. If the surface of the eye become damp during

the process it must again be dried: the tears not only carry the acid to points where it is not wanted, but also by diluting weaken its action where it is needed.

If the infection has reached a further stage we may see a pocket of pus in the cornea, as shown by a yellowish deep opacity, with a lustreless surface. Often we see a whitish-yellow line at the bottom of the cornea, which is bigger and more easily seen when the patient is looking down, and is smaller and may even be invisible when the patient looks up. This is "hypopyon," pus in the anterior chamber. The alteration of apparent size is due to the fact that the pus is behind the cornea. The hypopyon may increase in size until the lower half or more of the anterior chamber is filled.

This is a dangerous condition and may be followed rapidly by total loss of the eye. If drugs have been tried unsuccessfully, or if the large size of the hypopyon shows great urgency, the disinfection of the ulcer must be undertaken at once. The galvanocautery, if handy, or any red-hot point, may be applied (after cocaine) to destroy the septic focus in the cornea. Heat thus applied is even more efficacious than pure carbolic.

If the ulcer is not stopped it may perforate; the iris will often prolapse into the wound and remain to form an anterior synechia. Sometimes after perforation all symptoms subside with great rapidity; it has therefore been recommended by Saemisch that we should in severe cases make an incision across the ulcer floor; this will allow the escape of the hypopyon and relieve the ulcerated tissues from the pressure of the intraocular tension.

Phlyctenular Keratitis.—In all cases of catarrhal conjunctivitis the cornea is liable to become affected by small papules, which lose their covering epithelium and become ulcers. There is often a bundle of vessels running from the conjunctiva to the ulcer; such an ulcer is called a phlyctenule. They occur very frequently in strumous children, and in most cases yield to the ointment of the yellow oxide of mercury (grs. ii ad oz. i). When there is photophobia or redness atropine may be added to the ointment. The general health must be attended to, and any local eczema or ulceration of other parts treated. The corneal vessels persist after the ulcer is healed.

A very similar appearance in adults is associated with acne rosacea; it is often necessary to give arsenic internally to bring about a cure.

Dendritic Ulcer.—This is a chronic form of ulceration in which the ulcer tends to have the shape of a fine wandering line with branches, like the dendrites of certain minerals. It most commonly occurs associated with herpes febrilis.

The pain is often slight, and there may be few symptoms beyond "weakness" of the eye. Sometimes it may be very acute.

The most satisfactory method of treatment is the application of carbolic as already described, after the instillation of fluorescein to mark out the extent of the ulcer. This condition must not be confused with herpes corneæ, a complication of herpes frontalis with which it has little resemblance.

Herpes Corneæ.—Herpes of the cornea occurs as a complication of herpes frontalis; it is seen as a dull grey patch, with the "orange peel" or "leather" surface indicating œdema of the epithelium. The cornea is anæsthetic. There is always ciliary injection, and almost always iritis and K.P. In the later stages the cornea may ulcerate, and there may be hypopyon. Pain is often severe. The intraocular tension is almost always high.

The chief difficulty in dealing with these cases depends on the condition of the tension; it is often impossible to give atropine without raising the tension to a dangerous degree. We therefore have to fall back on other means to combat the iridocyclitis, e.g. heat, leeches and purgation. Sometimes dionin is useful to relieve the pain, but it may be necessary to give morphia, to control it: the weak yellow ointment is useful to apply to the cornea in mild cases.

Pannus.—True pannus (p. trachomatosus) is corneal trachoma. It begins always in the upper zone, as a crescent made up of small grey points which elevate the epithelium; into this numerous vessels run in approximately parallel courses, anastomosing freely by branches.

The vessels are connected with the conjunctival system. They are so numerous that the crescent is quite red; in front of the crescent fresh granules appear (they are practically trachoma granules), and as the disease spreads the vessels run farther and farther into the cornea. After a time the whole cornea may become covered, but this is rare in England. Sometimes small ulcers appear at the advancing edge.

When the disease recedes the cornea is left with a veil of thin scar tissue over the region of the crescent infiltrated with the vessels.

As this is simply part of the conjunctival disease, treatment is described under the diseases of the conjunctiva. In the late stages it may be useful to divide the vessels running into the cornea (peritomy).

Parenchymatous Keratitis.—Inflammation of the deeper layers of the cornea is recognized by the presence of a haze in the deeper parts of the membrane, while the surface remains unbroken and, in the early stages, unaffected.

The haze is often made up of small clouds

which coalesce, and is usually followed or accompanied by vessels which grow from the deep branches round the cornea and invade the substantia propria; they tend to form brushes of parallel twigs; traced by the eye to the limbus, they disappear behind the opaque margin, and do not, as do the vessels accompanying ulcers, join the conjunctival vessels.

Ciliary injection is always found; and there is often pain, which may be severe. As the more superficial layers of the cornea become involved by continuity, the epithelium shares in the process. The surface loses its lustre, and there are formed a number of small elevations, giving the whole an appearance compared to fine leather or orange peel.

Interstitial Keratitis.—The most common parenchymatous inflammation of the cornea is interstitial keratitis. This is usually a very chronic condition, most often due to syphilis, either inherited or, more rarely, acquired.

Children bearing well-marked stigmata of inherited syphilis are the most frequent victims, chiefly at the age of from ten to fourteen years. The disease commences often insidiously with slight ciliary redness and lachrymation. Then a grey crescent invades the upper region of the cornea, a crescent made up of a number of small detached clouds which tend to run together. Following the crescent comes a network of fine blood-vessels, which give the region of the cornea which they invade a dull purplish-pink coloration, the so-called "salmon patch."

Gradually the crescent spreads downwards, and a second appears at the lower corneal margin. The two eventually meet and the whole cornea is involved.

The surface partakes in the process and the lustre of the corneal reflex is lost. The epithelium is uneven, raised into small irregular papules and even bullæ, giving the "orange-peel" appearance. The condition of the cornea is only a part of the disease, which attacks also the iris and all the uveal tract.

After some time the inflammation usually fades, the cornea clears—though the fine vessels persist, showing the former inflammation—and if the choroid and retina have not been much damaged, vision is regained.

The course of the disease extends over many months, and is sometimes followed by relapses. The second eye, in the subjects of the hereditary disease, usually becomes attacked after a short interval.

Treatment is unsatisfactory; it seems to have no influence in protecting the second eye. The pupil must be kept dilated by atropine; pain, which is rarely severe, may be relieved by heat, but mercurials seem to have little effect. It has seemed to me that in a few cases subcon-

junctival injections of hydrarg. cyanid. (℥ ii-iv of a 1 in 1000 solution) in the very early stages have done some good. Recovery, or at least great improvement, as far as the corneal conditions are concerned, is the rule; it is not safe, however, to give an entirely favourable prognosis, as the deep structures, the choroid and retina, are often the seat of coincident inflammation.

The interstitial keratitis which comes on in tubercular patients is very like the syphilitic form, but the K.P. is grosser, and is often compared to "drops of mutton fat." An investigation of Wassermann's and von Pirquet's reactions will clear up the diagnosis. In tubercular cases vaccination by tuberculin may be tried; in the syphilitic, salvarsan has little value.

H. B. G.

DISEASES OF THE IRIS AND CILIARY BODY

Hyperæmia of the Iris.—The iris being so abundantly supplied with vessels and nerves, it very soon flushes up if there be any source of irritation in the neighbouring parts. This condition is visible previous to the development of an iritis, but it may often be seen when no iritis exists, and by careful treatment a real attack of inflammation may be averted. There is always some source of irritation present. It may be a severe catarrhal or purulent conjunctivitis, the presence of a foreign body in the conjunctival sac or in the cornea: in fact, any form of injury may cause it. On examination, a slight ciliary blush will be observed, which consists of a red ring of fine injected vessels close to the cornea, quite different in appearance from the large and injected conjunctival vessels. The pupil is contracted and reacts sluggishly, and there may be some slight photophobia with lachrymation, the eye will feel uncomfortable, while there may be a little deep-seated pain, but in simple hyperæmia this is very slight. On carefully comparing the two eyes it will be noticed that the hyperæmic iris has lost something of the lustre possessed by its fellow, and by strong magnification iritic vessels may be seen on it. Inasmuch as this is a stage which may very easily drift into a true iritis, it is of the utmost consequence to recognize it.

Treatment. A drop of atropine solution, 1 per cent. combined with hot bathing and the treatment of the original cause of the trouble, will quickly cure this; but should astringents, such as sulphate of zinc, be used (which may be quite right for a conjunctivitis), the hyperæmia will quickly pass on to a true iritis. Astringents in this condition increase every symptom, and many a case of iritis is developed in this way, which would never have passed beyond the

stage of hyperæmia had proper treatment been applied. Atropine is the one thing necessary, and this will speedily cure the condition.

Iritis.—All forms of iritis have much the same characteristics, yet they vary a good deal in detail and in treatment, according to the nature of the condition which is responsible for its presence.

Although we talk of iritis and cyclitis as being two distinct conditions, yet it is obvious, if we look at the anatomical relations of the two structures, that we can hardly expect one to be inflamed without the other being affected also. It therefore happens that we have certain cases which can neither be truly described as one or the other and are consequently termed irido-cyclitis. It is also common to find the inflammation spreading backwards, and then choroiditis is present as well. The possibility of this latter condition must never be forgotten when giving a prognosis, for there are many cases in which it is impossible to see the choroid, owing to opacities in the media due to irido-cyclitis, and although we may justly expect the latter to clear up, yet the eye may subsequently be found to be almost devoid of sight owing to extensive choroiditis which has been going on all the time, and which it was impossible to see until things had cleared sufficiently for a view to be obtained. At the same time the retina or optic nerve may have been likewise damaged.

Symptoms. Iritis, irido-cyclitis and cyclitis may be considered together, as far as symptoms are concerned, but as the ciliary body is the more important structure it usually is first affected. Owing, however, to the ease with which the iris can be seen, most of the signs are first apparent here.

The very first symptoms are those of hyperæmia of the iris, and these quickly pass on to true iritis. As in all other cases of inflammation, there are redness, swelling, heat, pain, and impaired function. The redness in the iris itself is somewhat masked owing to its pigmented condition, but if the oblique illumination be used with a corneal loupe it is almost always possible to see dilated vessels upon it. The lustre of the iris is gone owing to oedema, its colour, as compared with that of the other eye, has altered owing to the abnormal amount of blood and exudation which it contains. The pupil has an ill-defined swollen edge, is usually contracted, very sluggish in its movements, and usually does not react to either light or accommodation. The most marked feature of the case is the deep ciliary blush, which is from one to several millimetres wide, and occupies the circumcorneal zone. The injected vessels which cause this appearance are extremely fine, and the individual vessels can

scarcely be seen without high magnification, in fact, seen at a little distance it looks very like a painted red band with an ill-defined outer edge, the inner edge reaching close up to the cornea. It has a wholly different appearance from that caused by conjunctivitis, where the vessels are much larger and can be seen running for a long way individually. They are large and most marked away from the cornea, while the iris is quite bright. *But it must be remembered that with a severe iritis the conjunctival vessels may be injected as well as those of the ciliary body.*

Inflammatory exudation is present in the aqueous, which becomes turbid, and very greatly interferes with sight. This exudation varies much in its character.

In very acute cases blood itself may be exuded from the vessels of the iris or ciliary body, and may be in sufficient quantity to collect at the bottom of the anterior chamber, thus forming a hyphæmia. Short of this, the exudation may be very sticky, and contain a large amount of fibrinous material, which quickly forms adhesions between the iris and lens capsule—posterior synechiæ. Exudation is thrown out into the pupillary area and forms a membrane across it, uniting the whole together, which if left alone will cause complete blocking of the pupil, and will thus entirely separate the anterior and posterior chambers, so that fluid cannot pass from one to the other. At the same time, this sticky exudation will fill up the angle of the anterior chamber, temporarily blocking it, and perhaps permanently uniting the periphery of the iris to the back of the cornea. This is chiefly seen in sympathetic and syphilitic iritis. At other times the exudation is far less plastic, greater in amount, and very like water, thus deepening the anterior chamber. This condition is called serous iritis. Owing to the small amount of fibrinous material it contains, there is but little tendency to the formation of synechiæ. This exudation contains a certain number of cells, which have a great tendency to adhere to anything which may be near, and in the early stages they often arrange themselves in minute pyramidal heaps on the back of the cornea, the iris and the lens capsule. When seen on the cornea, the condition is termed “keratitis punctata” and is usually spoken of as “K.P.” It is, however, not a real keratitis at all, and the spots adhere to the cornea in much the same way as limpets attach themselves to a rock, just because it is there and ready for them to adhere to. These dots vary much in size and in number. Sometimes they are so minute that only with the best light and with high magnification can they be seen. At other times they are so large as to be plainly visible in daylight. This form of iritis is characteristic of the rheumatic variety, in which

is included not only the iritis following acute rheumatism, but also most forms of septic iritis, such as gonorrhœal, gouty, tubercular, and that following septic absorption from the mouth, throat, alimentary tract, genito-urinary passages, nasal sinuses or elsewhere. The serous and plastic varieties pass invisibly into one another, and all cases of iritis will form adhesions unless the pupil be kept dilated. Essentially, however, sympathetic and syphilitic iritis are of the highly plastic varieties, and all forms of "rheumatic" iritis (used in its broadest sense) constitute the serous variety.

The pain which accompanies any form of iritis is very characteristic; it is usually severe, and extends around the side of the head. The patient complains of headache, and the pain radiates down the nose and along the margins of the orbit, and is often so acute as altogether to prevent sleep, while the term "agony" is no exaggeration as a description of what a patient may suffer with acute iritis. However, in many cases of slow chronic iritis, usually of septic origin, there may be no pain, and little or no injection, and the first thing the patient notices is failure of vision. On examination, extensive posterior synechiæ may be found, and the patient may deny that he has ever suffered enough discomfort in his eye to make him realize that there was anything wrong with it.

Diagnosis. This is of the utmost consequence, for not only has iritis to be distinguished from other forms of inflammation of the eyeball, but the kind of iritis also requires to be recognized.

Broadly speaking, the deep-seated pain which the patient speaks about, which radiates all about the orbit, side of the head and down the nose, is very characteristic, and is quite different from the complaint of "sand" in the eye and pain confined to the eyeball which is present in cases of conjunctivitis. Perhaps, however, the most important thing to distinguish iritis from is glaucoma. Now, it happens that to superficial examination the cases are somewhat similar in appearance. The acute pain of the one certainly equals that of the other, though glaucoma more often leads to vomiting than does iritis. Still, on careful examination they are usually to be distinguished. The age of the patient goes for a good deal. Iritis is far more common in the young, owing to the presence of gonorrhœa, syphilis and tubercle, than in older people; but it must never be forgotten that quite old people may get iritis, and it is often seen in diabetes. On the other hand, glaucoma is scarcely ever seen before thirty to thirty-five, and is very rare even in those of that age. But the older a person is the more likely is glaucoma to develop.

The tension of the globe in this disease is always above normal, and sometimes the eye

is of stony hardness; but in iritis the tension is seldom raised, and the eye is more often soft than hard, owing to the ciliary body being implicated, although, on the other hand, it is possible for certain local conditions to cause an increase of tension. Still, this seldom, if ever, raises it to the extreme degree of hardness felt in glaucoma.

In conjunctivitis the pupil is active and perhaps small; in iritis it is small and is inactive; while in glaucoma the anterior chamber is shallow and the pupil dilated.

A correct diagnosis is of vital importance to the eye. As a good working rule, it should be remembered that astringents, such as zinc, alum, etc., cure conjunctivitis; but in a threatened iritis they would be certain to ensure a bad attack, and if used in a fully developed case, a blocked pupil with an exaggeration of all the symptoms would result. These drugs would also exaggerate the pain and symptoms of glaucoma.

Atropine will do all that is possible to dilate the pupil, and in iritis will save half the complications which might otherwise arise. It will do no good, although it will scarcely cause harm in conjunctivitis; but if used in a case of glaucoma it will ensure the patient never seeing again.

Eserine will do harm rather than good to conjunctivitis. It will, if it can act at once, cut short an attack of glaucoma, and may cure it in half-an-hour, but if put into an eye with iritis it is as disastrous as putting atropine into a glaucomatous eye. All the symptoms will be exaggerated, and the eye is not likely to escape without a totally blocked pupil.

The diagnosis is so important that too much stress cannot be laid upon it. Let no one attempt to treat these cases unless he is sure of his diagnosis; but, having once made up his mind, let him stick to it. Some of the worst cases seen are produced by a surgeon imagining he has, say, a case of iritis, and ordering atropine; shortly after, he changes his mind and thinks the tension is raised and it is really glaucoma, so he gives eserine. As the eye probably is not affected by both diseases at the same time (though it may be) he must have done almost irreparable damage by one thing or the other. Therefore if he really is in doubt he should not treat the case until the diagnosis is certain. Still, it must be remembered that, whichever it is, no time must be lost. A few hours' delay may for ever prevent the breaking down of adhesions and the cure of iritis, and may lead to a blocked pupil, while in an acute glaucoma a similar delay may ensure total blindness. There is no room in these two diseases for what is sometimes termed "masterly inactivity." Delay will ensure disaster, and wrong treatment will hasten it.

Sympathetic Irido-cyclitis.—The most severe and destructive form of irido-cyclitis which is possible is that following injury to the other eye. It is impossible here to go into the origin of this much discussed disease, but it always follows a penetrating injury of the fellow eye, and especially is it likely to develop after a wound involving the uveal tract. It scarcely ever develops in the sound eye until at least three weeks have elapsed since the eye causing the mischief was damaged, though it may occur years after the primary injury if it has been recently inflamed. The first sign visible in the sympathizing eye is a slight ciliary blush, with a tendency to lachrymation, and perhaps photophobia. Keratitis punctata may be seen if carefully looked for. Very soon all the characteristic signs of plastic iritis become visible; the pupil, in spite of vigorous applications of atropine, will contract, and most likely get totally blocked, while the inflammation is so severe that after several months, or perhaps years, the eye may be quite blind. All degrees of severity are seen, and useful vision may be retained, but the eye can scarcely avoid being most seriously damaged. Atropine and heat should be applied locally, and mercury given internally, while if the exciting eye be hopelessly damaged, it should be excised. But if any *useful* vision is likely to remain in the originally injured eye, it had better be left, for when once sympathetic irido-cyclitis has set in, the exciting eye may in the end retain the most sight. Far better, however, would it have been to have excised the injured eye before the disease had had time to develop. If the disease has started, excision of the injured eye is the proper thing to do in the interest of the other eye, but it will not save all the cases. Fortunately, with improved aseptic methods this disease is far less common than it used to be.

Syphilitic Iritis.—This usually comes on during the stage of secondary syphilis, and is essentially of a plastic nature. The anterior chamber is of almost normal depth, the pain is severe, and posterior synechiæ are certain to form. Unless atropine be used at once, they will become permanent; but in any case if they have formed at all and then have become broken down, uveal pigment will remain on the lens capsule, while more often than not the pupil is left scarred and irregular. This form of iritis has but little tendency to recur. As a rule, there is one severe attack, the eye is left permanently damaged, but the patient is unlikely to suffer from a recurrence. Often small tumours, like condylomata, develop on the iris, but they disappear fairly quickly. The syphilis must be actively treated by the usual methods. The injection of salvarsan in such cases is particularly useful, and its effects most remarkable. Atropine

drops, one per cent., with hot bathing, must be applied to the eye.

There is a form of iritis which may come on in tertiary syphilis, namely, the development of a gumma on the iris or ciliary body, but this is not common.

Gonorrhœal Iritis.—This is a form of iritis which essentially conforms to what has for years been termed rheumatic iritis. As a matter of fact, iritis following acute rheumatism is extremely rare, though if a patient has ever had gonorrhœa, and particularly gonorrhœal arthritis, it is decidedly common. The exudation is of the serous variety, and very often a curious jelly-like mass forms in the anterior chamber. Sometimes it assumes a lenticular shape, but as the disease subsides it is absorbed. Adhesions may, of course, form here as in other forms of iritis, but there is nothing like the readiness for this to take place as in sympathetic or syphilitic iritis. Atropine will usually break them down, unless they have been there a long time. The chief characteristic of this disease is its liability to recur, and many a patient has his life made a misery to him by these frequent attacks. Internally, mercury and quinine do more good than salicylates, and vaccine treatment is successful in some cases. Locally, atropine and hot bathing must be used, and in any case of severe pain from iritis leeches applied close to the outer canthus give more relief than anything else. Venesection is most useful for the relief of pain in young and full-blooded people, and the pupil will often dilate after bleeding when atropine had not the slightest effect upon it before. This applies to any form of iritis, except in old and feeble people.

Septic Iritis.—With this is included all the many cases which in bygone times were called rheumatic or gouty, when the patient had often suffered from neither disease. In practically every case of iritis a cause may be found if it be looked for. A condition which underlies many cases of iritis is pyorrhœa alveolaris, or any general septic condition of the teeth or mouth. The first thing which a surgeon should do on seeing a case of iritis is to discover its cause; and let no one forget to look at the teeth. Septic roots and decayed teeth are quite sufficient to produce it, while it is often seen to clear up at once when the cause is removed, or to go on to blindness if this remains untreated. Septic absorption from the nasal sinuses, alimentary tract and genito-urinary system are very dangerous. This form of iritis is essentially of the serous variety, and consequently keratitis punctata is often the first thing seen, so that this must be carefully looked for. A very useful way to see it is to use an ophthalmoscope with a plane mirror and a +12 D or +20 D lens

behind it. Even the most minute spots are seen black against the red fundus reflex. In this condition synechia are certain to form unless atropine be promptly used and the pupil kept dilated.

Treatment. First find the cause and treat it. In severe cases vaccines are useful. Use atropine and hot fomentations locally, and give mercury internally. Let every possible source of septic infection, especially in the mouth, be treated. All teeth whose roots are diseased, or which have loose spongy gums round them, thus providing pockets in which septic material can accumulate, should be removed at once.

Tubercular Irido-cyclitis.—In this disease the ciliary body is almost certain to be affected, and the tubercular nodules can generally be seen to be starting from it and involving the iris. It may assume the miliary form and be relatively mild, or a large mass of tubercle may develop. It used to be said that an eye with tubercular disease should be excised to avoid general infection, but as it is seldom primary, in most cases excision would not do much good to the health of the patient. General treatment will often do wonders, and many are the tubercular eyes which at one time appeared to be all but lost, which have recovered with very useful vision. Choroiditis is a very frequent accompaniment of tubercular irido-cyclitis, and the disease runs a chronic course. In severe cases the eye may shrink and become totally blind. Fresh air and general treatment for tuberculosis are all-important, while the application of atropine and heat is all that can be done locally. A solitary tubercle on the iris may be removed by an iridectomy, but it is not likely to do much good, and may actually do harm by further injuring an already diseased iris.

Irido-cyclitis due to Congenital or Tertiary Syphilis.—This disease is more often than not termed interstitial keratitis, and is described elsewhere as such. In origin, however, it is an irido-cyclitis which spreads forwards, and chiefly affects the interstitial substance of the cornea. In all these cases the iris and ciliary body are more or less affected, and choroiditis frequently results in consequence of the inflammation spreading backwards. In most early cases keratitis punctata is present, but it is seldom seen, as the patients are usually children, and are not brought until this stage is past and the cornea is obviously opaque. As a tertiary manifestation of acquired syphilis it is rarely seen, but it does occur, and runs a somewhat similar course to the usual form. More often than not, however, one eye only is affected, and in this way it differs from the congenital variety, which practically always affects both. Other

neoplasms of the ciliary body and iris are described with those of the choroid.

Wounds of the Iris and Ciliary Body.—Wounds involving this part of the eye are most destructive, and require the greatest possible care in treatment. Often such injuries are further complicated by the lens being injured as well. It is quite possible for the iris to be torn by a concussion injury without any penetration, but although such injuries are serious enough, as there is no fear of sympathetic ophthalmitis without a penetrating wound, the surgeon has far less anxiety, and there is little to be done in the way of treatment except to use atropine until the eye quiets down. The tear in the iris will never heal.

Penetrating wounds are far more serious, and are generally accompanied by a prolapse of the iris or ciliary body. Such eyes frequently contain foreign bodies, and any degree of damage may be done, from a fine needle prick to disorganization of the whole eye. Should the wound be very small and be caused by a clean instrument, it may heal without trouble, but if it be larger the escape of aqueous is almost sure to cause a prolapse, and this must be promptly dealt with. If, however, it be caused by a flying object, such as a piece of steel, the chances are that the foreign body is hidden in some part of the globe, and must at all costs be removed. Should the lens be clear, it may be seen in the fundus, but there are many parts of the globe in which it may be lodged which are invisible to the ophthalmoscope. In all cases of doubt an X-ray photograph should be taken, so that the size and exact position of the foreign body can be ascertained before proceeding to remove it. And, incidentally, it is of the utmost value to know for certain whether the foreign body is or is not situated in the globe. Very serious damage was often done in the pre-X-ray days by introducing a magnet into the eyeball for the purpose of removing a foreign body which sometimes was not there at all; it is, therefore, advisable in all cases where there is the least suspicion of the presence of such an object to make certain whether or not it is there before attempting to remove it by the introduction of a magnet within the globe. Should there be no X-ray apparatus available, its presence may frequently be detected by bringing the patient close to the Haab's magnet. It is often sufficiently powerful to pull it straight out of the wound of entry, or at least to produce pain from its movements towards the magnet, and thus prove its presence. The vast majority of foreign bodies found within the eyeball are steel or iron; even stonemasons and navvies who are injured are usually struck by a piece of the hammer, chisel, or pickaxe, rather than by a piece of stone, so that it should never be assumed

that the foreign body is of a non-magnetizable nature unless it be first tried. All such cases must be treated on their own merits, and no details can be given which will suit every case. Should there be a prolapse of the iris or ciliary body it must be promptly removed and the adjacent portions of tissue be got free from the wound. The prolapsed portion must be firmly grasped with a pair of capsule forceps, which have several teeth in the lower parts of the blades, so that they may hold the entire portion to be cut off. Ordinary iris forceps are useless, as they hold only a very small portion of the iris at their tips, and invariably tear through before the tissue has been really liberated.



Diagram of Correct Form of Forceps.

The iris must be firmly grasped in the forceps, which should then be raised, and considerable traction exerted. With a pair of De Wecker's scissors the greatly stretched tissue should be cut off with one snip close to the wounded sclera. If this be done successfully, the cut iris and ciliary body will at once spring back within the globe, and will be found to be quite free from the wound, which will heal without delay, and without any inclusion of tissue. If this takes place, the eye is quite sure to do well if sepsis has been avoided. If, however, iris or ciliary body remain in the wound, sympathetic ophthalmitis is by no means unlikely to develop. This is an operation which really requires great care in its performance, but is one which any practitioner may be called upon to do. It should never be attempted without the patient being under the influence of a general anæsthetic, for if it is, the pain caused by the necessary traction on the iris and ciliary body will be too severe to be borne quietly, while it is a variety of pain upon which cocaine has almost no effect. If the patient be not quiet it is impossible to clear the wound and do the operation neatly. If the lens be wounded it must be treated as a case of traumatic cataract, which is described under diseases of the lens.

Cysts and tumours of the iris are described with those of the choroid.

Diseases of the Choroid.

The choroid is the posterior portion of the uveal tract, and is abundantly supplied with vessels and nerves. It is in direct continuity with the iris and ciliary body, and inflammatory and degenerative changes are very frequently seen in it.

Most forms of choroiditis follow irido-

cyclitis, and are nothing more than an extension backwards of the inflammation. On the other hand, degenerative and inflammatory changes may start without any signs visible externally.

Disseminated Choroiditis is what is usually seen in cases of syphilis. Large black areas are present, and often there are white atrophic patches, which are really due to the choroid having degenerated and the white sclerotic being seen through. Usually these patches are surrounded by dense black pigment. Such changes are sometimes seen as the result of old tubercular mischief, while it is no uncommon thing to see extensive choroidal changes after such a disease as interstitial keratitis, and this causes a greater impairment of sight than does the corneal affection which, more often than not, clears sufficiently to allow of excellent vision, provided the fundus is unaffected.

Myopia is a frequent cause of choroiditis. The most common form is that which is seen when a posterior staphyloma develops and an area of choroidal atrophy is seen surrounding the disc. This, however, by itself does not cause much impairment of vision. Myopia, however, sometimes gives rise to central changes about the macula, and this may vary from fine degenerative changes to hæmorrhage and rupture of the choroid at this spot. Such a condition practically blinds the eye.

Senile Degenerative Changes are often seen in old people, and may occur at any part, but the most serious as regards sight are those which occur at the macula.

In **Diabetes and Bright's Disease** it is no uncommon thing to see hæmorrhagic choroido-retinitis, which is as destructive to sight as is any other form of central choroiditis.

Ruptures of the Choroid may occur at any part, and are generally caused by concussion injuries which produce no external wound. Nothing can be done in the way of treatment other than keeping the patient quiet and the eye under atropine until there is no further danger of hæmorrhage, and until the blood which is already in the vitreous has been absorbed. Any extensive hæmorrhage into the vitreous is sure to leave some black floating opacities which never quite clear up.

New Growths in the Uveal Tract.

1. Inflammatory.—Any part of the uveal tract is liable to a neoplasm, but the choroid is far more frequently the starting-point of this disease than any other part of the eye.

Tubercular masses may occur in either the iris, ciliary body or choroid, but they are usually secondary to some other tubercular lesion, and the diagnosis is materially assisted by finding evidence of the disease elsewhere.

Miliary tubercle is seen in the iris, ciliary body or choroid, and is most frequently present in cases of general tuberculosis, or in advanced cases of tubercular meningitis in children. It occurs late in the disease, and when in the choroid, is visible with the ophthalmoscope as small white raised nodules. Generally more than one nodule is present, and often they are scattered thickly over the fundus. Should there be only a few, and should the child recover, large pigmented degenerative areas are left behind.

(Retinitis pigmentosa, though really of the nature of a choroido-retinitis, need not be discussed here.)

Treatment. This consists of treating the disease which gives rise to the trouble, and, unfortunately, little can be done for the eye, owing to the fact that the inflamed portions of the choroid are usually destroyed. Mercury is the one drug which exercises control over most of these changes. Locally, dark glasses and atropine are the only things which can be given. Cyanide of mercury is frequently given as a sub-conjunctival injection, and perhaps exercises a more direct action on the affected part than when given by the mouth. Great care must be taken in the administration of mercury if the kidneys are in any way affected. Leeches near the outer canthus are sometimes useful.

Cysts of the choroid due to parasites are too rare to need description.

2. Malignant Diseases of the Uveal Tract.—By far the most common form of malignant disease here seen is sarcoma. The tissue in which it starts belongs to the connective-tissue group, and is developed from the mesoblast, consequently sarcoma is far more frequently seen here than is carcinoma, which latter is usually secondary to carcinoma elsewhere.

Sarcoma of the Uveal Tract is rare, and is practically always pigmented. Should it start in the ciliary body there may be a local bulging. If further back, the patient usually complains of loss of vision. On ophthalmoscopic examination a detachment of the retina is first seen, due to the fact that the growth is raising the retina above its normal level. Sometimes a dark mass is seen beneath the detached retina, but this is so unusual that it is impossible to wait until it comes into view before making a diagnosis. There is nothing, perhaps, more difficult in the whole domain of ocular diagnosis than to say with certainty whether a detachment of the retina is a simple one or due to a growth behind it. It may be said that a simple detachment of the retina is very seldom seen in other than highly myopic eyes, and it is very suggestive of a growth should a detachment be seen in an emmetropic or hypermetropic eye. In the

myopic eyes which develop detachment of the retina the vitreous is usually degenerated, and fluid, so that when the patient moves his eye the loose retina is seen waving and floating about like a curtain agitated by the wind. If it is stretched over a growth it generally has a solid appearance and does not move.

It must be remembered that the detachment of the retina in no way corresponds to the size of the growth producing it. The detachment is much larger, and corresponds in appearance to what would be produced by a cup or basin (which might represent the growth) being covered loosely by a table cloth (which corresponds to the retina). The tension of the eye is sometimes a guide. It has been said that if there is a detachment of the retina and the tension is raised, there is probably a growth inside the eye; but if this same condition is present and the tension is low, or not raised, it is probably a simple detachment. This, however, is by no means to be relied upon. It is true that if the growth is far back and away from the ciliary body, the tension is very likely to be raised, but is by no means always so. But if the ciliary body be involved at least 50 per cent. of the cases have normal or minus tension.

Transillumination is sometimes useful, but it is by no means an infallible guide. In spite of the difficulties, an accurate diagnosis is of prime importance to the patient, and no means should be neglected which might aid this.

Sarcomata which grow in the eye are all very malignant, and unless the eye containing them be promptly excised, abdominal and other recurrences are certain to take place within a year or two.

Treatment. This consists in immediate excision only, and if the growth has already extended to the orbit the entire orbital contents must be removed.

Primary Carcinoma of the Ciliary Body has been described, but it is of extreme rarity.

Secondary Carcinoma of the Choroid is by no means so uncommon as was once supposed to be the case. It usually occurs in a late stage of carcinoma of the breast, when secondary growths are appearing in other parts of the body, but it is sometimes seen to follow cancer of the stomach, lungs, etc. Frequently both eyes are affected, and from the nature of the disease treatment is useless.

Malformations of the Iris and Choroid.—Coloboma is the common congenital malformation of both the iris and choroid. The former is visible to the naked eye, and usually appears as if iridectomy has been done downwards and inwards. Coloboma of the choroid is a similar condition occurring in this coat, and frequently both conditions are present together. C. D. M.

DISEASES OF THE LENS

The lens tissue is not itself subject to inflammatory conditions, although, when wounded, leucocytic infiltration may take place into it from surrounding parts. The pathological conditions of the lens are limited to disturbances of parts by injury, congenital abnormality, malformation and to various forms of degenerations known as cataract.

Displacements of the lens may be either congenital or the result of injury. The congenital form is usually upwards and very often shows hereditary tendency. With a dilated pupil it is generally easy to see. The degree of displacement varies, so that in some cases part of the undilated pupil is unobstructed by the lens and very fair vision is obtained through a suitable glass. In cases where there is great interference with sight it is necessary to resort to operation. In the case of children and young adults absorption of the lens by the process of needling should adopted. This, however, is not to be lightly undertaken, for there are many difficulties to contend with. The non-fixation of the lens to the ciliary body causes it to swing away from the needle, and the mere puncture of the capsule is not sufficient, for in this condition the wound of the capsule will not readily gape. Dislocations, the result of injury, may be partial or complete. In complete dislocation the lens may be driven back into the vitreous or into the anterior chamber, or, after rupture of the eyeball, beneath the conjunctiva. Such rupture generally takes place just outside the corneal margin upwards and inwards, owing to the more exposed state of the orbit downwards and outwards. In these cases of dislocation beneath the conjunctiva it is not advisable to do any operation for the removal of the lens, at any rate until the scleral wound shall have healed, in order to avoid an external wound and the risk of sympathetic ophthalmia. Dislocations of the lens may be diagnosed by tremulous motions of the iris on movement of the eye. This is not always easy to obtain. Movement of the eyeball in all directions should be tried, not merely up and down or from side to side, and it must be borne in mind that very occasionally some peripheral tremulousness, though rather more like a wave of movement, takes place in uninjured eyes, especially those which are myopic. Interference with vision is sometimes not so great as one might suppose. Treatment is a difficult matter. The lenses tend to become opaque, but often before that condition has been reached glaucoma or chronic iridocyclitis, which are particularly liable to occur in these cases, has been produced. Where the sight is very much interfered with and the dislocation is only partial, the removal of the

lens offers the best chance of preserving the sight, but it is a difficult operation and often unsatisfactory. If the sight is fairly good and displacement slight, the eye may be left to take its chance, and if severe symptoms arise later on the lens can then be dealt with. Eventually, however, the sight, although it may last some time, is nearly always lost. In some cases where removal of the lens looks a simple and easy operation, as its edge lies against the back of the cornea, it is on the contrary very difficult, and frequently in the end the eyeball has to be removed.

Among congenital anomalies other than cataract there has been found a notch out of the lens, very rarely a bulge, associated with congenital coloboma of the iris and choroid. Other very rare conditions are lenticonus anterior or posterior, which conditions may also be acquired, indeed, the only cases the writer himself has seen have been acquired.

Cataract.—Cataract is a wide term applicable to all conditions where there is any loss of transparency in the lens, whether the trouble be due to congenital defects, injury or degenerative changes during life. It groups, therefore, under one heading all kinds of conditions, some of which have very little anatomical or pathological relationship to each other. The term was introduced in pre-ophthalmoscopic days, when only gross opacities accompanied by very serious diminution of vision could be observed. At the present time, with the elaborate instruments for observation which are at our disposal, very minute opacities, which may be of the same nature as the more gross conditions formerly observable but which may never lead to any diminution of sight, and which are present in the majority of people over sixty years of age, are also classed under this same heading, and though the term may be modified by such phrases as "incipient cataract," it is sometimes an extremely unfortunate one in the case of certain individuals, to whom the word "cataract" suggests blindness or operation. The writer suggests that the words "slight lens degeneration" or "small opacities in the lens" would more accurately describe the condition and would not produce the same sense of alarm in the minds of those who are frightened by the word "cataract."

The congenital and infantile defects of the lens, classed together because they are closely associated and sometimes run into each other, and also because in some cases there exists uncertainty as to the time the defects have developed, are complete cataract, nuclear, lamellar, coralliform, spindle-shaped, capsular, anterior and posterior polar, pyramidal, Doyne's discoid, and flecks in the substance of the lens.

Complete cataract is not very common. This generally presents the appearance of milk-white opacity in the pupil representing a lens of normal size. In many cases it is difficult to say whether the cataract is congenital or whether it has developed after birth. Sometimes these cataracts are represented either by very ill-developed lenses or lenses which have shrivelled. The writer believes that of these two classes the former is at least the more usual, for cases may be seen in which the opacity has not been homogeneous and general, but more or less patchy, and which upon operation have shown themselves to be lenses with a thickened capsule but containing very little lens matter. Had the lens been a fully developed one which had shrivelled, it would not be likely to contain any clear lens tissue whatever. Though most textbooks describe the condition as shrivelled lenses, the writer himself has not seen any case in infants which could come with certainty under that category, using the word "shrivelled" in the sense that there had been a more fully developed lens which had wasted; and while he thinks it much more probable that these apparently shrivelled lenses are the result of imperfect development, he does not mean to lay it down that they cannot have been more fully developed and have wasted.

Nuclear and lamellar cataract are rather varieties than different conditions, for the nucleus within the lamellar cataract has also scattered opacities, but in the case of the so-called nuclear cataract the nucleus is uniformly and densely affected. This condition is rare, but typical lamellar is among the most common of congenital cataracts. In these cases, which are nearly always bilateral, the part of the lens which corresponds with the nucleus in later life is, as it were, separated off from the rest of the lens by sharply defined opaque lamella, within which, as has been said above, there are also scattered opacities. The size of the cataract varies in degree, but except in cases of artificial dilatation of the pupil it almost always occupies more than the pupillary area. Outside the opaque lamella there may be what are called "riders." These are linear opacities which embrace the periphery of the lamella like the legs of a rider on a horse. The "riders" represent a second affected lamella and are sometimes so developed as to represent a double lamellar cataract, and in rare instances even a third lamella may be affected. On the other hand, there may be no defined lamellar cataract, but only two or three of these "riders." Besides these bars of opacity may extend towards the equator of the lens. The degree of opacity of the lamellar cataract varies very greatly, and sometimes is so slight that the condition of visual acuity would not excite suspicion of it. More

often the cataract is dense, interfering in varying degrees with sight, and in later life the degree of interference is often greater, due to the smaller pupil of advancing years. The extent of a lamellar cataract does not vary during life, though possibly its density may increase or the whole lens may take on senile changes. This form of cataract often shows an hereditary tendency. The heredity may not necessarily show itself in this form of cataract, but other developmental change may be present, for instance, a gross anterior polar cataract in the mother may be represented by a lamellar cataract in the child. For example, in a case which came under notice, the mother had a central anterior capsular and cortical opacity with a depression in the middle of it, more marked in the right than in the left, while the son had typical lamellar cataract, dense in the left and only very slight in the right eye. Several family trees showing the heredity of ordinary lamellar cataract have been published from time to time. There has been a good deal of discussion as to the causation of lamellar cataract and whether it is always congenital or infantile. Some have considered it as the result of convulsions, others, again, have gone so far as to attribute it to mercury administered for the relief of convulsions. In support of the infantile theory there is the known occurrence of this form of cataract from ergotism, which is associated with convulsions and spasms. Other epiblastic tissues, too, may show signs of malformation. The incisor teeth are very frequently affected, showing a deficiency in the enamel which causes a ridge on the surface of the tooth, and a condition of ichthyosis has been observed in the skin.

Coralliform and spindle-shaped congenital cataracts are very rare. The spindle-shaped variety shows a solid bar thickened in the middle from the anterior to the posterior pole. In this form of cataract the function of the lens as a refracting agent is usually very much interfered with. The coralliform variety has opacities extending laterally like sprays from a central opacity situated towards the posterior pole.

The congenital anterior cortical and capsular cataracts include a small dot or Y-shaped opacity at the anterior pole, as well as small areas of capsular opacity due to the remains of the foetal fibrovascular sheath or iritic adhesions arising from intra-uterine inflammation.

Pyramidal cataract presents also an anterior polar opacity, although it is not produced by developmental error, but by the mechanical effect of a perforating ulcer causing by the escape of the aqueous the cornea and lens to come in contact and thereby bringing about organic damage; some lymph also may be left at this point which may become organized, producing a heaped-up appearance of the opacity,

and hence the name given to this variety. It should be noted that this occurs only in very early life, for the contact of the cornea and the lens in later life does not produce it, and that when it has occurred the scar of the perforating ulcer cannot always be made out in the cornea, nor does the scar of the corneal lesion necessarily correspond in the more fully developed eye with the lenticular opacity. The posterior polar variety of capsular cataract is due to the remains of the fibrovascular sheath of the lens, which has not entirely disappeared in foetal life. In these cases it may cover quite a large area of the posterior capsule, although such condition is not very common. Persistent hyaloid artery may coexist. What is, however, quite common is a dot on the posterior capsule representing the position of the hyaloid artery. Occasionally too, the remains of it persist as a small rounded opacity connected with the posterior capsule by a short thread. It should be noted that such dots are never actually at the posterior pole, but are quite definitely to one side. Eyes as described above as having a large opaque area in the posterior capsule are very commonly amblyopic. Opacities in the substance of the lens may present in rare cases a large rounded opacity interfering more or less with vision according to its position. Such lenses may tend to earlier senile changes in the case of those who are disposed to them for other reasons, but their presence need not necessarily indicate a bad prognosis.

But the most common form of congenital opacities are minute flecks in the lens. These opacities by oblique illumination have a bluish-white appearance. They are generally seen in the external layers of the lens towards the periphery, although sometimes they may extend to the central part, but they are here nearly always more scanty. There is often a markedly hereditary tendency in these cases. As a rule such opacities do not interfere in the least with sight, even though fairly numerous, and usually they do not change during life, but every now and then the opacities are so extensive that sight is seriously affected and absorption of the lens by operation has to be resorted to. It should be noted that these cases may tend to increasing degeneration. Not necessarily nor probably ever is such increase in degeneration of the same nature as the original defect, but resembles rather senile changes. Thus in a large family affected with this type one member had to be operated on when quite young, while another had fairly good sight as a child, so that she could do her lessons readily, but at the age of thirty was almost incapacitated from following her work as a cook.

Doyme's discoid cataract is a peculiar condition at first sight resembling a very small

lamellar cataract, but on closer examination it will be observed that the nucleus of the lens is not affected, but the defect is situated in the substance of the lens close to the posterior pole. It occupies only one plane and has the appearance of a very finely stippled and perfectly defined circular plate of opacity. It is sometimes so faint as not to interfere with vision, at other times it is very dense. The density appears to increase with advancing life. It is markedly hereditary, and since the condition was described by the writer some years ago, other family trees where this condition is present have been recorded.

Cataract which comes on after infant life may be due to a variety of causes, old age, injury, lightning, occupation, disease of other parts of the eye, general disease (cholera), ergotism, tetany and epileptic convulsions. Senile cataract is the most common condition, and it manifests itself in various ways, usually beginning in radial opaque striæ at the periphery of the lens which extend to the pupillary area and gradually broaden out into wedges of opacity. Originally these striæ may not be opaque, but are only manifested by shifting the light thrown by the ophthalmoscopic mirror from one direction to another, when they show up as "striæ of refraction," a descriptive term introduced by Bowman. After a time a haze appears and then a general cloudiness, eventually the lens tissue becoming opaque, so that by oblique illumination no shadow is thrown by the iris into the depths of the lens, but the iris margin shows up sharply as lying immediately on the white background of the degenerated lens. Before entire opacity has resulted the iris by oblique illumination will throw a shadow into the lens. When the opacity is complete, only light sense remains, and this is never lost so long as the rest of the eye remains healthy. In another form, probably more purely senile and slower in progress, the nucleus of the lens becomes opalescent, varying as the condition progresses from an amber colour to brown. Fine striæ develop at the periphery of the lens, and by transmitted light the margin shows up as a hard somewhat crenate edge. In the process of degeneration such eyes sometimes acquire some degree of myopia. These lenses may be quite mature for operation, though they show some red fundus reflex to ophthalmoscopic illumination, and even though some limited perception of form remains and the iris margin throws to oblique illumination a deep shadow into the substance of the lens. A modification of this type and one which the writer described as long ago as 1889 in the *Transactions of the Ophthalmological Society* and has frequently demonstrated since under the name of "myopic degeneration of the lens," although it is only

now beginning to find a place in textbooks, is, strictly speaking, often not a cataract at all, in the sense that no actual opacity may exist, but the index of refraction of the nucleus of the lens rises considerably and its substance may become slightly amber-coloured and presents to oblique illumination an appearance of a defined and densely white central opacity; with the ophthalmoscope, however, by moving the mirror a little in different directions light can be seen to be readily transmitted everywhere. Yet, often fine filmy opacities may be made out, but not in the least corresponding to the apparently dense opacity. When the details of the fundus are examined in such a case the vessels are distorted much as they are in cases of conical cornea. Indeed this condition has very often been diagnosed as *lenticonus posterior*. This form of cataract develops very slowly indeed, producing an increasing degree of myopia, but the lens very seldom becomes opaque. It is the beginning of this change that enables elderly people who have needed presbyopic glasses gradually to require a lesser strength and eventually perhaps do without them altogether.

The formation of vacuoles in the lens comes in this category of degenerative changes. It is quite common to find one or two vacuoles like tiny bubbles in the substance of the lens at or even before middle age. They often persist for months and then disappear, leaving a very minute dot of opacity. They are found in the more peripheral layers, but seldom in the nucleus. Such vacuoles are usually of no serious significance, but when they occur in rows, forming a kind of streak in the lens, or in groups, some of them being of large size and irregularly oval, they generally indicate a rapid breaking up of the lens, although occasionally even in these cases they may sometimes to a large extent disappear.

Flocculent opacities may occur throughout the lens, eventually leading to complete cataract, and the early formation of such opacities in the pupillary area of the lens may interfere much more seriously with vision than is usual in the early stages of cataract. This type of cataract, however, is not generally purely senile.

The form of posterior capsular cataract produced by retinitis pigmentosa and other gross conditions of choroido-retinitis is represented by the appearance of smudges of no definite shape occupying the more central parts of the posterior capsule and is seldom very gross. Such a condition is at the outset purely capsular; but the cortex of the lens in the immediate neighbourhood may subsequently become affected and a rosette-shaped opacity like that seen in injury appear, followed by slowly forming opacity of the whole of the lens. In contradistinction to these are the large and always rather gross map-

like areas of cortical opacity at and including the posterior capsule, and which soon involve the adjacent lens substance. Such conditions are always indicative of deeper disease and degeneration of the vitreous and afford data for guarded prognosis when the cases have so far progressed as to demand operation. Another form of acquired posterior cortical cataract shows broad striae increasing to large sector-like areas of brilliantly white opacity and not obviously associated with deeper disease of the eye. They are extremely chronic and frequently show little tendency to further involve the lens substance, even when they have caused grave interference with sight. They seem to the writer to be more often associated with myopia. Probably in the same category with these are small smudges or globular opacities which may frequently be seen in myopes over thirty years of age, at the extreme periphery of the lens, somewhat regularly placed on the anterior and posterior capsules and corresponding to the insertion of the suspensory ligament. In such cases, in the writer's opinion, no serious deductions whatever need be drawn as to the probable super-vention of complete cataract, and it is for this reason especially that it is important to draw attention to them, for without such knowledge an alarming prognosis might be made in cases where they have been observed.

Sometimes a senile form of degeneration takes place before middle life or even before adolescence. Such cases often show a family tendency and are due probably to an inherited tendency to pre-senility of the lens. Other forms of cataract may take on senile changes, though primarily not in this category; indeed the lenticular changes in the above mentioned posterior capsular cataracts are instances of this.

Opacities in the lens due to injury usually proceed to complete cataract. Such may occur without perforation of the lens and are called concussion cataracts and may be associated with partial or complete dislocation of the lens. Probably in this class are the cataracts which are produced by lightning stroke. When the lens substance is actually wounded and the aqueous gains access to it, opacity begins to form at the seat of injury which rapidly spreads through the whole lens, the substance of which swells and, fungating through the wound of the capsule, is absorbed by the aqueous. Sometimes the whole lens in young people is absorbed in this way and a spontaneous cure of the cataract is thus brought about. Such recovery can hardly be looked for after the age of twenty-eight, and always the process should be carefully watched, for the débris of the lens may block the angle of the anterior chamber and produce glaucoma. In very rare instances the wound in the capsule heals and a small opacity only remains at the

seat of injury. When the extreme periphery of the lens is wounded, and sometimes even when the lens itself has escaped injury and only the suspensory ligament is damaged, there appears an opacity, often rosette-shaped, on the posterior capsule and greatly interfering with sight. It is probably due to some dissociation of the capsule from the lens substance. In some cases it may gradually disappear almost completely and sight be restored, but this happy result does not frequently come about. The difference between this rosette-shaped opacity and that seen in the before-mentioned posterior capsular cataract is that while the latter is striate, this is more like a skeleton leaf with rounded spaces, resembling again a bunch of grapes.

Occupation cataract is found in the case of glass-workers, and is probably due to the heat rays to which they are exposed. It presents a form of dense opacity in the substance of the lens near the posterior pole. It resembles rather the posterior cortical map-like opacity, but its actual seat is rather farther forward in the substance of the lens at the nodal point.

Ergotism, tetany and convulsions sometimes produce cataract and are probably allied to the injurious effects of concussion, for the degeneration in these cases is believed to be produced by the spasms of the ciliary muscle which arise in these conditions. It should be noted that lamellar cataract has been observed to occur from such a cause. Cataract may also be produced by the absorption of naphthalene. Several general diseases are held to be the cause of cataract, but in most cases it is an accompaniment of a general degeneration of the body that is induced by the disease. Diabetes, however, has a special effect on the lens and cataract is very commonly associated with it, when definite flocculent opacities with groups of large vacuoles often occur, but cataract due to this cause may also follow the ordinary type of senile degeneration. In diabetes, however, there may be some clearing coexistent with improvement in the general condition and diminution of sugar in the urine.

Morgagnian cataract is a further degeneration taking place after the cataract has become mature. It consists of a softening down of the cortex into a white fluid and presents the appearance of a milk-white lens. Often the capsule takes part in the degeneration and displays a thickened white area. During operation a small dark nucleus may be found free in the milky fluid.

Black cataract is a term given to cataractous degeneration when the change is accompanied by a very dark brown appearance of the sclerosed lens.

The cataract which occurs in cholera is due to the loss of water from the system. Cataract

may result from diseases of the eye itself, notably in the case of chronic cyclitis. This results no doubt from the interference with the nutrition of the lens. The cataracts following posterior capsular changes and associated with deeper diseases of the eye have already been mentioned. And in this connection a word may be said on behalf of cases of retinitis pigmentosa with posterior capsular opacities. In such cases, when the question of the lens is considered, the fact of the disease has up to quite recent time been considered to give the warning "noli me tangere." The writer has, however, from an experience of the last ten years found that such conception is not well founded, and that when disability has become great in this disease and posterior cortical opacity exists, extraction of the lens will restore to a surprising degree the power of vision. This should be done in suitable cases even though the rest of the lens tissue may be perfectly transparent and although the cortical opacity does not prevent a detailed examination of the fundus; the interpretation of such cases being that the diminution of light which is caused by the opacities does not affect the observer, although it does the patient to a very serious degree. The writer has known a number of cases who, from being practically incapacitated from going about alone, have been restored to a condition that hardly has placed them under any practical disability. When the central vision is present, operation should not be delayed, so soon as the patient has begun to experience serious inconvenience from the condition.

Treatment of Congenital or Infantile Cataract. The question of what shall be done for the relief of these conditions varies according to the interference with sight. If the cataract be so slight that there is very little interference with visual acuity, nothing, of course, should be done. When, however, there is great interference with sight the choice generally lies between two procedures, either an entire destruction and absorption of the lens by "needling" or the production of an artificial pupil by means of an iridectomy, so that light can pass by the side of the opacity, especially useful in some cases of lamellar cataract. This procedure sounds as if it should be always the more satisfactory one, because the power of accommodation would be left and spectacles need not be worn, whereas if the lens have been absorbed the patient must wear glasses constantly and a different pair for distance from those which are required for near work. The vision, however, by means of an artificial pupil is often very unsatisfactory, whereas good vision may be obtained after absorption of the lens. The decision as to which method shall be pursued in any particular case may be arrived at by dilating the pupil with

atropine and observing what standard of vision can be secured through the exposed periphery of the lens. If this be fairly good it may be presumed that the sight will be still better by means of an artificial pupil, for spherical aberration will not be present to the same extent. If, however, after correction of any error of refraction that may exist vision does not reach the standard of $\frac{6}{18}$ of Snellen types, the writer would suggest absorption of the lens in preference to an artificial pupil. On the other hand, if the vision reaches the standard of $\frac{6}{12}$ he would very much prefer iridectomy. In cases of complete congenital cataract operation should be performed as soon after birth as possible, in order that the function of sight may fully develop, for if such cases are not operated upon until the patients are older, the faculty of vision is not developed to anything like the same extent as in the case of early operation. It is probable that the faculty of vision and the nerves and centres upon which it depends being in abeyance at the time when rapid development is taking place in other directions, are relatively prejudiced, and what is known as amblyopia exanopsia occurs. Sometimes, too, nystagmus arises in these cases of bad vision, and this may perhaps be prevented by early operation. The position usually selected for iridectomy, unless there should be some special reason against it in any particular case, is down and in, and the smaller it is made the better. A modification of the operation of needling is described as discission, in which the lens is extensively dealt with by means of a cutting needle, so that it may quickly swell up and be evacuated along the groove of the curette a few days later. This produces a more rapid result, though it is not so safe a procedure as simple needling, which, however, takes much longer to bring to a successful issue. Sometimes when the lens has been drastically dealt with a suction curette can be used and the softened lens tissue removed in that way. In those cases which need not be dealt with in quite early life it is well not to delay operative procedure too long. About six or seven is quite a suitable age. The defect, however, is frequently not discovered until the child begins his educational life, and so operation is not performed until the age of ten or eleven. Sometimes the circumstances of the case will suggest the desirability of leaving one eye untouched with its power of accommodation, the other eye after operation to be kept for occasional use when more detail is required, but every case has to be considered on its merits and no hard and fast rule can be laid down.

The Treatment of Senile Cataract requires careful consideration and no uniform practice can be laid down, and though the details of the procedure that should be adopted are generally

left to the surgeon who is taking charge of the case, yet it is often the duty of the general practitioner to assist the patient with his advice when there is any choice of action. In days gone by it used to be the rule never to interfere with a cataract until the sight of both eyes had been reduced to perception of light only, but at the present time no one probably acts upon that principle. There are many things which have to be considered—the age of the patient, the degree of senility of the faculties, mental as well as physical, the state of health, the special needs of the individual and also his temperament; and, later, on what kind of operation and whether it shall be performed in one or in two stages. Ninety-eight or ninety-nine per cent. of operations for uncomplicated senile cataract are successful to a greater or a less degree, and the method of procedure varies from extraction in its capsule with or without iridectomy, to extraction from its capsule with or without iridectomy. Surgeons differ so widely in their practice, each one giving good reasons for his variations, that the writer thinks it will bring the matter more clearly before the reader if he describes the general lines of his own practice and gives his reasons for adopting the details of his procedure, at the same time stating some of the arguments which determine the course of action of others. In senile cataract his rule is to adhere, when possible, to the old-established custom of dividing the operation into two stages, and to perform at first what is known as a preliminary iridectomy instead of completing the extraction of the cataract at one time. The latter is obviously the more brilliant procedure, but the writer, in common with many others, considers the preliminary iridectomy a safer method. The reasons for this view are as follows. There is a lesser traumatism at the time of the more serious operation, that of extraction, and the writer believes the tissues have been rendered in a more recuperative state by the process of healing needed by the preliminary operation if it has been performed about eight weeks beforehand. Then, again, there is another detail of importance which is gained by preliminary operation, and one which means a great deal, namely, that the patient knows the surgeon and the surgeon knows the patient, and both are thus prepared for the more serious second stage. The patient, moreover, has usually lost his dread of the actual operation from his preliminary experience. All this may not sound much on paper, yet in actual practice it is a great asset. The writer could give many instances where unexpected events have occurred at the preliminary operation which probably would have destroyed the eye had the complete operation been undertaken, whereas it has been possible

to take precautions to prevent their recurrence at the second more serious operation. On the other hand, many surgeons, perhaps the majority, adopt the plan of performing the whole operation at once. Of course this means only one period of being laid up, and this is certainly a consideration in the case of very old people, in whom the disturbance of their routine of life is very upsetting, and frequently this objection to the preliminary operation should prevail. Again, it is maintained that two wounds at different times lay the patient open to double chances of infection. Here, again, particular cases have to be dealt with when this objection is quite sound. The question, probably, which gives rise to the greatest difference of opinion is when to operate. The writer suggests that when both eyes are affected and the vision of one is reduced to little more than "hand movements," though there is some reading vision in the other eye, operation on the worst eye should be undertaken, so that it may be ready to take on the duty when the other shall have failed. In this way the patient is protected from having any period of semi-blindness, and the most appropriate time for operation can be selected without adding to the inconvenience of the patient. It must, however, be remembered that so long as the patient has any reading vision whatever and the power to move about with the aid of the eye which has not been operated on, he will prefer to use this eye, though the vision of the eye from which the cataract has been removed is of much higher acuity. It is unnecessary here to enter into reasons for this, but it will be found universally true. Great annoyance is often expressed in consequence, because the vision, instead of being any help, may even for a short time give rise to some confusion. The operation of extraction of cataract therefore should not be too hastily performed, even though the cataract may be mature, when there is still sufficient vision for practical purposes in the other eye. A more difficult question to solve is when to operate in the case of a patient both of whose eyes fail at the same time. If left until the cataracts are mature, the patient may be in a semi-blind state for many years. In the case of those whose livelihood depends entirely upon their sight, the writer does not hesitate to operate on one eye when the cataract is still quite immature. The increased risk, which is very slight, is well worth running for the enormous gain which results. In the case of those who are not dependent upon their work, so early an interference, as has just been suggested, is not called for. At the same time elderly people lose a great deal of their physical activity and they are more dependent on reading and working to occupy their time. For them the deprivation

is very great, and the writer never hesitates to advise such people to submit one eye for operation. Some surgeons employ a method of artificial maturation of the cataract, but many, including the writer, think such a procedure involves greater risk than extraction of an immature cataract in the usual way.

The question of whether a second eye shall be operated on when the cataract has been successfully removed from the other is one upon which, again, different opinions are held. The writer never urges such a procedure upon the patient. There are, of course, obvious advantages in having two eyes which can see, but there is no sort of necessity for the second eye. Still, if after such explanation the patient desires it, the writer does not hesitate to undertake the operation. There is, of course, the danger of exciting sympathetic ophthalmia in the other eye, but the risk of this terrible disaster taking place is, in a straightforward case, so remote that it is not sufficient to outweigh the advantages of binocular vision. When the patient whose lenses are becoming cataractous gets to a stage that is sometimes described as "light hunger," and when direct sunlight produces semi-blindness through contraction of the pupil, weak mydriatic drops such as atropinæ sulph. ($\frac{1}{8}$ gr. to an ounce) will often give great assistance by producing a slight dilatation of the pupil. It is almost impossible to say for certain when help will be gained by this means, for often, although the patient gains more light, at the same time he gets greater confusion on account of the want of uniformity of the index of refraction of the cataractous lens. The only way is to try, and if the effect is unfavourable the drops can be discontinued. Of course, any tendency to glaucoma, which must be continuously watched for, contra-indicates their use. It must, too, be particularly borne in mind that semi-dilatation only is required, and wide dilatation defeats the object, so the drops should be used as infrequently as possible; the intervals vary with individual susceptibility; for some twice a week will be sufficient, while others may require them every other day.

When traumatic cataract occurs from wound of the lens, treatment should be prompt, and a useful maxim to bear in mind is that the earlier the surgical interference the better the eventual result. Such accidents are common in country districts among hedgers, and are far too often treated on the expectant plan. Very frequently the iris is wounded at the same time and the escape of aqueous from the leaking of the anterior chamber acts as a prophylactic to the onset of acute inflammatory symptoms, but when the chamber heals, active inflammation begins and the vascularized iris, lymph and lens tissue become matted together, setting up

a low inflammatory state of the whole eye, a condition much more unfavourable for operation. The error, therefore, of believing from its quiet appearance that all is going on well should be avoided and the eye should be dealt with at once by a large iridectomy at the seat of the wound and evacuation of the lens substance, except in the case of children, when, the iris being unharmed and the wound clean, the lens may be dealt with by the usual process of needling. In adults, too, when the iris is unwounded and there is only a small clean punctured wound of the lens, its extraction may be delayed until the whole of it shall have become opaque, but the case must be kept closely under observation, lest the swelling lens should induce glaucoma.

In all cases from the earliest moment the pupil should be kept under the influence of atropine to guard against the iris being involved with the exuding lens tissue. R. W. D.

DISEASES OF THE RETINA AND OPTIC NERVE

The retina, the peripheral sense organ subserving vision, with its nerve, must be regarded clinically as well as developmentally as an integral portion of the central nervous system. It is only by keeping steadily to this point of view that one is able in a short article to bring into proper perspective the various lesions which may affect these two structures. A knowledge of the variations, both physiological and pathological, that may be seen with the ophthalmoscope is as essential to the physician as a knowledge of the variations in the nature of the radial pulse or the capacity to use a stethoscope. To most men the eye as a gateway of knowledge is more important than ear or finger; what we can see for ourselves is more easily comprehended than what we can only learn by touch or by hearing, and in the retina we can see the changes that are produced in all the stages of vascular disease and the degenerations in nerve tissue caused by inflammation or cedema. Most important of all is the evidence that the ophthalmoscope can give of changes in intracranial pressure produced by various intracranial lesions.

The optic nerve, piercing the sclerotic at the lamina cribrosa, spreads out on the inner surface of the retina, separated from the vitreous humour by the internal limiting membrane and the hyaloid membrane. The ganglion cells, of which the optic nerve fibres are the neurones, lie in the inner portion of the retina, immediately outside the nerve fibre layer.

Medullated Nerve Fibres. The nerve fibres are, as a rule, non-medullated inside the eye, and become medullated only after passing through

the lamina cribrosa. Occasionally a few bundles retain their medulla inside the eye, producing white flame-shaped patches at or near the edge of the disc, which partially obscure any small blood-vessels which run through the patch.

Physiological Pit and Entrance of Vessels. The retinal blood-vessels, the central artery and vein of the retina, enter with the optic nerve and are seen in the centre of the disc lying in a little pit, the physiological pit, which usually slopes off gradually to the temporal side of the disc and has a steeper wall on the nasal side. In the condition known as Fuch's coloboma the slope of the pit is towards the lower side, where the coloboma appears as a white crescent and the steeper edge of the pit is above. Occasionally in myopic eyes the position of the pit seems to be reversed, so that the slope is to the nasal side. In some cases at the foot of the pit the sieve-like arrangement of the lamina cribrosa can be seen over a small area.

Myopic Crescent. At the edge of the disc a thin rim of sclera may show as a white ring beyond the choroid, and in myopic cases this may extend into a broad crescent, greatest in its extent at the temporal side of the disc. Occasionally a heaping up of choroidal pigment forms a partial black edge to the disc.

The Retinal Vessels. The central artery and vein of the retina form in the pit two main branches which pass to the upper and lower edges of the disc, where they again divide into temporal and nasal branches. The upper and lower temporal vessels supply the branches which run towards the macula, but no vessels actually enter the macular region.

Cilio-Retinal Artery. In some eyes a vessel (usually an artery) is seen coming round the edge of the disc, unconnected with the central vessels. This is a branch of the ciliary vessels, and if present may be of value in preserving a portion of the retina from injury in cases of embolism of the central artery.

The larger vessels lie in the inner layer of the retina immediately under the membrana limitans interna, and among the superficial nerve fibres. The terminal ramifications probably do not pass farther out than the outer molecular layer of the retina, and small hæmorrhages in the retina usually occur in the nerve fibre layer or the outer molecular layer. The rod and cone layer of the retina must mainly depend for its nutrition on the chorio capillaris, the close meshwork of fine capillaries forming the inner layer of the choroid and only separated from the rods and cones by the pigment layer of the retina and the membrane of Bruch.

Vascular Diseases of the Retina

Embolism of the Central Artery.—An embolus lodging in the central artery of the retina pro-

duces very characteristic appearances and symptoms. The loss of sight is sudden and usually complete (except when a cilio-retinal artery is present). The main arteries can be seen as tiny threads, the veins remaining more or less normal in calibre. The retina becomes intensely oedematous, white and opaque, and, unless the embolus is dislodged speedily, is destroyed. By contrast with the white oedematous appearance of the rest of the retina the fovea shows up as a bright red spot, the typical cherry-red spot at the macula, one of the most characteristic features of retinal embolism.

Occasionally the embolus lodges not in the main vessel, but in a branch. When that is the case there is a sudden loss of visual field, corresponding to the portion of the retina supplied by the affected branch. Massage of the eye has been known to effect the dislodgement of the embolus from the main vessel into a branch and so bring about partial restoration of vision. Similarly reducing the intraocular tension by tapping the anterior chamber (paracentesis of the cornea), may dislodge a recent embolus and save some sight.

Thrombosis of the Central Artery and Arterio-sclerosis.—Thrombosis of the central artery gives rise to a clinical picture very similar to embolism. It occurs in older people, and when there are obvious signs of arterio-sclerosis in the retinal arteries generally. The ophthalmoscopic signs of arterio-sclerosis are very easily observed and very important. The walls of the healthy retinal artery are probably almost transparent, and what we see is the contained column of blood. In arterio-sclerosis the walls become opaque and the vessels appear whiter, and the reflex from the surface is brighter and harder. The curves in the course of the larger arteries are flattened out, as if a longitudinal contraction of the walls necessitated a straighter path from point to point. On the other hand, the tiny terminal arterioles become very much more tortuous, just as a hair which has been stretched between the finger-nails and then let go curls up into a corkscrew spiral. Usually when an artery crosses a vein the vein can be seen through the artery, pursuing its course with even calibre, but in arterio-sclerosis the vein is not only hidden but its course is deflected and its calibre diminished (and in some cases even its lumen may be blocked) by the crossing artery, while on the distal side the vein is swollen. Hæmorrhages may arise both from the rupture of tiny arterioles and from the venous blockage.

Thrombosis of the Central Vein.—The loss of sight when a thrombus forms in the central vein of the retina is almost as sudden and complete as in the case of embolism of the central artery. The history of onset usually differs

in one important particular. In embolism the blindness comes on suddenly while the patient is up and going about, whereas in thrombosis it is very usual to find that the patient goes to bed with quite normal sight and awakens up in the morning to find one eye blind. The thrombosis occurs when the cardiac action is at its lowest point and when there may not be sufficient *vis a tergo* to prevent a temporary stasis in the retinal veins and a consequent clotting. When the fundus is examined the veins are seen to be greatly swollen and tortuous, and scattered everywhere over the retina are large flame-shaped hæmorrhages. The edge of the disc is blurred and the surrounding tissues are oedematous, but the disc is not much raised above the general retinal level. The arteries are diminished in size. When the thrombosis is complete it is hopeless to expect much recovery of vision, but when it is only partial there may be very definite improvement as the thrombus shrinks in size. In treatment, therefore, we must do all we can to promote absorption of the clot and to prevent further clotting, while we must at the same time avoid anything which will lower too much the vigour of the heart's action. Administration of citric acid or of the juice of fresh lemons (six per day made into a drink with a minimum amount of sugar) will hinder blood coagulation. Local depletion by leeches applied to the temple will reduce venous congestion. Calomel in half-grain doses should be given every night. On the other hand, some diffusible cardiac stimulant should be given to such patients every night at bedtime, and for this purpose probably good whisky or brandy given in soda-water is as useful and palatable a medicine as can be ordered, though it need not preclude the use of other cardiac stimulants. It is well always to remember that in dealing with such cases one has to steer between the Scylla of hæmorrhage and the Charybdis of thrombosis.

Intravitreous Hæmorrhage.—A cause of sudden blindness in apparently healthy young adults is free hæmorrhage into the vitreous humour. It is more frequent in young men than in young women and its causation is as yet quite obscure. It was not due to hæmophilia in any one of a series of cases I examined carefully some years ago. In some cases it follows on a thrombosis of a large branch of the central vein. In other cases the blood seems to come more from the ciliary region. In course of time the blood is absorbed from the vitreous, and there may be very little permanent damage to vision though numerous floating opacities are left. In other cases, however, the hæmorrhages are repeated and they may form the initiatory stage of a condition known as *retinitis proliferans*, in which strands of con-

nective tissue pass through the vitreous from the retina. The contraction of these strands may later give rise to large retinal detachments. It has lately been suggested that such cases should be treated by withdrawing a portion of the vitreous and replacing it with sterilized normal saline. As many of them recover very good vision without this treatment it is probably better in most cases to leave this somewhat heroic method alone.

Massive Exudate into Retina.—This condition is usually seen in young children and the appearances simulate a tumour of the retina. The exudate seems to be due to hæmorrhage into the deeper layers of the retina. The cases are comparatively rare, but as the eyes are usually excised on the suspicion of tumour it has been thought desirable to mention the condition.

Inflammatory Diseases of the Retina

Many of the diseases which are classified under the heading of **Retinitis** are probably not inflammatory in their origin. The three most important varieties are (1) albuminuric (2) diabetic and (3) syphilitic. There is no absolute ophthalmoscopic criterion by which we can form a differential diagnosis between the three, and at most the oculist should content himself by suggesting the probabilities to the physician.

Albuminuric Retinitis may be clinically divided into: (1) a form in which the retina shows most change—simple retinitis, (2) where the nerve head and the retina are equally affected—neuro-retinitis, and (3) where the neuritis is very marked. This latter form, with marked swelling of the optic disc and hæmorrhage, is very liable to be confused with the optic neuritis caused by intracranial growths, and in some cases the diagnosis can only be made after examination of the urine. A fourth form of retinal degeneration allied to albuminuric retinitis occurs in arterio-sclerosis.

The most typical fundus changes in albuminuric retinitis take place in the macular area. The retina here is slightly clouded from oedema, and faint grey radial striations can be made out in it. Along the lines of these striations bright white dots and lines form a star-shaped figure, sometimes coalescing at the centre over the fovea into a greyish white area. The edges of the disc are blurred and the disc shows a small amount of swelling, usually not more than 2 D or 3 D. The arteries are brighter than normal and their calibre is contracted. The amount and distribution of the hæmorrhages vary. In some cases they are numerous and spread some distance out into the retina. In other cases they may be absent or very few in number and small in size. In the more severe cases there may be many areas of

a dusky white character not so hard in their outline as the bright white areas forming the star figure. These are patches of degenerating nerve fibres. The prognosis of cases of albuminuria in which retinitis occurs is not good (except from this statement the albuminuric retinitis occurring in pregnancy). Much depends on the conditions of life to which the sufferer may be exposed. In patients of the hospital class the outside expectation of life is two years. In better-class patients this may be prolonged to as much as five years. The treatment must be mainly directed to the relief of the constitutional cause. Rest in bed, frequent hot-air baths (two or three in a week if the patient can stand them), small doses of calomel nightly, and in many cases bleeding are all of value in reducing the pulse tension and in controlling the oedema. The rest in bed should continue for six weeks, the hot-air baths should be given up during the last week or ten days, and at any time it may be necessary to relax the rigour of the treatment if the patient should get too depressed. There must be no use of the eyes during this time, and they must be protected from glare by chlorophyll-tinted glasses, but it only adds to the depression of the patient to keep the room itself darkened. When the patient responds favourably to treatment very considerable improvement in vision may take place and may be maintained for a long time. In some cases I have thought that calcium lactate produced a definite beneficial effect on the retinal condition.

Diabetic Retinitis may resemble albuminuric, but usually there is little general oedema of the retina. The white spots are not arranged in a star-shaped figure but irregularly round the macula; they are variable in size and often rounded in outline. The hæmorrhages usually form a small circle of petechiæ round the macula, and there is no obvious disc change. Typical cases are easily differentiated, but he would be a bold man who would base his diagnosis on the ophthalmoscopic picture alone.

Syphilitic Retinitis may resemble very closely albuminuric, but usually there is more disturbance of the retinal pigment in it, so that when the star-shaped figure is formed at the macula it is of a deeper grey colour and the whole macular area may show irregular pigmented stippling.

Atrophic Diseases of the Retina

Retinitis Pigmentosa is a primary atrophy of the retina in which the characteristic appearance of pigmentation arranged like a spider's web or like bone corpuscles is produced by the retinal pigment wandering to the inner layers of the retina and becoming deposited superficially to the vessels. The characteristic pigmentation appears first in patches in the equatorial region

of the retina. These gradually coalesce into a ring which broadens slowly and encroaches on the macular area. The rest of the retina loses its brightness and takes on a dead-leaf colour, the arteries diminish very much in size and as the disease progresses may become mere threads. The disc passes into a state of yellowish waxy atrophy.

The earliest symptom in the clinical history is night blindness. The patient can see perfectly well in the daytime, but as soon as the light fails in the evening he becomes unable to see at all, and blunders into all sorts of obstacles. Macular vision tested in good daylight at this time may be quite normal, but there is found a very marked scotoma in the form of a ring in the peripheral field corresponding to the portion of the retina where the pigmentation first appears. This ring broadens both outwards and inwards until the visual field becomes almost telescopic, so that the patient can only see the face of the person to whom he may be talking. This disease probably belongs to the class which Gowers calls *abiotrophies*. It is frequently found to be hereditary and to occur in the offspring of consanguineous marriages. Little can be done in the way of treatment for these cases except to keep the general health as good as possible and to save them as far as can be from over-use of the eyes. Fortunately many cases remain non-progressive over long periods of years.

Secondary Atrophy of the retina follows disseminated choroiditis, and if the lesions caused by the primary disease are not very conspicuous it may be a little difficult to distinguish this form from ordinary retinitis pigmentosa; but on carefully taking the visual fields the peripheral scotoma is found to be more patchy and not in such a regular ring as in the primary form of the disease.

Amaurotic Family Idiocy is a rare form of retinal degeneration found exclusively in infants of Jewish descent. The central portion of the retina is white and opaque-looking, with a chocolate-coloured or reddish spot at the macula (where the retina is very much thinned). There is accompanying cerebral degeneration, and luckily the children usually die before reaching the age of two.

Retinal Detachment.—In normal eyes the posterior chamber is filled by the vitreous humour contained in its hyaloid membrane, and the retina is kept in close apposition with the choroid. It is really, however, only attached at two places—the edge of the disc and the ora serrata. In myopic eyes, with the stretching of the sclera the retina and choroid have also to stretch to keep in apposition, and the bulk of the vitreous has to increase to fill the increased volume. In some cases

this seems to result in a degeneration of the vitreous which instead of retaining its jelly-like consistency undergoes a fibrillar change. In doing so it probably forms false attachments to the retina, and when the fibrillæ subsequently shrink they pull on the retina and cause it to come away from its apposition to the choroid. The cause of ordinary retinal detachment has not yet been adequately worked out, but there seems to be little doubt that vitreous degeneration is one of the important factors.

It is in cases of myopia that detachment of the retina is most commonly found. The retina projecting forward into the vitreous can be seen in old-standing cases in bluish-white folds, and in fresher cases where the retina is still transparent the wavy course of the vessels and the fact that they have lost their normal bright reflex and look like copper wires, indicate the detachment. The best evidence is the difference in level between the normal retina and the detached area, which can often be seen with a + 8 or + 10 D lens behind the mirror in direct ophthalmoscopy. The field of vision in detached retina is interfered with but need not be completely lost over the affected area. Vision in that part of the field may be blurred or distorted rather than lost. The commonest predisposing cause, as I have said, is myopia. The immediate cause may be a blow or sudden strain, and a severe blow may cause detachment in perfectly healthy emmetropic eyes. A cause of detachment of great importance is choroidal tumour, and in any case it is of the first importance to exclude this. The first diagnostic point is the intraocular tension, which in simple detachment is lowered, but is not lowered in tumour detachment. In the later stages of a tumour it is definitely raised, so that the eye may become glaucomatous; but unfortunately it is not advisable to wait for the raised tension to develop before removing an eye with a tumour in it. Examination by transillumination in some cases affords valuable information by showing the tumour shadow, but it is of little value when the tumour is far back. If there is any doubt and the other eye is healthy it is better to remove an eye with a simple detachment than to run the risk of leaving an eye with a malignant growth in the choroid.

Detachment may occur in choroiditis, proliferating retinitis, and often in the last stages of diabetic or albuminuric retinitis. It sometimes appears in seemingly perfectly healthy young people without any obvious cause.

The *treatment* consists in trying to secure removal of the fluid behind the retina and so getting the retina back into position and retaining it there. Absolute rest in bed, hot-air baths, pilocarpine injections and deep sub-

conjunctival injections of saline may all be tried. The eye should be covered with a light pressure bandage. In operating it is advisable to aim at securing not only removal of the sub-retinal fluid but re-attachment of the retina, and I feel sure that the best method of doing so is by post-equatorial scleral puncture with the galvano-cautery. If successful the retina is then actually pinned down by the resulting slight inflammation over the cauterized point.

Retinal Tumour.—**Glioma Retinæ** is the only form of primary tumour found in the retina. Others may exist, but those that have been described are few in number and doubtful in origin. The disease occurs in early infancy, may attack both eyes in the same patient, and may occur in several members of the same family. I have had under my care three children with glioma out of a family of four. In the eldest both eyes had to be removed, and one eye from each of the other two. Clinically two forms exist, glioma exophytum, in which the tumour grows into the subretinal space and lifts the retina forwards, and glioma endophytum, in which the retina remains in position, becoming generally infiltrated, and outgrowths of the tumour pass forward into the vitreous. The tumour appears as a whitish mass, often easily seen by focal illumination behind the lens. It may show normal retinal vessels on the surface, or hæmorrhages. In the later stages the eye becomes glaucomatous, and if the growth is allowed to progress and become extra-ocular marked proptosis develops, and finally death from extensive metastases. The tumour in the second eye is supposed to be of independent origin and not metastatic. A proof of that is that the patient referred to above is still alive eight years after removal of both eyes. Early removal of the affected eye is essential if life is to be saved.

Pseudo-Glioma resembles glioma in its appearances, but it is a plastic cyclitis or uveitis, occurring usually in debilitated children after acute illnesses such as broncho-pneumonia, measles or scarlet fever. There is usually some evidence of ciliary involvement in the retraction of the outer portion of the iris, though the lens is shoved forward and the central portion of the anterior chamber is shallow. In the later stages the eyeball shrinks (phthisis bulbi).

Diseases where the Optic Nerve is primarily affected

It is unfortunate that the term optic neuritis has by long usage come to be applied to the changes in the optic disc which appear when the intracranial tension is raised or when there is present an albuminuric or other form of

retinitis. It is true that in some cases of inflammation of the optic nerve similar changes may show themselves in the disc, and we then have ophthalmoscopic evidence of true optic neuritis; but the great majority of cases of so-called optic neuritis are not primarily inflammations at all, but simple œdemas; and on the other hand, in the great majority of cases of true inflammation of the optic nerve the changes produced in the papilla or disc are only slight and the existence of the inflammation has to be inferred from other clinical signs. But as matters stand at present true inflammation of the optic nerve is called retro-bulbar neuritis, while the œdema of the disc is generally written and spoken of as optic neuritis, but is better named papilloœdema or choked-disc.

Retro-bulbar Neuritis, or true optic neuritis, is characterized by rapid loss of vision in the affected eye. Central vision is as a rule first affected, so that a central scotoma develops which increases in extent till the whole field of vision is lost. If recovery takes place the peripheral field reappears first, and there may remain a small absolute central scotoma, and even in those cases which seem to show complete recovery careful investigation may show the presence of a relative central colour scotoma. In these cases the pupil reactions are of great importance in the diagnosis. On exposing the pupil of the affected eye to light, the sound eye being covered, an immediate and fairly brisk contraction takes place, but is followed immediately by a dilatation which may make the pupil even wider than it was in the shade. On exposing the sound eye to light the pupil of the affected eye contracts well, and the contraction is maintained well. If both eyes are affected the pupils react to light, but in neither eye is the reaction maintained, and the final pupil diameter may be as great after exposure as in shade. In retro-bulbar neuritis of local origin there is usually pain on movement of the eye or on pressure. In the form that occurs in disseminated sclerosis pain is not a common symptom. In the early stages of a retro-bulbar neuritis the presence of ophthalmoscopic signs depends on the part of the nerve affected. If the lesion is behind the entrance of the central vessels no change will be seen in the fundus until the pallor of the atrophying disc appears, weeks after the onset of the inflammation. If the lesion be far forward the veins will be congested, the edges of the disc blurred by œdema, and there may even be a definite degree of swelling of the disc. The main diagnostic points in retro-bulbar neuritis are the rapid loss of sight, the characteristic pupil reactions, and it maybe pain on movement or deep pressure. In such a case, even if there is no change to be seen ophthalmoscopic

ally, the diagnosis of retro-bulbar neuritis is justified.

The inflammation may be due either to local or to general causes. Amongst local causes the most important are orbital cellulitis, inflammations in the accessory sinuses of the nose, more especially the sphenoidal sinus, and possibly in rheumatic people a form of scleritis affecting the posterior pole of the eye. Of general causes the commonest is undoubtedly disseminated sclerosis, though it is not certain that it is justifiable to use the term "inflammation" in connection with the lesions caused in nervous tissues by this disease. In a very definite proportion of cases no cause, either local or general, can be discovered. In such cases it is well to be on the outlook for the subsequent development of symptoms of disseminated sclerosis.

The prognosis in the less severe cases of retro-bulbar neuritis is on the whole good. Any local cause must be dealt with. Local depletion by leeching, rest, purging and diaphoresis should all be employed. In cases of disseminated sclerosis the recovery of vision may be absolute, and it is not uncommon to find very marked pallor in the disc of a patient with a visual acuity of $\frac{6}{5}$ and full fields both for white and colour.

The **Toxic Amblyopias**, due to tobacco, methyl alcohol, carbon bisulphide, etc., are sometimes described as forms of chronic retro-bulbar neuritis. It is more probable that the signs of interstitial fibrosis found in the optic nerves in such cases are secondary, and that the poison primarily acts on some of the retinal elements. The main symptom of the condition is the loss of sight due to the development of a central scotoma which becomes absolute for colours. Green usually goes first, and consequently in testing it is best to use a 2 mm. green square. Sufferers from tobacco blindness sometimes see better in dim light than in full daylight. They mostly are smokers of heavy tobaccos, such as shag or black cavendish, of which they use from four to eight ounces or more in a week. Spirit drinking and exposure to cold are added predisposing causes. Often the actual exciting cause is some domestic or financial worry. So it may happen that a man goes on smoking heavily and drinking frequent nips of whisky or gin for years, and only develops tobacco blindness when some worry adds to the general strain on his nervous system. The treatment consists in cutting off the supply of the poison. Tobacco in any form must be given up entirely, and alcohol also, except that it is permissible to allow an occasional half-pint of mild ale with meals. The bowels should be kept open with saline aperients and a plentiful amount of fluid taken; strychnine should be

given as it improves the conductivity of nerve tissue, and so allows what vision there is to be used to the best advantage. The cases usually take from three to six months to clear up, and unless the disease has progressed too far the prognosis as regards vision should be good.

Papilloedema (*Optic Neuritis*) is the term used to describe the series of changes in the optic nerve head consequent on an increase of intracranial pressure. Optic neuritis, as it is still most frequently called, constitutes the most important sign of the presence of a cerebral tumour. It is present at some stage or other in eighty per cent. of all cases, and in a great majority of cases if the intracranial pressure is not relieved by operative measures the condition leads to blindness. It is very important to remember that in the early stages of papilloedema vision may not be affected in any degree. There may be a history of attacks of temporary dimness of vision lasting for a very short time, but these are in all probability not due to the papilloedema, but to a distension of the third ventricle pressing on the chiasma. It is quite possible for a patient to pass through all the stages of optic neuritis from its earliest inception to a swelling of five diopters with hæmorrhages, and then to complete subsidence without ever showing any notable loss of visual acuity, and one cannot too much insist on the necessity of early and frequent examination of the fundi in all cases where there is any suspicion of raised intracranial pressure. The earliest signs are a slight blurring of the upper and lower edges of the disc, hyperæmia and slight venous turgescence. The blurring passes round the inner edge, and often the inner three-quarters of the disc circumference may be completely blurred while the other quarter remains clear. The swelling of the tissues conceals the vessels in part of their course over the disc, but the increasing venous turgescence always allows the veins to remain more obvious than the arteries. Small linear hæmorrhages appear mostly towards the outer edge of the swelling. As the swelling and hyperæmia increase all signs of the disc edges disappear, and its position is only determined by the confluence of the vessels. The œdema may spread for some distance out into the retina, especially along the lines of the vessels. In very severe cases it forms a blunt wedge of swelling towards the macula, and gives rise to a series of radiating white lines constituting what is known as the macular fan. In addition to the hæmorrhages there are sometimes to be seen soft-edged white patches about the crest or slopes of the swelling. These are the result of the swelling and disintegration of nerve fibres, and on section are found to be made up of clusters of so-called cytoid bodies

and fatty matter resulting from their breaking down.

Papillœdema occurs in eighty per cent. of all cases of cerebral tumour. Tumours lying deep in the white matter of the hemispheres do not cause optic neuritis, nor do pontine tumours, so long as they do not invade the neighbouring structures. On the other hand, cerebellar tumours invariably cause a very severe optic neuritis which speedily passes on to atrophy. In tumours of the cerebral cortex the severity of the neuritis seems to vary inversely with the distance of the seat of the tumour from the optic foramina. Atrophic changes set in much sooner in cases of cerebellar tumour than in the other cases, unless where the tumour is in such a position that it may press directly on one of the optic nerves or on the chiasma.

Apart from cerebral tumours any other lesion which can bring about a rise in intracranial pressure may also cause papillœdema. Thus we find it in cases of meningitis and in cerebral abscesses, but as the mechanism of the production is probably similar in all these cases, the appearances of the disc present no special distinguishing features.

Optic Atrophy.—There are five common causes of optic atrophy. These are: (1) papillœdema (optic neuritis); (2) retro-bulbar neuritis; (3) pressure on or injury to the optic nerve or chiasma; (4) tabes; (5) retinal or choroidal degeneration. These different forms are not always easily distinguishable from one another, and it is sometimes quite impossible to tell from the appearance of the disc whether the atrophy has followed on papillœdema or is the result of pressure on the optic nerve or retro-bulbar neuritis.

In the most typical manifestation of post-neuritic atrophy the disc has a solid, opaque, white appearance, the vessels are diminished in calibre and show whitish lines on either side. There may be a slight fluffiness of the edges and some disturbance of the pigment round the edges. In the descending atrophy caused by retro-bulbar neuritis, or by pressure on the nerve, the pallor is most marked on the temporal side of the disc. The lamina cribrosa is usually visible over a greater extent than normal, the edges of the disc are clear and the colour is usually very white. Tabetic atrophy differs very little from this except that the colour tends to be dirty grey and the vessels are more diminished in calibre, and the disc may show a shallow cupping. The atrophy following retinal and choroidal degeneration is characterized by a yellowish waxy appearance.

Leber's familial atrophy is a form of optic atrophy usually attacking the males of a family only. It is an hereditary disease and usually

appears about the same age (early adult life) in different members of the same family.

L. P.

GLAUCOMA

By this term is meant the result of excessive intraocular tension, a condition which can only be ascertained by palpation of the eyeball. For this purpose the patient should be directed to look downwards, when the surgeon places the middle, ring and little finger of both hands upon the forehead and temporal region, and with his index fingers palpates the patient's eyeball through the upper lid, alternately pressing with each index finger to ascertain the intraocular tension of the eyeball. The tension of the two eyes is compared, and in case of doubt the surgeon should compare the tension of the eyes under examination with those of a normal individual. In such examinations the intraocular tension may be found to be just above normal ($T = + \frac{1}{2}$), definitely raised ($T = + 1$), the eyeball may be distinctly hard ($T = + 2$), or it may be of stony hardness ($T = + 3$).

The sclerotic coat of the eyeball, which, with the cornea also, is made up of fibrous tissue, is somewhat tough and unyielding. It is thinnest at the lamina cribrosa, where the fibres of the optic nerve enter the eyeball, and is also somewhat thinned over the ciliary body.

The contents of the eyeball within these coats appear to be at capillary blood pressure.

The aqueous humour nourishes the nonvascular parts of the eyeball. This fluid is distributed to the vitreous humour and its capsule, the hyaloid membrane, to the lens and its capsule, together with the zonule of Zinn, or suspensory ligament of the lens, also to the elastic lamina of Descemet, the substantia propria of the cornea, and the stratified epithelium upon its surface.

The aqueous humour is probably secreted by the columnar epithelium present upon the free surface of the vascular tufts of the ciliary processes, and circulates in a fairly definite manner within the eyeball.

Most of the aqueous humour passes forward through the posterior portion of the aqueous chamber, through the pupil into the anterior portion, thence to the corneo-iridic, or filtration angle. Here the aqueous humour goes through the meshwork of the cribriform ligament, or spaces of Fontana, and thus gains the canals of Recklinghausen and the connective tissue spaces of the cornea. Some of the aqueous humour leaves the anterior chamber by way of the crypts of Fuchs, which are situated near the base of the iris upon its anterior surface. The lymphatic or connective-tissue canals

which contain this fluid open into the veins at the base of the iris, and also at the corneo-scleral junction into the canal of Schlemm, which is a circular plexus of veins. From these veins the blood passes back by the anterior ciliary veins, and the veins which cross the supra-choroidal space.

A small proportion of the aqueous humour filters through the zonule of Zinn, through the meshwork of the canal of Petit, and through the hyaloid membrane in order to reach the vitreous humour, which it nourishes. The aqueous humour then gains the canal of Cloquet, which traverses the vitreous humour and returns to the blood stream through the veins, accompanying the main vessel of the central artery of the retina, and so into the ophthalmic vein.

Given, therefore, that the structures contained within the eyeball are, in normal circumstances, at the intraocular capillary venous pressure, and that the *vis a tergo* of this venous pressure is due to the blood pressure of the arterioles and the pressure of the aqueous humour, which is actively *secreted* by the ciliary processes, it follows that a rise of intraocular tension may be brought about by a rise in local arteriole blood pressure, which must, sooner or later, mean a rise in venous blood pressure, or by a rise of the pressure of aqueous humour, which may be brought about by increased production, or by obstruction to its escape from the anterior chamber at the filtration angle. Many cases of *hypertonus opus*, or increase of intraocular tension, are due to more than one of these factors, all of which must be kept in mind.

Moreover, if the tension is not reduced within reasonable time, the pressure upon the retina is succeeded by a loss of acuity of vision, by a bulging backwards of the lamina cribrosa, undermining of the optic disc, and later by secondary pressure atrophy of the optic nerve and partial or complete blindness.

The chief conditions of the eye associated with an increase of intraocular tension (*hypertonus opus*) are the following—

1. Sero-plastic irido-cyclitis, *i.e.* an inflammatory condition.

2. Primary Glaucoma—(a) Chronic, or a non-congestive condition; (b) Subacute, (c) Acute, or congestive conditions.

3. Secondary Glaucoma.

4. Infantile Glaucoma (Buphthalmos, or Hydrophthalmos).

It is obvious, therefore, that a correct diagnosis is essential for adequate and rational treatment.

1. Sero-Plastic Irido-Cyclitis or Serous Iritis

The chief cause is alimentary toxæmia, the patient often suffering from oral sepsis, *e.g.*

carious teeth with or without pyorrhœa alveolaris, follicular tonsillitis or a septic nasopharynx. Absorption of toxic substances may possibly take place from ulcers or fissures about the anal canal, and in women from the genital tract. As a rule, the patient is debilitated and complains of dimness of vision and "watering" of the eye in bright light, also of dull aching pain in the eye, and occasionally the patient may be alarmed at the "redness" of the eyeball.

The physical signs are those of *inflammation* of the anterior part of the eyeball. The superficial conjunctival vessels are actively congested and the deep circumcorneal vessels injected. The cornea may appear normal or hazy, but, upon minute examination the lower part of the cornea is seen to be hazy with minute dots, of varying size, upon its deep surface. Typically these dots form a triangular area with the apex at or near the middle of the cornea and the base at the filtration angle below. These dots, due to the deposit of masses of leucocytes, are known as punctate keratitis. The aqueous chamber is, as a rule, *deep*, and the aqueous humour murky. The increased depth of the aqueous chamber is probably due to the fact that the aqueous humour contains an albuminous exudate of inflammatory origin which does not readily filter through the spaces of Fontana at the filtration angle. The spaces of Fontana also become partially blocked by leucocytes and precipitates from the murky aqueous humour. The pupil may appear normal or slightly contracted, and responds sluggishly to light. The iris is usually discoloured, and if a drop of a weak solution of atropine sulphate (two grains to the ounce) is instilled, the pupil will dilate irregularly, and one or more posterior synechiæ may be demonstrated. In position these are usually downwards. The tension of the eyeball is increased ($T = +1$) and the condition therefore may be mistaken for glaucoma. In the later stages of the disease, however, the intraocular tension becomes lowered. On ophthalmoscopic examination the optic disc frequently appears to be hazy and its margins ill defined. This is due to the fact that the disc is seen through media which are not clear, the cornea is hazy, the aqueous humour murky, and frequently there is an effusion of an inflammatory exudate (leucocytes and fibrin) from the ciliary processes into the vitreous humour chamber.

The treatment of the condition should be along rational lines.

First, a possible source of toxic absorption should be sought. Buccal and nasopharyngeal sepsis should be treated, a purge prescribed, and small doses of grey powder and the sulphate of quinine given three times daily. Atropine sulphate (two grains to the ounce) must be

instilled twice daily in order to break down synechiæ and to rest the ciliary body by paralysing the ciliary muscle. Dark protecting glasses should be worn.

If the circumcorneal zone becomes further congested and the pain increases, one or two leeches should be applied to the lower lid just below and external to the outer canthus. Frequent bathing with hot boric acid lotion and applications of persistent dry heat will relieve the pain in the eyeball, reduce congestion, and diminish tension. If, however, the tension still remains excessive, paracentesis of the aqueous chamber, which may have to be repeated, should be resorted to. In the acute or subacute stage of the disease there is no indication for an iridectomy, though this operation may become necessary to prevent the formation of further synechiæ in cases of relapsing irido-cyclitis.

2. Primary Glaucoma

This disease rarely occurs under forty years of age, and is usually symmetrical; hypermetropia predisposes to the condition. At the outset the patients frequently ascribe their gradual failure of vision to the fact that they require glasses, or stronger ones than they are using. There appears to be a rapidly increasing presbyopia due to loss of tone of the ciliary muscle.

Cause of Primary Glaucoma.—The hypermetropic eye, in which glaucoma frequently occurs, is smaller than normal. It is quite usual in chronic primary glaucoma to find a small palpebral fissure, and a comparatively small cornea.

The hypermetropic individual has to accommodate for distant as well as for near objects, and if he does not wear appropriate glasses his ciliary muscle is practically always acting. The meridional and circular fibres of this muscle are attached to the cribriform ligament, which probably becomes partly sclerosed as age advances. The result is that the spaces of Fontana become smaller, and the outflow of aqueous humour impeded. The aqueous humour, accumulating in the posterior portion of the eyeball, pushes lens and iris forward, and the true filtration angle may be obliterated as the base of the iris becomes adherent to the posterior surface of the cornea in the neighbourhood of it. The anterior chamber thus becomes *shallow*, and may become almost obliterated. In some cases the capillaries of the eyeball become congested and an attack of *subacute or congestive glaucoma* occurs. In other cases the congestion of the eyeball is so definite and the pain so acute that the condition becomes one of *acute congestive glaucoma*. In the worst cases hæmorrhage may occur within

the eyeball, giving rise to the condition of *acute hæmorrhagic glaucoma*.

Chronic glaucoma may progress more or less painlessly for years. The cornea becomes anæsthetic, the anterior ciliary veins dilated, the anterior chamber shallow, the pupil semi-dilated and oval, the fundus reflex greenish, and the eyeball almost stony hard ($T = +3$). Blindness ensues, chiefly from optic atrophy. The disc is, as a rule, deeply cupped. This condition is called *glaucoma absolutum*.

The diagnostic signs, symptoms and treatment of primary glaucoma—

From a practical point of view it is well to deal with these under the headings of *Chronic Glaucoma*, *Subacute Glaucoma*, and *Acute Glaucoma*.

Non-Congestive Glaucoma (Chronic Glaucoma).—

This condition occurs almost equally in males and females, and commonly in hypermetropes, though not exclusively; as a rule, both eyes eventually become attacked. The patient complains of loss of acuity of vision, and frequently requires a change of glasses. Vision is generally worse at night, and he may see coloured haloes around the lights, due to alteration in the corneal refraction. Vision is improved after a night's rest; the visual field becomes restricted. There is, however, little more than a slight aching of the eyeball. Examination shows the episcleral vessels distended. The cornea may be small. The anterior chamber is *shallow*, the pupil somewhat dilated, possibly ovoid. The media may have a greenish tint. Examination by oblique focal illumination may demonstrate lens opacities, which may be accidental, although cataract is sometimes secondary to glaucoma. On ophthalmoscopic examination the posterior media of the eyeball may be hazy and the optic disc definitely cupped. If the glaucoma is of long standing, the disc may be pale from atrophy. The tension of the eyeball may vary considerably from $T = +\frac{1}{2}$ up to $T = +3$ (glaucoma absolutum). If a perimetric tracing is taken in the early stage, the field of vision will be found contracted on the nasal side (temporal half of the retina), later it becomes generally contracted. Chronic primary glaucoma is frequently mistaken for incipient and progressive cataract, consequently the patient is sometimes told that "the vision must get worse before anything can be done," and treatment is postponed till optic atrophy has set in, or the base of the iris become so atrophied that treatment is not likely to be successful.

The treatment of chronic primary glaucoma—

There is no doubt that the use of appropriate glasses for hypermetropia is to a very considerable extent a prophylactic for glaucoma.

In the early stage of the disease, as soon as the eyeball has been thoroughly examined and

a diagnosis arrived at, the patient should be warned of the seriousness of the condition and told how important efficient treatment is.

A drop or two of a *fresh* solution of eserine sulphate (one-third grain to the ounce) should be instilled thrice daily. The contraction of the pupil draws the base of the iris away from the cornea, opens up the filtration angle, and allows the aqueous humour to filter through. The patient must be kept quiet, constipation and straining must be avoided. *As soon as possible, however, a carefully planned iridectomy must be performed by an ophthalmic surgeon.* The effect of this is to open the lymph spaces of the iris freely right down to its base. These spaces remain open, and so allow absorption of the aqueous humour after the scleral wound has healed. If, however, the base of the iris is atrophied and adherent to the cornea at the filtration angle, a *filtering cicatrix* must be left, otherwise, if the wound heals completely, the atrophied iris will permit little or no absorption to occur, and the tension is likely to become again raised. If operation is refused, the patient must be warned, and eserine sulphate persevered with. If this irritates the conjunctiva, pilocarpine nitrate drops (strength half grain to the ounce) may be substituted for it.

Small doses of quinine sulphate (one grain) should be given twice or three times daily, after food.

The vascular tension of the patient must be kept somewhat low by regulation of the diet and the use of saline purges, otherwise an attack of congestive glaucoma (subacute or acute) is liable to set in.

Congestive Glaucoma.—This disease, associated with venous congestion, is somewhat common in elderly women. There are two clinical types of the disease, namely, subacute and acute congestive glaucoma.

Subacute Glaucoma.—The patient usually gives a history suggestive of chronic glaucoma, but presents herself because of an "attack of pain and congestion in the eye." The pain in the eyeball is dull and aching, and frequently referred to the brow, along the supra-trochlear, supra-orbital and lachrymal divisions of the first division of the fifth nerve. The patient may complain of a feeling of nausea and even of an attack of sickness. During the attack there is a very definite diminution of vision, and objects are seen as through a mist.

The conjunctival vessels are *congested*, and there may be slight oedema of the sub-conjunctival tissue. The episcleral vessels are dilated. The cornea appears steamy. The aqueous chamber is *shallow*, and the pupil dilated and ovoid. The iris appears discoloured.

The posterior media of the eyeball give a greenish fundus reflex, and it is almost impossible

to see any details of the optic disc and the fundus oculi. The tension of the eyeball is generally + 1 or + 2.

The disease may easily be wrongly diagnosed. The conjunctival congestion and sub-conjunctival oedema may lead to the diagnosis of conjunctivitis, and valuable time be lost.

The discoloration of the iris and the irregularity of the pupil may lead to the diagnosis of iritis. The result of this usually is that atropine is instilled into the eye, the pupil dilates further, the filtration angle becomes more blocked, and the patient's condition definitely aggravated. After such treatment the tension of the eyeball usually becomes + 3.

On the other hand, the supra-orbital pain and the feeling of nausea, or the actual attack of vomiting, may lead to diagnosis of migraine and consequent delay in appropriate treatment.

The *treatment* of subacute glaucoma resolves itself into overcoming the congestion and relieving pain. The patient should be recumbent in bed. One or two leeches should be applied just below the outer canthus; this, as a rule, quickly relieves congestion and eases pain. A drop of a solution of eserine sulphate (one-half to one grain to the ounce) should be instilled every two hours.

A saline purge should be administered and the patient be kept upon a milk diet.

As soon as possible iridectomy must be performed.

Acute Glaucoma.—The onset is usually sudden. The patient complains of tenderness of the eyeball and acute pain, not only in the eyeball, but also along the brow and forehead, and frequently over the malar eminence and below the eye. In other words, the pain is referred to the regions supplied by the supra-trochlear, supra-orbital and lachrymal nerves, also to those supplied by the infra-orbital and temporo-malar nerves. The patient complains of nausea and may actually vomit. The vision, at first misty, rapidly diminishes, objects are seen as through a fog. Before the onset of the acute attack the patient may have experienced coloured haloes around artificial lights.

The signs are those of acute *congestion*, the eyelids are swollen and, when gently separated, the ocular conjunctiva is found to be darkly red and oedematous, the cornea is usually *hazy*, and there is a circumcorneal zone of deep congestion. The aqueous chamber is *shallow* and the pupil slightly ovally dilated. The iris is discoloured, and, in some cases, minute hæmorrhages may be seen upon its surface and blood may be observed in the lower part of the anterior chamber. In the most severe cases hæmorrhages occur in the retina and may be associated with thrombosis of the retinal veins, the blood becomes effused into the vitreous humour, and

a condition called acute hæmorrhagic glaucoma results. As a rule, however, ophthalmoscopic examination of the fundus oculi is impossible owing to the cloudy media. The intraocular tension is usually fully + 2.

Diagnosis. A case of acute glaucoma may be mistaken for acute plastic iritis, but in the latter condition there are definite signs of *inflammation* and photophobia. The cornea is, as a rule, clear, the aqueous chamber normal or deep, but contains murky fluid, the iris is discoloured, and the pupil *contracted*.

The pupil does not dilate when shaded, and posterior synechiæ may be seen. The intraocular tension is usually normal or slightly diminished.

The *treatment* of acute congestive (primary) glaucoma is as follows—

The patient is put to bed in a darkened room. A purge should be administered and two leeches applied to the temple, and a hypodermic injection of morphia given to relieve the pain. A drop of a solution of eserine sulphate (one grain to the ounce) should be instilled every half-hour for four instillations. Strong solutions of eserine sulphate (three or four grains to the ounce) are unnecessary. A weak solution of eserine sulphate (half a grain to the ounce) should be instilled into the *other* eye as a prophylactic measure.

As soon as possible the patient must be prepared for a general anæsthetic and a large upward iridectomy very slowly performed. In these circumstances this operation is one of the most difficult in ophthalmic surgery.

Iridectomy is contra-indicated in acute hæmorrhagic glaucoma, as it leads to further hæmorrhage, with the result that vision is completely lost.

3. Secondary Glaucoma

In this condition there are several factors at work, many of them mechanical in their action, interfering with the normal circulation of the intraocular fluids. The treatment of secondary glaucoma is directed towards the removal of the cause of the disease.

The following are the chief causes of secondary glaucoma—

1. *The baneful use of atropine*, especially to the eyes of those over six and thirty years of age. The treatment is to instil eserine sulphate (two grains to the ounce) every three hours for four instillations until the pupil begins to contract and the intraocular tension becomes less. A weaker solution may then be used three times daily for the next ten days. If the early instillations do not reduce the intraocular tension, an iridectomy must be performed at once.

2. *Injury.* Injuries are of two types, those with a perforating wound of the eyeball and

those without. Each of these may be associated with a rise of intraocular tension.

- (a) Those injuries with a perforating wound most frequently occur near the corneo-scleral margin, the iris prolapses, and consequently interferes with aqueous filtration.

The appropriate *treatment* is to draw the iris farther out of the wound in order to break down adhesions, then to cut it off flush, and to see that the cut surfaces return to the aqueous chamber free of the wound.

- (b) Injuries without a perforating wound, which result in a rise of tension, are—

- (i) A traumatic cataract rapidly swelling after the lens capsule has ruptured.

- (ii) A swelling lens after the operation of discission. The swollen lens pushes the iris forwards, so that the corneo-iridic angle becomes more acute or even obliterated. The swollen lens fibres must be evacuated.

- (iii) The lens may be dislocated as the result of injury. If dislocated into the anterior chamber, it blocks the filtration angle. In this position it may be transfixed and then removed. If in the posterior chamber, an attempt may be made to remove it; if this fails the eyeball should be excised.

- (iv) An intraocular hæmorrhage (intravitreous or subchoroidal) may cause a secondary glaucoma by pushing forward the lens and iris. For this condition absolute rest flat on the back must be insisted on, hot bottles applied to the feet, moist iced flaps over the eye, and a saline purge administered.

3. *Inflammation.* Ulcerative keratitis with extensive perforation into the anterior chamber and prolapse of the iris into the hole, *i.e.* an extensive anterior synechia interferes with the access of the aqueous humour to the filtration angle, causing secondary glaucoma. A carefully performed iridectomy usually meets the case. A plastic iritis, if inadequately treated, may lead to extensive posterior synechiæ. In the worst cases the iris at the pupillary margin may be completely bound to the anterior surface of the lens capsule, *i.e.* the pupil is excluded. In other cases the plastic exudate may become organized in the pupillary area, producing occlusion of the pupil. In such cases intraocular tension rises, the iris becomes bowed forwards (bombé), and this causes the anterior chamber to become shallow. In the early stages of iritis an attempt should be made to break down the posterior synechiæ by instilling atropine sulphate (two grains to the ounce) every three hours; this may be preceded by the instillation of cocaine hydrochloride (four per cent.), which partially overcomes the congestion of the iris.

4. *Intraocular new growths.* In infants and young children gliomata arise in the retina, in adults sarcomata (melanotic and leucosarco-

mata) arise in the choroid, ciliary body and, occasionally, in the iris. In what is termed the second clinical stage (glaucomatous stage) of such growths the intraocular tension is increased. The appropriate treatment is the immediate removal of the eyeball, with as much of the optic nerve as is possible.

4. Infantile Glaucoma, Buphthalmos or Hydrophthalmos

This condition is due to the occlusion in early life of the spaces of Fontana in the cribriform ligament. As the cornea and sclera in the young child are less resistant than in the adult, they yield, with the result that the dimensions of the eyeball are increased and the coats thinned. This condition is usually symmetrical.

The eyeballs are prominent, the corneæ appear enlarged, though actually thinned and spread out. The thinned sclera is bluish, because the uveal pigment appears through it. The anterior chamber is usually deep. The zonule of Zinn or suspensory ligament of the lens becomes stretched, the lens flattened and displaced backwards. In this way the iris loses its support and consequently becomes tremulous (iridodonesis).

The intraocular tension is raised and there is distinct cupping of the optic disc, with optic nerve atrophy and consequent blindness. The diagnosis of this rare condition is obvious, but the condition does not readily yield to treatment.

Iridectomy under a general anæsthetic may be performed, but in this condition it is a risky operation. After the aqueous humour has escaped the lens comes forward, the previously stretched and thinned zonule of Zinn ruptures, and vitreous humour consequently escapes from the wound.

H. W. L.

AFFECTIONS OF THE OCULAR MUSCLES

Functional Affections (*excluding Comitant Strabismus*).

Either the internal ciliary muscle, or the external muscles, or both may be affected.

Ciliary Muscle.—A weak response on the part of the ciliary muscle is common, the condition being known as **Ciliary Asthenopia**. It shows itself subjectively by aching of the eyes on prolonged efforts of accommodation, with stabs and darts of pain referred to the back of the eyes. Objectively, there is patchy redness about the corneal limbus, and in bad cases injection and lachrymation if the accommodation is forcibly called into play.

It follows eye-strain in errors of refraction, especially in children, who are apt speedily to exhaust their nerve power by inability to properly control its expenditure. It is also a

very frequent complication of neurasthenia, and objective evidence of ciliary weakness is then absent. Patients with this trouble are unable to use their accommodation for long, even when the refraction is normal, and the inability to read makes it difficult to control those debarred from this relief to the monotony of the treatment.

It is obvious that ciliary asthenopia may also be a concomitant of physical disease of any kind in that the ciliary muscle will share in any general muscular debility.

The *treatment* consists firstly in correcting any error of refraction. In children, attention to their methods of work and attitudes when at work are all-important, and care should also be given to any interference with the general health, such as constipation, indigestion or general debility.

In adults, the same line of treatment holds good, but in confirmed neurasthenics nothing is likely to be of much service. In them, vision may be normal, but their ability to utilize it without distress, when it entails the exercise of much mental effort, will often remain persistently absent in spite of all treatment. All grades and varieties of case in this latter category are encountered, but all are troublesome and refractory.

Functional Affections of the External Ocular Muscles of various kinds are common in nervous children and are often associated with refractive errors and debility. Sometimes they precede chorea, or may be reflex from thread-worms. Mostly, they can be classified under the generic term of *habit-spasms* and are without any special significance, tending to spontaneous cure at puberty without treatment, but the latter should not be neglected.

The commonest varieties are an irritating blinking of the lids, or a twitching of the orbicularis, frequently associated with a simultaneous twitching of one or other nostril. More rarely the affection consists of a frequent rolling of the eyes, usually either upwards or in a rotatory manner. It becomes most evident upon excitement or fatigue, and increases with self-consciousness. Hence, parents should be warned against discussing the matter before the patient, or finding fault, and the treatment must be directed against the cause.

Such habit-spasms originating in adults are comparatively rare, and, in my experience, when once fully developed, are almost incurable, and may tend to increase as time goes on and become a most serious defect. One of the worst varieties is a convulsive contraction of the orbicularis (*orbicular tic*) which sometimes develops into an almost permanent spasm, so that the patient cannot open the eyes for more than a second or two before a fresh spasm forces

them to be convulsively closed again. Perhaps the most frequent, however, is a functional ptosis, most apparent in the morning, often passing off later. It is not infrequently accompanied by a rolling of the eyes upwards when the patient tries to open the lids. Sometimes it is in the evening when the patient is tired that the ptosis appears. In such cases an organic cause for photophobia must not be overlooked, producing precisely similar symptoms; but here there would be watering and redness of the eyes on exposure to light, symptoms not present in purely functional cases.

Little can be said on the subject of *treatment*. Refractive errors should be corrected, and other possible causes of local irritation sought for. Orbicular tic may sometimes be relieved by division of the orbicularis at the outer canthus by a horizontal snip with strong scissors, one blade being passed behind the canthus, and all structures divided up to the external orbital margin. For the rest, treatment must be on broad lines.

Ocular Pareses

These may be divided into the two main classes (1) *congenital*, and (2) *acquired*.

1. **Congenital Ocular Pareses** embrace quite a large variety of cases. The most common is *ptosis* on one or both sides. Affecting both eyes to a slight degree, it is often regarded as an attraction in the child's face, to which it imparts a sleepy or saucy look. When, however, the droop of the upper lids is sufficient to hide the greater part or whole of the cornea, it becomes a serious defect.

Treatment is essentially unsatisfactory, because, although it is quite easy to pull the lid up by one of the many operations devised for this purpose, no method yet has been able to reproduce in even a moderately satisfactory manner the action of the levator palpebræ, which elevates the lid not so much by directly lifting it, as by rolling it backwards, producing in its action a well-marked horizontal crease known as the oculo-palpebral fold. The absence of this fold is a very conspicuous feature of congenital ptosis, and if it is not reproduced, the effect of operation is only to lessen, and not to annul, the deformity. On this account it is wise not to interfere with these cases unless the deformity is so great that the child is unable to see without backward tilting of the head.

Of the various operations described, I think those of Panas and Hess are perhaps the most efficient.

Associated with the ptosis, it is not uncommon to find a paresis of the superior rectus, the nerve supply of the levator and superior rectus being derived from a common nerve trunk.

The next most common variety is paresis of the external rectus, usually on one side only. This paresis may escape notice for many years. One would expect such paralysis to be associated with a high convergent squint, owing to the unrestricted pull of the opposing internal rectus. The resulting squint is, however, usually absent or of small degree, owing to the internal rectus not having experienced the opposition of a healthy outward pull. It thus never develops a corresponding inward pull, so that the mid-position of the eye is but slightly, if at all, affected. The child, also, quickly learns that a conjugate movement of the eyes towards the affected side causes diplopia, so that he instinctively neutralizes the trouble by turning the head instead of the eyes.

Isolated paresis of other external ocular muscles may occur, such as the inferior rectus and superior oblique, but they are very uncommon.

The *treatment* of these pareses consists in leaving them alone; no operation should on any account be attempted. It is obviously useless to divide an internal rectus to relieve convergence due to paralysis of the opposing muscle, as there is nothing to draw the eye back to the proper position; and, equally, an advancement of the paralysed muscle, when no active contractile fibres exist to move the eye after the operation, can have but a disappointing result.

Congenital paresis of the sphincter iridis on one side is not very rare. It has no pathological significance and simply produces the defect of one pupil appearing rather larger than the other. It is always partial, so that the dilatation of the pupil is much less than that seen in cases of internal ophthalmoplegia of later life. Sometimes, too, there is a congenital inhibition of the dilating fibres of the iris, so that what appears to be a normal pupil will not respond to a mydriatic. This defect is generally associated with other mal-developments, particularly with congenital cataracts. Nothing can be done to remedy these defects.

2. **Acquired Ocular Pareses** may arise from traumatism, pressure, inflammation, or wasting affecting the ocular nerves at their nuclei or at any part of their course, either intracranial or orbital. The possible causes are therefore very numerous. The most frequent intracranial causes are pressure from extravasation of blood or pus, direct pressure from growths and affections incidental to the progress of diffuse nerve disease, especially tabes. In the orbit, traumatism and direct pressure from tumours or extravasations of blood or pus are the most frequent agents.

The most prominent and earliest symptom arising from the paresis of one of the recti or oblique muscles is diplopia. The co-ordination

of the two eyes for the maintenance of single binocular vision is so exact that diplopia may intrude itself forcibly on the patient before any deviation of the axis of the affected eye becomes visible to the patient or surgeon. As the paresis becomes more pronounced, the affected eye assumes a false position, owing to over-action on the part of the healthy opponent muscle, and at the same time an examination will show limitation of movement in the direction of the paralysed muscle. Thus, when a muscle or group of muscles are much affected, a train of symptoms presents itself which makes recognition of the trouble quite easy.

One or two points will help the practitioner in cases where the paresis is slight and the diagnosis consequently more difficult. (a) The false image, or that formed by the affected eye, is always rather fainter than the true image formed in the healthy eye, and it is generally somewhat tilted owing to a slight rotatory deviation of the eye, in addition to its vertical or lateral deviation. (b) The false image lies either on the same side as (*homonymous diplopia*) or on the opposite side to (*crossed diplopia*) the true image. It is always projected to the opposite side of the deviation, and is therefore always "homonymous" in the case of paresis of outward-moving muscles—viz. the external rectus and the two oblique muscles, and always "crossed" when the affection involves inward-moving muscles—viz. the internal rectus and the superior and inferior recti.

When the paresis is very slight, or, on the other hand, when it involves more than one muscle, or when both eyes are affected, the exact recognition of the muscles involved may become very difficult indeed.

Paralysis of Convergence is an interesting variety of ocular paresis. It has generally a syphilitic origin and is then not uncommonly associated with paralysis of the ciliary muscle (**paralysis of accommodation**). The latter may also occur as an isolated affection, and is especially common as a post-diphtheritic lesion. In this case the sphincter of the pupil is generally not involved, so that there is no dilatation of the pupil which generally accompanies paralysis of accommodation due to other causes.

The *treatment* of ocular paresis depends entirely upon our ability successfully to combat the cause. Direct treatment of the affected muscles is not to be advised for the reasons stated in discussing congenital pareses.

The diplopia, which is the most distressing symptom to the patient, is usually best relieved by wearing a shade over the affected eye, which also has the advantage of concealing the deformity. In a few cases of very slight degree prisms may be of service, but as a rule they are quite useless. The most hopeful class of cases,

apart from pareses due to extravasations and tumours which are amenable to direct surgical interferences, are those due to peripheral syphilitic lesions.

Strabismus (Squint)

Strabismus is an affection of the muscles concerned in controlling the movements of the globe, whereby the parallelism of the optic axes is lost, and binocular vision rendered impossible. The disease may be classified according to its etiology into two main varieties: (1) organic squint, due to organic affections of the ocular nerves or muscles; (2) non-organic or comitant squint, which is functional in origin.

1. **Organic Strabismus** has been sufficiently discussed under the heading of "Ocular Pareses."

2. **Functional or Comitant Strabismus** is an extremely common affection of childhood, and comprises the vast majority of all cases of strabismus. It shows itself as a periodic or constant deviation of one eye (never both eyes at the same time), either limited entirely to one eye (*monolateral squint*) or appearing sometimes in one and sometimes in the other (*alternating squint*). The deviation generally takes the form of convergence or divergence of the affected eye, not always strictly lateral in character, but sometimes oblique in direction. Purely vertical squints are very rare.

It is therefore plain that several sub-varieties of comitant squint can be arranged, and indeed such divisions are necessary in order thoroughly to appreciate the treatment of this complicated disease. There is, however, no scope in this article for more than the broad facts which everybody should know, and my remarks must be limited thereto.

The causation is complicated and very important, as it bears largely on treatment. In the first place, the co-ordination of the two eyes for single binocular vision at all ranges is probably the most highly complex reflex in the body, because of the enormous number of minute variations that are imposed by constantly changing degrees of convergence. Every child has unconsciously to learn this co-ordination and, given a primary excuse for not doing so, often learns it wrongly. When this happens, the inevitable consequence—supposing each eye to have sight—is diplopia; but the infant brain rebels against such a result, and disposes of the difficulty by turning one eye—always the more defective one—to one or other side, *i. e.* causes it to squint. The rays of light passing from an object and focused correctly on the macula of the one eye will then fall to one side of the macula in the squinting eye, and the image thus formed, being much less prominent than the other, is without any

apparent difficulty suppressed altogether. Such suppression is difficult except in the young brain, and for this reason comitant squint rarely arises after puberty, except when associated with blindness or high myopia in the squinting eye.

Thus the fundamental origin of a very large proportion of cases is the wrong learning of binocular co-ordination in infancy or early childhood. This is naturally fostered by any mechanical obstacle in one eye, such as corneal nebula, and cases of this sort often commence squinting very shortly after birth. A condition similar to a mechanical impediment is furnished by a high refractive defect in one eye, or a congenital dullness of sight (*amblyopia*) or by anything that causes great apparent difference in the visual acuity of the two eyes. In all these cases the baby is very apt to find out that there is little to be gained by binocular vision, and then the impulse to desist from attempting it, or to get rid of it, whichever it may be, soon dominates the situation. The age incidence of this class of case is therefore before the completion of the second year.

There exists, however, a second class of cases, almost as numerous, where the co-ordination has been learnt correctly in the first instance, but as the child begins to advance into the age of picture-books and to imbibe a taste for amusement with toys, etc., at close range, the effort of maintaining co-ordination becomes an increasing one, and the child may then seek an excuse for disposing of it.

The effort is often very largely of the child's manufacture; for children will, if left to themselves, always approximate their head and eyes to an object much more than is necessary in order to get as large a mental image as they can. The greater the convergence, the greater the difficulty in maintaining binocular vision; so, if there exists any reason which makes binocular vision more difficult and less advantageous, the child will soon learn to squint. This class, therefore, embraces squints which make their appearance between three and six years, and includes a considerable proportion of cases where the vision of both eyes is good, and sometimes extremely good, with very little inequality in the acuity of both eyes and very little refractive error in either. In these latter cases the impulse to squint is induced by over-convergence or debility and the squint is usually of the alternating variety above mentioned.

A third and more restricted class of squint, coming on much later, in neurotic or weakly children is due to disturbance of the cerebral co-ordinating centre set up by sudden shocks or prolonged illness, or due to over-fatigue or excitement. In these cases there is generally some excuse, in that the squinting eye is less efficient

than the other, and probably in these cases the maintenance of co-ordination, rightly learnt and rightly maintained under ordinary circumstances, is only supported with an effort which is sometimes beyond the power of the child. Such squints, usually very amenable to treatment, are not likely to occur after the advent of puberty, because the power of voluntarily suppressing an image decreases with age, and has nearly always disappeared by the time puberty is reached.

There remains a fourth class, which in this article is best mentioned here, and to which the term *latent squint* or *heterophoria* has been given. This is not a real squint, in that a deviation of an eye is not apparent, but a deviation can be very easily produced by annulling the desire for binocular vision. In these cases, if a screen is put over one eye, the other eye immediately deviates in some direction, as the case may be, showing that the maintenance of binocular vision is carried on with some difficulty. The impulse to squint is there, but it is over-ridden by the desire to co-ordinate correctly. As a result, there is, as it were, a sort of struggle going on unconsciously, which very often sets up a train of subjective symptoms, causing inability to read or work long without discomfort. These cases are, in fact, the converse of those included in the other classes, where the impulse to squint has proved more powerful than the impulse to co-ordinate correctly. These cases are very common—quite as common as real squints, but they do not give rise to the anxiety and trouble appertaining to apparent squints, as there is no deformity to cure. On the other hand, apparent squints, from their very nature, do not of themselves cause subjective feelings of pain or aching.

The *treatment* of squint is a very large subject and requires a great deal of experience. As in other diseases, a great deal may be done in the way of preventive treatment, which, though more attended to now-a-days, is still very generally neglected. One of the most common causes for trouble is the presentation to the infant of comforters, rattles, balls, etc., at all of which it gazes whilst it sucks them, meanwhile teaching itself to squint.

If parents and more especially if nurses would only understand that babies do not want toys until they are old enough to sit up and play with them, much worry and anxiety would be spared, and the first class of squints would be much smaller than now. Then, when the child is older, toys, etc., should only be given when it can be watched and taught to adopt correct attitudes. On this account, toys and picture-books should not be allowed in bed to keep the child quiet in the morning. Especial attention is needed when the child begins to

look closely at letters, or starts lessons even of the most elementary kind. Lessons are often much too long, lesson-books often much too small, and the child's head generally much too close to the work. Lessons given on flat tables, the child seated in a chair made for an adult, is a common sight, with the result that over-convergence cannot be avoided. Of course, the light on the work is important, and children should not be allowed to read by firelight, curled up in arm-chairs, lying prone on heart-rugs, etc. It is perhaps as well to mention that children, with their extraordinary power of mimicry, may sometimes copy a squint, and for this reason no nurse who squints is fit for her business, whilst it may explain the frequency with which the children of squinting mothers reproduce the maternal defect. So much for preventive treatment.

For curative purposes we should, in almost all cases rely on orthoptic or rational methods until puberty has passed. In other words, operative measures are, in the majority of cases strongly to be condemned. The exceptions are squints of *high* degree in which the deformity is very great and which, for one of the reasons mentioned above, are quite hopeless to treat by any other method. The great objection to operative measures in childhood is that a general anæsthetic is necessary, which entirely masks the squint for the time being and renders the effect of any operation upon the squinting muscle very difficult to gauge. Up to quite a few years ago, wholesale tenotomies used to be performed on young children, with most disastrous results to a very large number. A temporary amelioration or removal of the deformity is obtained, but as time passes on the eye often begins to assume a false position again, and in not a few cases the last deformity is worse than the first, and further it is then much more difficult to treat. After puberty the effects of operative measures are much easier to control.

Patience and perseverance with rational methods will not only cure an enormous percentage of squints, but in those not actually cured will generally bring about an improvement which makes the final removal of the deformity fairly straightforward later on.

The first thing to do is to correct all refractive errors accurately; that is, the correction should be done under a mydriatic, and the glasses ordered should closely correct the error. In other words, we try and make the eyes as nearly normal as possible, and annul any difference in the visual acuity of the two, so as to make the excuse for squinting as small as possible. In very young cases just commencing to squint, the mere suspension of the accommodation, and so of the convergence, by the use of a mydriatic for a week or two, may stop the whole

process. After the glasses have been given there is often a very rapid improvement in the deformity, but in a large number of cases much remains to be done. In monolateral squints, the child has to be made aware that he has two eyes and to learn how to use both together. In alternating squints, the child is aware of both eyes, but these cases are particularly difficult because they have deliberately sacrificed binocular vision, and it is very hard to induce a fresh desire for it. The easiest cases, of course, are those in which the squint is only periodic, and the mere correction with glasses will often effect a cure. Glasses have to be supplemented in most cases, therefore, by steady treatment with discs and shades, stereoscopes or their modifications, and various other methods, which must necessarily be left to the guidance of an expert, for it is by experience and attention to minutiae that success is won in bad cases.

We should, of course, aim at not only curing the deformity, but also, where such a hope is permissible, at bringing about good stereoscopic vision. It is not often, however, that we can get this absolutely perfect result, and speaking generally from a practical point of view, neither patient nor parents understand what is implied by binocular vision, and will appreciate the surgeon's ability precisely by the result on the deformity, and by that only.

With regard to operations, it is advisable to use local anæsthesia exclusively, as only then can the surgeon tell exactly what effect he is securing.

The operative measures to be employed consist in tenotomy of the muscle producing the deviation or in advancing the tendon of the opposing muscle, or in combining both measures. It is impossible to go into details, but, speaking generally, it may be said that, whereas tenotomy is the easier and slighter operation and disables the patient for a much shorter time, it has the disadvantage that it is impossible to gauge within certain limits what will be the exact result on the deformity, and consequently advancement of the opponent muscle is often preferable. Tenotomy of the internal rectus will generally relieve a deformity not greater than fifteen degrees deviation, whereas the tenotomy of the external rectus will only control a deviation of half that amount. Advancement in skilled hands is easily controlled and can always be aided by a tenotomy of the opponent muscle if desired.

The treatment of latent squints (heterophorias) consists in correcting any refractive errors, often assisted by the use of prisms. For the complex details, the reader is referred to technical works on ophthalmology.

A. L.

DISEASES OF THE LACHRYMAL APPARATUS

Lachrymal Obstruction.—It cannot be too strongly insisted upon that the obstruction in the vast majority of cases is not an organic stenosis of the duct or the canaliculi, but is due to swelling of the mucous membrane from inflammation or venous congestion. In some cases there is obstruction to the orifice of the duct in the nose. This may be caused by deformity of the inferior turbinal bone or hypertrophic rhinitis. The turgid condition of the mucous membrane is caused either by extension upwards of inflammatory and septic conditions in the nose, or by the chronic irritation caused by a dacryocystitis, which is increased by the stagnation in the sac, and thus a vicious circle is formed. The inflammation of the sac is usually due to a pneumococcal infection, but staphylococci are also frequently present. The presence of these pneumococci makes dacryocystitis an extremely dangerous disease, for a slight abrasion of the cornea which would normally heal in a few hours may become infected, and a formidable hypopyon ulcer may appear. The infection of the sac causes chronic conjunctivitis, which is the chief cause of the epiphora or lachrymation so troublesome in the disease; mere obstruction of the lachrymal passages does not cause epiphora. The discharge from the sac, at first mucoid, may become muco-purulent and finally purulent. The tissues round the sac often become infected, there is a pericystitis, and an acute phlegmon may form. This, if untreated, generally softens, and an abscess forms, which bursts externally, leaving in some cases a permanent lachrymal fistula. The lachrymal duct is formed by the canalization of a solid rod of embryonic tissue. This process may be incompletely performed, and there results the dacryocystitis of infants. This not uncommon disease is generally easily cured. It is usually sufficient to squeeze the pus out of the sac several times a day and order boracic lotion, or, if necessary, the sac may be syringed out under an anæsthetic, as described below. If this treatment fail the canaliculus must be dilated with Lang's dilator and a fine Bowman's probe passed carefully into the nose to clear out the embryonic detritus which blocks the duct. This, in our opinion, is the sole and only condition which necessitates the use of a probe in lachrymal disease.

The treatment of dacryocystitis in adults calls for great patience both on the side of the surgeon and patient. The nose must be examined in all cases, and abnormalities rectified. The sac must be syringed out *daily* with normal saline. Luer's lachrymal syringe and Harrison Butler's cannula should be used. This cannula

is so fine that it will enter most canaliculi. If not, the canaliculus must be dilated with Lang's dilator. If this syringing be persisted in for some weeks, eventually fluid will pass into the nose, and then cure is within sight. If there be a purulent discharge a *few drops* of five per cent. protargol may be left in the sac. Great care must be used; the protargol not being forced in. If the sac burst and protargol enter the tissues an indelible black stain of the skin will follow. In passing the cannula remember that the canaliculus passes directly downwards for about 1.5 millimetres and then inwards. As soon as the cannula has entered the punctum the lid must be drawn tightly outwards to straighten the canaliculus and avoid the creation of a false passage. The cannula must not be pushed in, but must slip in naturally. Should this treatment fail one of two courses may be adopted. In simple epiphora with no discharge, and if no pneumococci are present, it is best to leave matters as they are, only syringing the sac out once a month to keep it clean. If there be a discharge it is necessary to excise the sac. This operation is almost painless and bloodless if performed under codrenine anæsthesia. The results are excellent. There is no scar, and epiphora is only noticed in a wind or when the eye is inflamed. The general practitioner may perform the operation if he will carefully familiarize himself with the details. They are to be found in the *Ophthalmoscope* for September 1911, and in Meller's *Ophthalmic Surgery*.

Some ophthalmic surgeons still cling affectionately to the old treatment with probes and styles. According to Römer only five per cent. of the cases are cured by this horribly painful treatment. And even in the so-called "cured" cases a septic funnel-shaped canal is left, which is a permanent menace to the eye. Whatever view may be taken by the expert, it is certain that *it is most unwise for a general practitioner to pass a lachrymal probe*.

A lachrymal phlegmon should be freely incised by a vertical incision down to the bone and packed with gauze. Subsequently, when all is quiet, the sac must be dissected out. Under these conditions the operation is one of extreme difficulty and requires great experience.

Eversion of the lids causes epiphora, for the puncta are removed from the globe. The blepharitis which causes the ectropion must be treated. Operation may be called for. The puncta lachrymalia may be stenosed. This condition is cured by the use of a fine knife followed up by the dilator. Such cases are best left to the expert.

Dacryoadenitis is a rare condition. It may be a complication of mumps, but is generally a suppurative adenitis calling for incision and

drainage. The incision is made through the conjunctiva.

Dacryops is another rare disease, caused by obstruction of one of the ducts of the gland, a condition which is comparable to ranula.

T. H. B.

DISEASES OF THE ORBIT

These are generally of a very serious nature, and therefore of great importance. The most valuable sign of orbital disease is an alteration in the position of the eye. Any condition which increases the volume of the orbital contents will displace the eye forwards—*exophthalmos*. Similarly a diminution in the volume of the orbital contents relatively to the size of the orbit will be followed by a sinking of the eye—*enophthalmos*.

The chief causes of *exophthalmos* are—

1. Inflammation in the orbit.
2. Vascular changes in the orbit.
3. Tumours in the orbit.
4. Traumatism and operations.

Orbital Inflammation.—This may be connected with the bony walls, within the capsule of Tenon, or in the loose orbital tissues. Generally an *orbital phlegmon* is formed, which rapidly develops into an *orbital abscess*.

Primary osteitis is rare, *periostitis* is much more common, and is generally tubercular in nature. Sequestra are formed and should be removed as early as possible.

Orbital Phlegmon.—The researches of Onodi have shown that the relationships between the orbit and the walls of the posterior ethmoid cells and the sphenoidal sinus are very irregular. The partition of bone may be exceedingly thin or even absent in places. This being the case, it is obvious that empyemata of the nasal sinuses may be complicated by extension of the infection into the orbit. The statistics of orbital phlegmon show that at least sixty per cent. of all cases are secondary to empyemata in the nasal accessory sinuses. It is therefore essential in all cases of orbital inflammation to make a thorough examination of the nose. Mere inspection is insufficient. The nose must be anesthetized with cocaine and adrenalin, and most systematically examined, preferably by a surgeon with considerable rhinological experience.

Other causes of orbital phlegmon are local caries and periostitis, the presence of foreign bodies, and extension of infection from the lachrymal sac and from other neighbouring foci of inflammation. The symptoms of orbital phlegmon are pain, malaise, rise of temperature, *exophthalmos*, chemosis and swelling of the lids. There is generally oedema round the lids. The retinal veins may be engorged, the disc

hyperæmic, and in late stages pale. If the abscess be left undrained it generally bursts spontaneously, but by this time there will be complete loss of sight and the cavernous sinus may have become infected. The abscess must be opened *at once* by an incision along the orbital margin through the upper or lower lid, according to where the pus is judged to be, and drained by Hilton's method. In many cases complete optic atrophy and loss of sight follow.

Thrombosis of the Orbital Veins.—The symptoms are similar to those of phlegmon. It is generally caused by extension forwards of a thrombotic process in the cavernous sinus, or from infection from carious teeth, septic tonsils, boils, or facial erysipelas. The prognosis is bad.

Vascular Changes in the Orbit.—Circoid aneurysms, arterio-venous aneurysms in the cavernous sinus, and varicosity of the orbital veins all cause *exophthalmos*. The first two cause *pulsating exophthalmos*. They have been treated, in some cases successfully, by ligature of the common carotid.

Tumours of the Orbit.—These are benign or malignant. Sarcomata are very common, generally springing from the periosteum of the orbital bones. Radical extirpation after removal of the eye is indicated. The lid margins can be cut away and the lids sewn together over the empty orbit. Other tumours grow from the optic nerve and its sheath. Some of these are benign, and can be removed by Krönlein's operation without enucleating the eye.

The benign tumours are dermoid cysts, hydatid cysts, encephalocoeles, mucocoeles from one of the nasal sinuses, cavernous angiomas, lymphomata and neuromata. Osteomata may project into the orbit from the nasal sinuses, especially the frontal.

Chloroma.—This is a peculiar and rare disease. A green-coloured sarcoma develops in the outer wall of the orbit and under the temporal fascia. It spreads all over the body and is associated with lymphatic leucocythæmia. Under forty cases have been recorded, and only a few have been diagnosed before death.

The *diagnosis of orbital tumours* is by no means easy in some cases. The eye is pushed directly outwards in tumours within the pyramid formed by the four recti muscles. Those which spring from the walls push the eye out obliquely. The *exophthalmos* may be so great that the eye is almost dislocated. Tumours arising within the optic nerve cause rapid alterations in vision, but when they grow outside the nerve good vision may be retained for a considerable time. Great *exophthalmos*, associated with engorgement of the conjunctival vessels and of the veins of the lids, but without obvious signs of inflammation, suggest tumour. In many cases the tumour can be felt by pressing the

fingers into the space between the eye and the orbit.

No changes may be visible in the fundus, but there may be venous congestion, hæmorrhages and optic neuritis. In a later case optic atrophy may be seen.

Injuries to the Orbit.—Fractures of the bones of the orbit are not uncommon, the thin lamina papyracea of the lachrymal bone being most frequently broken. This fracture is liable to be followed by surgical emphysema of the lids and conjunctiva. In these cases the patient must be warned not to blow his nose. Fractures of the orbital bones are often followed by sudden and complete blindness caused by injury to the optic nerve. In a few weeks the complete ophthalmoscopic picture of grey atrophy of the optic nerve is present.

Foreign Bodies frequently enter the orbit, and may remain there for long periods of time without causing serious symptoms. Large pieces of wood, knife blades, and other articles

have been removed from the orbit. More usually they give rise to orbital abscesses, to optic atrophy, or to strabismus. Needless to say, such bodies should be removed as soon as possible.

Enophthalmos is one of the symptoms of *Horner's syndrome*. Paralysis of the sympathetic produces enophthalmos, slight ptosis, contraction of the pupil, unilateral sweating and unilateral pallor of the face. When the sympathetic is paralysed cocaine does not dilate the pupil (Jessop). The enophthalmos is not caused by paralysis of the unstriated muscle fibres (Müllers) which span the sphenopalatine fissure. These in man are too rudimentary to have any such action. It has been shown that electric stimulation of the superior cervical ganglion in man does not cause protrusion of the eyeball.

Enophthalmos often follows fracture of the orbital bones. The exact mechanism by which it is produced is not quite clear. T. H. B.

II.—DISEASES OF THE EAR

DISEASES OF THE EXTERNAL EAR

Anatomy. The external auditory meatus measures just over one inch in length, the inner two-thirds being bony, the outer third being a fibro-cartilaginous continuation of the auricular cartilage. In the infant there is no bony meatus, this developing after birth by growth from the tympanic ring.

The meatus is lined by skin, which over the osseous portion becomes thinner and ultimately continuous with the periosteum. Modified sweat glands, which secrete the ear wax, are practically confined to the cartilaginous portion.

Injury of Auditory Canal.—Direct injury is practically confined to that produced by insertion of foreign bodies, when the walls may be injured or the drum perforated. Indirect injury may occur through fracture of adjacent bones, as in fracture of the glenoid fossa or of the middle fossa of the skull, when the upper meatal wall may be fractured.

The *symptoms* are hæmorrhage, or possibly escape of cerebro-spinal fluid.

Treatment is mainly directed to prevention of sepsis.

Abnormalities of Cerumen. Excess.—The cerumen is normally composed of fatty and colouring matter of a honey-like consistency; when excessive it varies from a soft semi-fluid mass to a hard black or grey plug of wax, débris and hair, occasionally even containing a piece of wool or foreign body. The accumulation may be due to hypersecretion or to a narrow or unusually deep meatus, or to some obstruction, such as an exostosis.

Symptoms. Deafness is the main symptom, of gradual onset or sudden if the mass swells through entrance of water in bathing. Other symptoms may arise through pressure of the mass upon the meatal walls or drum, such as tinnitus, giddiness, reflex cough or even epileptoid seizures.

Diagnosis. A plug of wax may be confused with dried blood, a pledget of wool, foreign body or cholesteatoma, whilst it is well to bear in mind that even in the presence of wax deafness may be due to some other cause.

Treatment. If the mass is hard and dry it must be softened before syringing can be carried out effectively. For this purpose peroxide of hydrogen may be used or bicarbonate of soda 30 gr., glycerine 1 dr., to an ounce of water, the drops being instilled two or three times a day for a day or two. Care is needed in the simple operation of syringing, which is best performed

with a Higginson's syringe with suitable nozzle attached. The metal ones in common use are less easy to manipulate and apt to get out of order. Bicarbonate of soda solution, one or two drachms to the pint, is the most efficacious lotion and should be just warm. The auricle is pulled upwards and backwards and the stream directed under observation, with a fair degree of force, once the patient is accustomed to the sensation. Giddiness and even faintness are not uncommon and the deafness may at first be made worse. Care should be taken to abate the force of the stream once the plug has been loosened, as the impact against the drum is alarming and painful to the patient. If the mass resists repeated syringing it may be necessary to break it up with an aural probe. If deafness persists after removal gentle Politization may be necessary.

Deficiency.—The auditory meatus is pale and dry and itching is common. Cases of otosclerosis and middle-ear catarrh often manifest this symptom.

Treatment is to allay irritation. Nitrate of mercury ointment 1 dr., vaseline to 1 oz., or menthol 10 gr., paroleine and almond oil aa $\frac{1}{2}$ oz., are useful applications.

Foreign Bodies.—These fall roughly into three categories, those introduced in play by children into their own or companions' ears—by far the commonest; those purposely inserted by adults and forgotten, such as plugs of wool; insects, such as flies, maggots, earwigs, etc. Careful inspection is always necessary, even if a circumstantial history is given; the foreign body may have been present, but have come out again, or, on the other hand, it may have passed into the tympanic cavity, or be imbedded in, or indistinguishable from, a mass of wax.

Symptoms. There may be none, or the body may set up acute inflammation with purulent discharge. If of sufficient size to block the meatus, deafness results; or if the membrane be pressed upon, tinnitus, coughing, vomiting, or even convulsions may ensue. Serious consequences are less likely to result from foreign bodies than from unskilful attempts at their removal.

Treatment. In the great majority of cases the removal of foreign bodies can be accomplished by syringing, which should be tried first in practically every instance. (Syringing may be inadvisable if there are signs of pus pent up behind the foreign body.) Careful inspection will probably reveal a gap between the foreign body and the meatal wall, and the stream of

water should be directed towards this. If syringing is unsuccessful, attempts at removal should be made with a hooked probe passed behind the body, or sometimes a snare can be made to encircle it. If forceps are used great care is necessary to avoid pushing the substance farther in. If repeated attempts fail, or if there is evidence of retained pus in the middle ear, the auricle must be turned forwards by a post-aural incision, part of the posterior meatal wall being removed if necessary.

Furunculosis.—Furuncles in the ear are directly due to staphylococcic infection of hair follicles or glands. They may result from an infected scratch, from suppurative otitis media, or, as in boils elsewhere, from lowered resistance due to constitutional disorder; the urine should be examined as a routine measure. They are commonly multiple.

Symptoms. The chief symptom is pain, which may be intense. It radiates over the side of the head, is made worse by movement of the jaws and auricle and by pressure on the tragus. The pre-auricular gland is often enlarged and tender. If the boil is on the posterior meatal wall there may be œdema over the mastoid, with displacement forwards of the ear. There may be partial deafness.

Examination reveals one or more tender swellings, or the whole of the meatus may be occluded by swelling. Within two or three days the furuncles burst, with great relief of the pain. Successive crops of boils often make their appearance.

Diagnosis. The mistakes likely to occur are that a small commencing furuncle is overlooked or that considerable post-auricular œdema arouses suspicion of mastoid suppuration. In the latter case the displacement of the ear is downwards as well as forwards.

Treatment. In the early stage alleviation of pain is attained by instillation of sedative drops containing one or more of the following ingredients in glycerine or vaseline:—carbolic acid ten per cent., morphia five per cent., menthol three per cent., as hot as can be borne. Dry heat in the form of sand or salt bags is preferable to moist. If the pain does not subside, incision (under gas) is advisable. As a rule the pain is too great for a general anæsthetic to be dispensed with and local anæsthesia has little effect.

It is wise to give antistaphylococcic vaccine injections as a preventive of recurrence. After rupture or incision it is well to order an antiseptic instillation, *e.g.* ung. hyd. nitrat. 3 i, ol. amygdal ad 5 i. Constitutional treatment should not be neglected.

Diffuse Inflammation of the External Auditory Meatus.—This may arise as an extension of inflammation from the skin, as in eczema or

erysipelas, or may accompany furunculosis. It sometimes results from trauma, as in attempts to remove foreign bodies, or from punctured wounds, as in cleaning the ear. It may be diphtheritic or parasitic in origin, occasionally syphilitic.

Symptoms. There is pain, usually less acute than in furunculosis, aggravated by pressure or traction on the auricle and by mastication; the amount of deafness is proportional to the swelling, unless the middle ear is simultaneously involved. In the eczematous form there is itching.

Signs. There is hyperæmia and swelling, followed by desquamation and discharge, serous at first, later purulent. If the meatus is cleansed the meatal and tympanic surfaces are seen to be red, swollen and raw, with possibly granulations. The inflammation may involve the periosteum and perichondrium.

Treatment. This is much the same as in the early stages of furunculosis, sedative drops and dry heat, with possibly gentle syringing with hot boracic lotion. Later, antiseptic treatment with hydrogen peroxide, lysol one per cent., biniodide of mercury 1 in 2000; astringent applications, such as equal parts of spirit and water, painting with silver nitrate solution ten per cent., or, if there be not much secretion, desiccative powders, *e.g.* boracic acid, dermatol, etc. The oily solution of nitrate of mercury ointment (one drachm to the ounce) is also useful.

If treatment be neglected the disease may be of long duration, the inflammation may spread to the middle ear, or stenosis result from ulceration.

Eczema of the External Auditory Meatus.—No hard-and-fast line can be drawn between this and the foregoing. If the inflammation be definitely eczematous the treatment in acute cases should be sedative rather than irritative; the mercurial oil, calamine or lead lotion, calomel and boracic powder (one drachm to the ounce) are suitable, whilst in the more chronic stage nitrate of silver (ten per cent.), tar (two to five per cent.), or more, salicylic acid (one to two per cent.), sulphur and resorcin (two per cent. of each) may be used.

Necrosis of the External Auditory Meatus.—This commonly occurs as a sequela of middle-ear and mastoid-antrum suppuration, occasionally as the result of primary inflammation of the meatus. There is discharge, often sanious, granulations occur and recur after removal, and a sequestrum may be felt.

Treatment. The ear should be kept clean until the sequestrum is loose, when it can be removed.

Otomycosis is due to the growth of moulds, chiefly the *aspergillus niger* and *flavus*. There

may be no symptom except irritation, or diffuse inflammation may arise. The meatus contains epithelial debris, with black or yellow spots. The fungus can be destroyed with an alcoholic solution of biniodide of mercury (1 in 1000), followed by boracic insufflation.

Stenosis of the Meatus—

1. **Congenital Atresia.**—The meatus may be completely absent, represented only by an indentation, or exist as a blind cul-de-sac. The auricle may be malformed or normal. Other deformities of mouth, palate or face may coexist. The middle ear participates in the maldevelopment, so that treatment in such cases is not called for.

2. **Acquired Atresia** may result from ulceration, diffuse inflammation, operation, caries and necrosis. In slight cases where adhesions or septa form, these may be divided and a cannula worn until healing is complete. In cases of fibrous stricture operation by turning forward the ear and incising the posterior wall of the cartilaginous meatus will be necessary. Where possible, operation is better avoided.

Stricture of the Meatus.—The causes of atresia may give rise to stricture, which may also be due to exostoses and hyperostoses. The symptoms are deafness due to impacted cerumen, or retention of pus if otitis media is present.

Treatment. Radical treatment is only likely to be necessary if there is suppurative otitis media with insufficient drainage, in which case the complete mastoid operation is indicated.

Exostoses and Hyperostoses.—These occur in three forms:—(1) General thickening of the bony meatus—hyperostosis, (2) multiple, sessile ivory exostoses, (3) single, pedunculated exostoses.

Causation is uncertain; hyperostosis appears sometimes to be due to chronic otorrhoea; exostosis to have some relation, on the one hand, to gout and rheumatism, on the other to frequent entry of water into the meatus, as in divers and seamen.

Symptoms. Per se they produce none, such as arise are due to stenosis of the meatus leading to impaction of cerumen and epithelial debris, or impaired drainage in suppurative otitis media.

Treatment will only be required in cases of retention of pus, if the exostoses produce pain by pressure, or if blocking appears likely to occur in the future on both sides.

New Growths of the External Auditory Meatus—

Papilloma should be thoroughly removed, as it may be the forerunner of epithelioma.

Epithelioma may begin as an apparently simple abrasion; recurrent granulations in elderly patients should arouse suspicions. There is fetid discharge, with persistent and intense pain. The disease spreads to the middle ear,

producing facial paralysis, to the mastoid and bones in the neighbourhood.

Free removal is the only *treatment*, but as early diagnosis is difficult, this will very likely only be palliative.

Rodent Ulcer occurs and will be amenable to X-ray or radium therapy.

Sarcoma is uncommon; its treatment is that of sarcoma elsewhere.

Syphilis may occur as condylomata, leading to inflammation and ulceration. If neglected it may be a cause of stricture.

Treatment should be local as well as general. Condylomata may be touched with chromic acid and calomel insufflated. E. P.

DISEASES OF THE TYMPANIC MEMBRANE

It is still a disputed fact whether a primary pathological condition of the tympanic membrane can occur, most authorities asserting that it is always secondary to some affection of the external or middle ear; and there is no doubt that in most cases what at first sight appears to be a primary inflammation of the tympanic membrane will be found, on careful examination, to be really secondary to some external or middle-ear affection. Nevertheless, from a clinical point of view, certain conditions may be described under the heading of "Diseases of the Tympanic Membrane."

Myringitis (inflammation of the tympanic membrane), as a primary affection, can occur in its *acute* form from a sudden cold in the ear, from excessive heat, such as scalding, from a chemical irritant, or from direct injury to the drum, such as from a scratch with a hairpin, or from a fracture through the middle fossa of the skull. The onset is usually sudden, being accompanied by acute earache, frequently paroxysmal or neuralgic in character. In contradistinction to acute inflammation of the middle ear, the hearing power remains good. Examination may show merely a local congestion of the affected part, but usually the whole drum surface is involved, and there may be serous or hæmorrhagic blebs and bullæ from exudation between the outer and middle layers. Even in very acute cases, the pain, though intense, lasts only for a few hours and suddenly ceases on rupture of the bullæ which is accompanied by a slight sanious discharge from the meatus. In less acute cases there may be absorption of the exudation without bursting of the bullæ. In other cases an interlamellar abscess may occur; this, however, is extremely rare. In influenza, hæmorrhagic blebs may be observed on the surface of the membrane, usually also involving the adjoining wall of the auditory canal. This cannot be described as a true primary myringitis, but I have more

than once, in such cases, observed these hæmorrhagic bullæ limited to the drum itself, with all the symptoms pointing to a primary myringitis.

The *diagnosis* is of importance from the point of view of the prognosis and treatment. Chief reliance should be placed on what is found on inspection, and on the acuteness of the hearing power. Inflation of the ear, which would determine whether there is any fluid in the tympanic cavity, is not permissible. If the acute inflammation be limited to the membrane, the symptoms rapidly subside; if coexistent with acute middle-ear inflammation, their duration may be a matter of weeks rather than days.

The *treatment* depends on the condition found. In a case of acute middle-ear inflammation, paracentesis of the tympanic membrane will almost certainly be indicated, but in acute myringitis this is contra-indicated, as the middle ear might thereby be also infected. In the early stage it is sufficient to instil some drops of a ten per cent. solution of carbolic acid in glycerine, and to protect the ear with compresses of wool. If the pain and bullæ increase, they should be incised with a paracentesis knife, care being taken not to pierce the tympanic membrane. The ear may then be gently syringed, dried, and a small quantity of borochloretone powder insufflated, a strip of gauze being inserted as a drain. The dressing should be changed daily until the discharge ceases.

Chronic Inflammation of the Tympanic Membrane is usually secondary to some inflammatory affection of the external meatus which may have already subsided. The chief symptoms are itching within the ear, with occasional fetid discharge. The surface of the drum usually appears irregular, thickened, and of a greyish colour; or crusts and inspissated pus partly obscure it; or it may be covered to a greater or lesser extent with purulent granulations.

The *diagnosis* is made on inspection, by the use of a Siegle's pneumatic speculum, and by inflation of the ear, in order to determine whether there is any perforation or not. If the middle ear is not affected there will be no perforation, and also the impairment to hearing, if present, will be slight.

The *treatment* consists in getting the ear aseptic. An ear bath of hydrogen peroxide, ten volumes, should be given, the ear then syringed out with a one per cent. solution of lysol, then dried carefully, and a strip of gauze soaked in an alcoholic solution of biniodide of mercury, 1 in 3000 inserted. If it is found at the beginning of treatment that it is difficult to remove the thickened and desquamating masses of epithelium, the meatus should be filled at night with carbolic oil 1 in 20, and then syringed out in the morning. After their removal any granulations on the surface of the drum should

be touched (under the local anæsthetic of cocaine) with chromic or trichloracetic acid, after which a small quantity of boracic acid or borochloretone should be insufflated, and a strip of gauze inserted into the meatus. The latter should be changed daily. In some cases simple syringing out of the ear, and the insertion of a strip of gauze soaked in the biniodide of mercury solution is sufficient to bring about a rapid cure; other cases are most obstinate, and require much patience. A point to bear in mind is that unless the patient is completely cured, the trouble may recur again and again.

Herpes of the Tympanic Membrane may occur as a primary condition, usually associated with herpes of the auditory canal and auricle. The chief symptom is neuralgic pain in the ear, and on examination two or three vesicles may be seen surrounded by a zone of congestion. They quickly burst and leave behind tiny ulcers.

Tubercular Nodules are occasionally observed on the tympanic membrane, either as a primary condition or as one of the early signs of tubercular disease within the middle ear. They are sharply defined as yellow or yellowish-red points, eventually causing multiple perforations to the drum, which usually coalesce into one large perforation.

Traumatic Perforation of the Tympanic Membrane may here be conveniently considered, although it can hardly be described as a disease. The appearance of the drum depends on the manner in which the injury was inflicted. In a simple case, the result of violent concussion, either by a blow with the palm of the hand on the ear, or from an explosion, an elliptical perforation is usually seen in the inferior part of the membrane radiating towards its circumference. The edges are generally coated with blood crusts, and the membrane may be slightly congested in its immediate neighbourhood. Through the wound the promontory of the inner wall of the tympanic cavity will be seen to be normal. If due to direct violence, such as a stick being poked into the ear, or to injury caused by an unskilled attempt to extract a foreign body from the meatus, the drum may be more or less destroyed, and the perforation may be of any shape or character. In a traumatic perforation due to concussion the symptoms are those of sudden pain accompanied by a loud noise or crack in the ear, with temporary giddiness, which may be extreme. This may be followed by immediate and marked deafness, chiefly the result of the concussion. When due to direct violence the symptoms are more severe, and the accompanying deafness will then be due to the destruction of the structures within the middle and perhaps even the internal ear. The treatment in a simple traumatic perforation consists in protecting the

ear from infection from without by means of a pad and bandage. If there is any discharge it should be carefully wiped away and a small drain of gauze inserted into the meatus. If the patient is only seen a few days after the injury, middle-ear suppuration may already have taken place, then the case must then be treated on these lines.

The prognosis in a simple case is good, and in the mild forms of concussion, even if the internal ear be affected, as a rule recovery can be guaranteed. In the more severe cases, however, if there be complete deafness due to involvement of the labyrinth, it is difficult to say what improvement will take place, and the prognosis should be guarded. If middle-ear suppuration has occurred, then all the complications associated with it may follow, depending largely on the extent of the injury to the middle ear and on the virulence of the infection.

The *treatment* in those cases in which suppuration has not taken place consists in rest, avoidance of noise, and in the internal administration of strychnine. In the early stage, if giddiness and tinnitus be marked, bromides may also be given.

The *diagnosis* is of importance from the medico-legal point of view, and can only be given with certainty if the case is seen within the first few days after the injury. The points to be relied on are, the position of the perforation, its appearance, and the lack of all other signs of middle-ear inflammation or suppuration. If seen at a later stage it is difficult to determine to what extent the alleged injury to the drum has caused the symptoms. If, however, scarring of the membrane or calcareous deposits, pointing to old middle-ear suppuration, be discovered, and especially if associated with a similar condition in the other ear, too much reliance should not be paid to the statements of the patient.

H. T.

ANATOMY AND EXAMINATION OF THE MIDDLE EAR

Anatomy.—The term *Middle Ear* includes, besides the tympanic cavity, the mastoid cells and antrum and the Eustachian tube, all of these being in communication with one another and with the naso-pharynx.

The *tympanic cavity* is an irregular space lying between the internal ear and the external auditory meatus, and is traversed from without inwards by the chain of ossicles. It is prolonged upwards above the level of the upper margin of the tympanic membrane into the *recessus epitympanicus* or *attic*, which contains the head of the malleus and most of the incus.

The *roof* of the tympanic cavity, or *tegmen tympani*, is a thin plate of the petrous portion

of the temporal bone, separating it from the middle fossa of the skull. The *floor* is formed by the tympanic plate, which separates the cavity from the jugular fossa. The *outer wall* is the tympanic membrane below, the outer wall of the attic above. The *inner wall* consists principally of the promontory, an eminence produced by the first turn of the cochlea. Above the promontory lies the *canalis facialis* (Fallopian), containing the facial nerve; in front of it is the orifice of the Eustachian tube, and behind it a recess which separates the fenestra ovalis above from the fenestra rotunda below. The *posterior wall* contains the orifice leading to the mastoid cells—the *aditus*. *Anteriorly* the tympanic cavity is prolonged into the Eustachian tube.

The *Eustachian tube* is partly osseous (half an inch), partly cartilaginous (one and a half inches). The junction between the two is the narrowest portion, known as the *isthmus*. It opens on the lateral wall of the pharynx on a level with the posterior end of the inferior turbinal.

The tympanic cavity contains the *ossicles* (malleus, incus and stapes), the tensor tympani and stapedius muscles, nerves, vessels and ligaments. The outermost link in the chain of bones—the malleus—is intimately adherent to the *membrana tympani*, the innermost—the stapes—is fixed by its foot-plate to the membrane filling in the fenestra ovalis. The connecting link is the incus, the posterior ligament of which fixes it to the posterior tympanic wall close to the *aditus*. The sound vibrations taken up by the drum are thus conveyed across the middle ear to the labyrinth.

Mucous Membrane. The mucous membrane of the tympanic cavity is continuous through the Eustachian tube with that lining the pharynx, a fact of the utmost importance in the pathology of middle-ear affections. It is thin and transparent and vascular folds extend from the tympanic walls to the ossicles, which are covered by it. The *membrana tympani* and roof of the tympanic cavity are covered with non-ciliated epithelium, the rest of the cavity and the Eustachian tube with columnar ciliated epithelium.

The *mastoid antrum* lies behind the tympanic cavity, and communicates with it posteriorly and superiorly through the *aditus*. The floor of the antrum lies below this opening, so that drainage in purulent inflammations may be interfered with. The *mastoid cells* mostly are superficial to the antrum.

Examination of the Middle Ear—

Investigation of Hearing. This may be undertaken in several different ways, each of which has its own importance. These are the watch, the voice, the tuning-fork, the acoumeter and

Galton's whistle. Hearing should be tested before treatment is begun and always under the same conditions, whilst both ears should be examined, even if only one is complained of. Before testing the hearing of the middle ear any possible obstruction, from wax, etc., in the external auditory meatus should be eliminated.

The Watch Test. The distance at which any given watch can be heard should be ascertained by experiment upon healthy ears. The opposite ear is closed with the finger whilst the watch is brought towards the ear, being tested from outside hearing range; the reverse proceeding may be done as a control. The eyes should be closed. This is not a test of great value.

The Voice Test. This is the most important test for ascertaining the amount of deafness. Except in cases of extreme deafness the whispered voice should be used. Repetition of numerals affords the readiest means; questions, especially in children, are not always understood, or even if imperfectly heard the answer may be guessed at. The examiner stands at a distance and whispers a number; if unheard he gradually approaches until the patient is able at once to repeat the word used. If whispering is not heard, ordinary or even loud conversational tones may be employed, the distance in each case being noted. In order to avoid lip-reading, the patient should sit sideways or keep the eyes shut. Each ear is tested in turn, the opposite one being closed. Whispers can normally be heard at twenty-five feet.

Examination of Children. In children the watch test is quite unreliable, and in young children it is difficult to elicit the necessary repetition. A few simple questions in varying tones of voice will often suffice to indicate the amount of deafness, but in the case of shy children it will often be necessary to instruct the parents how to examine the child at home.

The Tuning-Fork Test. This test is chiefly used in the differential diagnosis of middle from internal ear deafness. The vibrations of the tuning-fork are conveyed to the labyrinth either through the tympanic membrane and ossicles or directly through the bones of the skull. The former constitutes "air-conduction," the latter "bone-conduction," and in a normal person the vibrations are better heard by air-conduction.

Rinne's Test compares the varieties of conduction. The vibrating tuning-fork is held with the shaft on the mastoid process until the sound is no longer heard, when it is rapidly moved so that the vibrating ends are close in front of the auricle. In a normal ear it will be heard a little longer in the latter position than in the former (positive Rinne). In middle-

ear disease the reverse holds true, the sound being longer heard when the fork is upon the mastoid (negative Rinne). In nerve deafness the relation of air- to bone-conduction is the same as in a normal person, but the duration is less (Rinne shortened). Rinne's test is unreliable in old people and also in cases where there is internal as well as middle-ear deafness.

Weber's Test. The tuning-fork held to the middle of the forehead is heard equally in both ears by a normal person; with unilateral middle-ear deafness it is heard better on the affected side. In unilateral deafness Rinne's test may be misleading owing to the vibrations being conveyed across to the sound ear. Weber's test is useful to eliminate this source of error.

Schwabach's Test. Here the examiner's hearing must be normal. The vibrating tuning-fork is placed on the mastoid of the patient and when no longer audible is transferred to that of the observer. If still heard by the latter, labyrinthine disease in the patient is indicated, but if the patient hears the vibrations after the surgeon has ceased to do so middle-ear deafness is suggested.

Gelle's Test is useful to determine whether ankylosis of the stapes is present. A Siegle's speculum is inserted into the meatus and the bag compressed. If the stapes is movable the intra-labyrinthine pressure is increased and a vibrating fork on the mastoid is less well heard (Gelle positive). If the stapes is fixed there is no diminution (Gelle negative). This is a useful supplement to Rinne's test. These tests must be taken together, in individual cases one or other may be inconclusive.

To recapitulate. In *middle-ear deafness* bone-conduction is increased, Rinne's test is negative, Weber's test referred to the deaf side, Gelle's test is positive, except in ankylosis of the stapes, when it is negative; in addition low-pitched tuning-forks are better heard than high. In *internal-ear* or *nerve deafness* bone-conduction is lessened, Rinne and Gelle's tests are positive, and tuning-forks of high pitch better heard than low.

Galton's whistle emits a very high-pitched sound and is useful in determining the upper limit of hearing.

Inflation of the Middle Ear. This is performed for purposes of diagnosis as well as for treatment, and may be carried out in three ways.

1. *Valsalva's Method of Auto-Inflation.* A forcible expiratory effort is made, the patient closing the mouth and compressing the nostrils, whereby the air is forced into the Eustachian tubes if they are not too much obstructed.

2. *Politzer's Method.* For this a rubber bag of six to eight ounces capacity is necessary, which has connected to it a rubber tube ending in a perforated nose-piece of vulcanite, with or

without a rubber covering, of such shape as to fit into the nostril and occlude it. The patient takes a sip of water, which he holds in his mouth. The surgeon holds the nozzle into one nostril of the patient with his left finger and thumb, at the same time closing the other. As the patient swallows the water the bag is sharply compressed. The entrance of air into the middle ear should be checked by the auscultatory tube, as the patient's sensations are not always reliable.

3. Catheterization. The catheter should be silver or plated and boiled before use; it should not be too fine. The air-bag is provided with a vulcanite nozzle fitting the open end of the catheter. The auscultatory tube has an ear-piece at each end, one of which is inserted into the patient's and one into the surgeon's ear. The surgeon stands in front of the patient who is seated and grasps the catheter lightly in the right finger and thumb, with the beak turned downwards and the stem nearly vertical, inserting it into the nostril so that the point lies on the floor of the nose, whilst the thumb of the left hand tilts up the tip of the nose.

The right hand is then gradually raised and the catheter pushed gently through the nose in a horizontal position till the point comes into contact with the posterior pharyngeal wall. Care is necessary to keep the point in contact with the floor of the nose and to prevent it being pushed up into the middle meatus.

The next stage is to rotate the point inwards through ninety degrees (as indicated by the ring) and withdraw the catheter until it comes into contact with the free edge of the nasal septum. If the point is now pushed just far enough backwards to clear the soft palate and rotated a little over one hundred and eighty degrees downwards and outwards, or until the ring is directed towards the outer canthus of the eye of the same side, it will slip into the Eustachian orifice. Once in, the surgeon grasps it firmly with the left hand, retaining one or more fingers in contact with the nose to avoid jerking. This hand should not be removed until inflation has been performed. It cannot too strongly be insisted upon, that under no circumstances must any force be exerted.

Difficulties Encountered. Spurs or a deviated septum may make it necessary to use a light and a nasal speculum, to bend the instrument so as to adapt it to the obstacle to be avoided, and in some cases even to pass it through the opposite nostril. If there is great irritability cocaine may be advisable.

Information Derived. When air enters through a patent tube the sound heard by the listener is full and clear; if the tube is obstructed, fainter and more distant. Moist, crackling sounds indicate fluid in the middle ear; a

whistling or hissing sound is heard with a small perforation, a large one may cause an unpleasant sensation on the drum of the observer. A very loud sound may point to undue patency, as in otosclerosis. Experience is required, however, rightly to interpret the sounds heard.

Complications. Giddiness and syncope occasionally occur after any kind of inflation. Surgical emphysema, epistaxis, or even rupture of the tympanic membrane have all resulted from catheterization. It is inadvisable to pass the catheter in the presence of a septic condition of the nose, such as suppuration, ulceration or ozæna.

Choice of Method of Inflation. Politzer's method is usually employed for children and nervous adults, with marked nasal obstruction, and for auto-inflation. It is also preferable where both ears are involved or where the medical man is inexperienced. Catheterization, on the other hand, affords more information as to the condition of the Eustachian tube; it is indicated where one ear is normal and when treatment of the tube is required, whilst in cases of marked obstruction of the tube it is the only way in which air can be made to enter.

Siegle's Speculum. This consists of an aural speculum fitting into an end-piece, the broad end of which is covered with an obliquely-placed lens or plane glass disc, on to the side of which end-piece a rubber ball and tube connects. The speculum fits accurately into the external auditory meatus, so that pressure on to the ball drives the tympanic membrane inwards and, if the speculum be introduced with the ball squeezed in the hand, relaxation of the pressure draws the membrane outwards.

The uses of the instrument are diagnostic and therapeutic. As an aid to diagnosis it enables the observer to judge of the mobility of the drum, whether it is thickened, scarred or adherent to the inner tympanic wall. From a therapeutic point of view it is used to extract secretion from the tympanic cavity through a perforation and to effect massage of the drum by alternate compression and relaxation.

E. P.

CHRONIC CATARRH OF THE MIDDLE EAR

Synonyms: "Chronic Adhesive Catarrh," "Throat Deafness."

Chronic Adhesive Catarrh is a disease of the middle ear and Eustachian tube characterized by gradual and progressive loss of hearing—adhesions form in the tympanic cavity as a result of repeated attacks of catarrh; these adhesions, on contraction, draw upon the membrane and distort it; the movements of the ossicular chain are interfered with, thus still further impairing the hearing power, and eventually

the balance of forces in the internal ear is disturbed.

The name catarrh is a misleading one, for the condition is really a result of catarrhal attacks, and it is unusual on inspecting the membrane, to detect signs of fluid or mucus in the tympanic cavity. The fluid which must have been present at some time or other having been absorbed by the lymphatics or having drained through the now occluded Eustachian tube into the pharynx; all that can be seen on inspection is a tympanic membrane showing indications of the absence of air in the tympanic cavity, as well as a retraction of the membrane with displacement upwards and backwards of the handle of the malleus, the result of the slow work of atmospheric pressure.

Pathology. It is essential to normal hearing that the air pressure on one side of the membrane should be counterbalanced by an equal pressure on the other. If from any cause the air pressure in the tympanic cavity is less than that in the meatus, the membrane is depressed and becomes "cupped" or "retracted" and its vibrations are impaired. The tympanum is ventilated by means of the Eustachian tube, and if, owing to abnormalities present, the tube becomes occluded and mucus or fluid in the middle ear is unable to drain away, we have the condition of catarrhal otitis; this is precisely what occurs in this affection.

It is quite impossible for repeated attacks of catarrh to occur in so delicate a structure as the middle ear without damaging its mechanism. Just as inflammation elsewhere in the body, *e. g.* synovitis of joints, leaves the articulations affected, with stiffness and contraction of the joints as a possible result, so repeated attacks of catarrh terminate in the formation of adhesions which subsequently contract, producing the deformity and distortion in the middle ear which are characteristic of the disease. In severe cases the entire middle ear becomes bound up and hampered with adhesions, the movements of the ossicular chain are impaired, with the result that deafness and tinnitus are complained of.

Etiology. It would be almost true to say that this disease is always secondary to affections of the nose and naso-pharynx—hence its popular term "throat deafness"—therefore any abnormality in these cavities tending to produce catarrh or obstruction of the Eustachian tube is a cause of the disease; first and foremost come adenoid vegetations—or rather neglected adenoid growths. Children who have been allowed "to grow out" of the condition invariably remain with, or develop later, some impairment of hearing. The nasal growths have disappeared, it is true, but they leave their train of symptoms behind and a legacy in the

form of deafness. Enlarged tonsils, pharyngitis, repeated colds, rhinitis, hypertrophic rhinitis, the infectious fevers, polypi, septal deformities, spurs and deviations, etc., enlargement of the posterior ends of the inferior turbinates, etc., all tend to produce Eustachian obstruction.

Take the case of a victim of adenoids with an attack of coryza. The catarrh spreads up the tube into the middle ear and infects it. Catarrh with effusion results, the inflammation subsides, and the fluid is absorbed. If the tube remains occluded air does not enter the tympanic cavity; atmospheric pressure from without displaces the membrane inwards; it becomes retracted or cupped; the balance of forces in the middle ear is upset; unless the middle ear is reinflated it remains so; adhesions begin to form, at first only slight, but with repeated attacks this increases; the adhesions become organized and we have the condition of adhesive catarrh and its results.

Symptoms. The chief symptom when the condition is of some standing is gradually increasing loss of hearing, limited as a rule to one ear, and not as in otosclerosis affecting both. There is tinnitus—with loss of appreciation of the lower tones. The higher notes are as a rule well heard unless the labyrinth is involved. Patients will say that they hear certain sounds well and can appreciate ordinary conversation with one individual, but at the dinner table, theatre, etc., they are unable to discriminate voices or hear general conversation, *i. e.* the membrane fails to accommodate properly; it has lost its fine power of adjustment with selection of the tones to which it formerly used to vibrate. Giddiness is a common symptom and may be very severe, but it is rarely so unless the internal ear is secondarily deranged in the later stages of the disease. "Paracusis Willisii," the phenomenon of hearing better in a noise, is a late symptom in catarrhal deafness, and when present it is an unfavourable one.

Physical Signs. The membrane, unlike that in otosclerosis, is never normal, nor is the Eustachian tube ever free, and the nose on the affected side is generally more obstructed than on the other. The amount of obstruction can be gauged and ascertained by spraying a solution of menthol or cocaine into the nose and noticing the amount of contraction of the soft tissues which results. On inspection, the membrane has lost its pearly lustre, it is opaque and thick in parts, thinned and translucent in others; on inflation by Valsalva's method (blowing out the cheeks with the nares compressed) a portion of the membrane, usually the posterior superior quadrant, will bulge out like a sail, or may hardly move at all, being adherent to the inner wall of the tympanic cavity or

fixed by adhesions which radiate from the promontory; thin white streaks can be seen crossing and recrossing the membrane; the cone of a light (a reflection of the light which the examiner throws on the concave membrane) is altered, and instead of bearing resemblance to the shape of "an equilateral triangle" with the base pointing anteriorly, it resembles that of an isosceles triangle, *i. e.* it is elongated (Milligan), or the cone of light may be broken up into various specks of light—at all events it is *not normal*, but it has shifted or is lost to view. The handle of the malleus is drawn upwards and backwards and is shortened, or rather appears to be shortened, as it is seen in perspective; it appears to be thinner because the edge alone is seen, for it is rotated and tilted away from the observer. The anterior and posterior folds are drawn rightly over the processus brevis, which appears as a white shining knob straining through the membrane, and there is a marked shadow in the posterior fold—possibly the membrane has fallen in upon the stapes, which bone, together with the long process of the incus, is seen through the thinned and transparent membrane. This picture is a typical one of retracted drum-head. In other cases bands of adhesions can be detected behind the membrane, and calcareous deposits are visible in its periphery. These are usually crescentic in shape and of no import: the Eustachian tube, being a part of the middle ear, shares in the general condition; the ostium is occluded and the lumen of the canal is narrowed, the constriction being more marked at the narrowest part of the tube, *i. e.* the junction of the bony and cartilaginous portions of the canal. When air enters the ear the membrane does not respond to the inflation, or it may respond too much and bulge out like a sail caught in the wind. The patient, it will be noticed as a rule, has some trick, either of compressing the tragus with his finger or yawning to adjust the displaced membrane; the sound of a constricted tube on inflation as heard through an auscultating tube is typical; it is of a whistling far-away character, or if fluid be in the middle ear, moist sounds are plainly detected. These differences in diagnosis can only be learnt by constant practice, but as a rule the diagnosis is easily made if attention be paid to these points.

Treatment. Adenoids and other abnormalities in the nose and nasopharynx should be dealt with promptly as a preliminary. The Eustachian tubes should be opened up and kept open. If Politzerization fails to inflate the middle ear recourse must be had to catheterization. The effects of the two are really different. The effect of Politzer's method is in some cases superior to that of catheterization, and is more

employed on the Continent than it is in Great Britain. The effect of inflation by means of the air douche is equably and forcibly to open up the Eustachian tube and distend the middle ear with air under pressure with the object of stretching adhesions and producing a freer movement between the hampered ossicles so as to increase their mobility. Catheterization has the same effect in a much less powerful way, for little pressure can be brought to bear on a column of air so fine as that propelled through a catheter. Another advantage of Politzer's method is that both ears can if necessary be inflated at the same time—but this is, of course, a disadvantage if only one ear is affected. Speaking generally, Politzerization is more suited to children, who are less tractable, and catheterization to adults, and by the latter method a diagnosis can at the same time be made of the condition of the lumen of the tube, in addition to detecting any obstruction to the passage of the catheter through the nasal cavities.

Inflation methods can be employed to introduce certain medicaments into the middle ear: a few drops of some volatile preparation such as equal parts of spir. vin. rectificat, chloroform and acetic ether can be blown into the tympanic cavity by means of the air douche: oily solutions, *e. g.* paroline, benzol with or without menthol, (gr. vii ad ʒi); alkaline solution; sodii chlor.; sodii bibor. gr. v. āā ad ʒi; iodide of potass. in glycerine (grs. iii. ad. ʒi) and many others are useful. The writer has found that the greatest amount of temporary relief is obtained by injections of alkaline solutions and that the greatest amount of sustained relief is obtained by intratympanic injections of menthol dissolved in one of the oils just mentioned. This should be accompanied by internal administration of iodide of potassium with nux vomica, not merely because it tends to produce tissue absorption, but because it renders the tympanic cavity moister; when the tympanic cavity is dry, conduction is not so good as it is when moist.

Hot air is being extensively used by some aurists, and injected by means of a suitable apparatus; but it is not decided whether the advantage gained is not as much due to the inflation as to the temperature of the air employed. *Oto-massage* as described in the article on *Otosclerosis* is of great value, and this is what one would expect from the pathology of the affection. The question of ossiculectomy, tenotomy of the stapedius or tensor tympani muscles as practised by some cannot be dealt with here, as it requires expert knowledge for its performance.

The treatment of chronic catarrh of the middle ear often resolves itself into treatment of the

post-nasal catarrh which as a rule is the precursor of the trouble. Post-nasal catarrh is a chronic affection and a troublesome one to cure, for the part is not easily accessible by the patient. If adenoids are present the treatment is obvious; if not, careful examination should be made (and this can now be done without much practice with Hay's pharyngoscope) as to whether the posterior ends of the inferior turbinals are hypertrophied; this is easily detected and the redundant tissue can be removed with a cold snare passed down the nose under cocaine anaesthesia. It is obvious that if cocaine and adrenalin be employed to excess, the hypertrophy will subside and the wire of the snare will not engage the vascular swelling which has temporarily collapsed. This is a common cause of failure in removing a "moriform body." Sometimes the swelling is so hard and fibrous from connective tissue formation, the result of hypertrophic rhinitis, that it will hardly be affected by cocaine and adrenalin, and the redundant tissue is easily snared.

The most satisfactory way of treating post-nasal catarrh, is by means of an alkaline solution, either sniffed, sprayed or syringed into the nose; the latter must be employed with caution, for unless the patient is instructed how to perform this manoeuvre, fluid finds its way into the middle ear and probably determines an attack of acute otitis. This can happen readily in children, where the Eustachian tube is comparatively short, and the writer in consequence never orders a child's nose to be syringed. The lotion should be dropped into the nose by a pipette or placed in the palm or teaspoon and sniffed up, first one nostril and then the other; in this way the solution reaches the ostium tubæ, clears away any mucus which may be adherent to it, braces up the mucous membranes and tissues in its vicinity and relieves congestion.

An important bearing upon treatment is the question as to whether nasal abnormalities such as enlarged anterior ends of the inferior turbinal, enlarged or bulbous middle turbinal, deviations of the septum or nasal spurs (by which are meant proliferations of cartilage at the junction of the cartilaginous with osseous portions of the septum), should be corrected as a matter of routine, and here it may be said that some divergence of opinion exists. It may be laid down as a good rule that if any abnormality in the nose interferes with the passage of the catheter, this should be rectified; if inflation produces improvement, correction of abnormalities in the nose will benefit the patient; if nasal obstruction is constantly present there is no doubt that treatment should be directed towards its relief, and a few cuts with the galvano-cautery along the inferior turbinals, or application of trichloroacetic crystals

or chromic acid—preferably the former—to the septal side of the inferior turbinate produces a rapid result.

It is well known that it is essential to proper hearing that ventilation of the nasal cavities should be free; if this is not so the Eustachian tube, which is an offset of the cavities, shares in the obstruction, and the writer is firmly of opinion that if any nasal conditions exist which impede drainage or interfere with free breathing the patient is the better for such local nasal treatment.

The treatment of this affection may be summed up in these words:—Open up the Eustachian tubes and keep them open by catheterization with or without bougies, Politzerization, or both; correct any obvious nasal deformities. If the mucous membranes of the nose or nasopharynx are affected, suitable treatment in the form of mild alkaline washes should be employed; if the tonsils, both faucial and naso-pharyngeal, are enlarged, remove them at once.

H. J. D.

OTOSCLEROSIS

Synonyms: "Capsulitis Labyrinthi," "Chronic Progressive Deafness."

Otosclerosis is a name given to a disease, unfortunately a common one, which is characterized by a gradual fixation of the foot-plate of the stapes in the fenestra ovalis; the fixation is not one by fibrous tissue, but it is a fixation by bone. Otosclerosis is not a disease of the middle ear, nor is it a disease of the internal ear to commence with, but it is a primary disease affecting the bony labyrinthine capsule, and hence the name "Capsulitis Labyrinthi," by which it is also known.

The physical signs, as gauged by tuning-forks, are in the early stages suggestive of middle-ear disease alone, but as the disease progresses and implicates the labyrinth the functional tests point to those of degeneration of the acoustic nerve.

If the disease is complicated by an affection of the middle ear as well, as is often the case, it is not easy to differentiate the complaint from that of chronic catarrh of the middle ear, and in later stages the symptoms of both diseases are often similar.

The importance of a correct diagnosis in these cases cannot be overestimated, for the treatment of the two diseases is dissimilar. The fundamental change in otosclerosis is an early fixation by bone of the stapes in the fenestra ovalis; the fundamental change in chronic catarrh of the middle ear is a deposition of fibrous tissue in the tympanic cavity, which on contraction distorts the membrane and binds the ossicles one to another by adhesions, and

later the foot-plate of the stapes may be hampered by adhesions which on contraction bind it to the fenestra ovalis and render it immobile, but these adhesions are never bony.

Otosclerosis is, therefore, a primary disease, chronic catarrh is a secondary disease consequent on repeated attacks of inflammation, catarrhal or otherwise, of the Eustachian tube and middle ear.

Pathology. This has only lately been understood. The predominating change is a gradual absorption of the bone in the region of the fenestra ovalis and fenestra rotunda and its replacement by a new growth of spongy bone, which itself becomes gradually denser and more compact, until it is indistinguishable from the normal bone in its vicinity. The Eustachian tube, the tympanic cavity and the membrane are normal, but the stapes slowly becomes fixed in the fenestra ovalis by extension of bone along its foot-plate or by bony bridges extending from the capsule of the labyrinth to the crura. As the disease extends, either through the windows or through the capsule itself, this formation of new bone invades the interior of the labyrinth, which itself becomes affected, increasing the tinnitus and deafness, and producing other symptoms which point to implication of the terminals of the auditory nerve and the organ of orientation, *i. e.* the vestibular apparatus with the semicircular canals.

Etiology. The causes of the disease are various; it is twice as common in women as it is in men: it manifests itself in early adult life between the ages of twenty and thirty. Syphilis has nothing to do with the disease, but anæmia is an important factor, the puerperium still more so, and it is well recognized that at each successive pregnancy the disease progresses and the deafness increases. Exposure to cold, rheumatism and gout are other factors predisposing to the change, which is so slow and insidious in its onset that a high degree of deafness is often present before patients seek advice, and as a rule, when they do so, tinnitus is the symptom which determines their visit to the aurist. Heredity is another important factor, and a history of inheritance is nearly always present. It may be pointed out that this is not a true inflammatory process, and beyond signs of hyperæmia of the mucous membrane over the promontory, an indication of which is the presence of a pink reflex often observed through the posterior quadrant of the membrane, there are no manifestations of inflammation nor even a history of any previous inflammatory disease; this is a very significant fact. The various theories as to its origin need not be discussed here.

Otosclerosis may remain limited to one ear

for years, but later both ears are affected: the disease is painless, progressive, bilateral, slow and, though remediable, is incurable.

Symptoms. The chief symptoms are a gradually increasing deafness associated with tinnitus; sometimes tinnitus is the first sign to attract attention. Vertigo is not, as a rule, complained of, but "paracusis Willisii," the phenomenon of hearing better in a noise, is always present. It has been pointed out that "this is an early symptom in otosclerosis, and a late one in catarrhal deafness, an observation which supports the long-held opinion of the unfavourable significance of this symptom." The deafness may for a long time be limited to one ear, but in the later stages it is bilateral; sometimes the progressive loss of hearing is arrested, it may be for years, or it may be stationary for long periods, and alternate with periods of rapid deterioration. When the internal ear becomes affected the deafness may be absolute, though this is rarely the case.

Physical Signs. The membrane, in cases uncomplicated by middle-ear catarrh, is normal, it is easily seen, and often presents, as mentioned above, a red reflex shining through the drum and due to a hyperæmia of the mucous membrane lining the promontory. The Eustachian tubes are patent, often unduly so, and inflation by catheterization or Politzerization produces no improvement whatever. There are three important signs which can be elicited in a typical case of otosclerosis—

1. *Increased bone conduction;*
2. *A negative Rinné test;* signs also found in chronic middle-ear disease; and
3. *Elevation of the lower tone limit,* *i. e.* the lower tuning-forks are not appreciated, though the higher tuning-forks are heard unusually well.

These signs, often referred to as the "symptom-complex" or "Bezold's triad," are most important, and will be dealt with separately.

Increase of bone conduction is always present. By this we mean that a vibrating tuning-fork is heard not only better on the mastoid than when it is held in front of the ear (*i. e.* by air conduction), but that the fork is heard more loudly and for a longer period than would be the case in a normal ear. When the labyrinth becomes invaded the bone conduction of necessity becomes relatively diminished, for "the sound-perceiving apparatus" has become impaired; this is what one would expect to occur.

Negative Rinné's Test. As the "sound-conducting" apparatus is at fault, the vibrations of a tuning-fork would be heard louder by bone than by air conduction (Rinné -); but if, and when, the labyrinth or sound-perceiving apparatus becomes later involved, Rinné's test

—which was negative—would tend to become positive (Rinné +), for the patient, as far as he could hear the tuning-fork at all, would tend to hear better by air conduction than by bone conduction, *i. e.* the functional tests would point to an implication of the labyrinth; hence the primary “negative Rinné” test is masked, or tends to become so as the disease advances.

Elevation of the Lower Tone Limit. It may be taken as a general rule that loss of perception of the low tones points to implication of the middle or external ear, and that loss of perception of the high tones points to affection of the internal ear. Therefore, in early otosclerosis, as part of the sound conducting apparatus, *i. e.* the stapes, becomes implicated, the lower tones are not so well heard, but the labyrinth being free, the high notes are still perceived. When the labyrinth itself becomes involved the higher notes are lost as well, and the deafness is then extreme. This loss of perception of the lower tones is a very important sign of fixation of the stapes, and it may therefore occur in the late stages of adhesive catarrh and post-suppurative deafness.

Gelle's test for fixation of the stapes must also be applied, and it is based on the following physiological fact: if the air in the meatus is compressed by the finger, or better still by a Siegle's speculum, and a vibrating tuning-fork is placed on the vertex or mastoid, if the stapes is movable, as in the normal ear, the sound is lessened on air compression, whereas if the stapes is already fixed the sound is unchanged. A want of appreciation, therefore, by the patient of any *alteration* of sound, whether it be increased or diminished, points to fixation of the stapes.

Treatment. As far as is at present known, a cure for otosclerosis does not exist, but treatment can be and should be directed towards alleviating the symptoms, which in later stages render a patient's life a misery.

There is no doubt that *phosphorus* administered in small doses has some effect on the course of the disease. It is best given in the form of “perles,” in doses of $\frac{1}{100}$ gr., gradually increased to $\frac{1}{50}$ gr., three times a day. The pil. phosphori of the *British Pharmacopœia* is quite unsuitable, as it is dissolved internally with difficulty, if at all, but pure phosphorus dissolved in suet and made into pills and varnished is efficacious, as also is the oleum phosphoratum in doses of two to five minims in capsules.

Next to phosphorus, the *iodides*, in the form of iodide of potash, have been extensively used, or iodide in combination with iron as the syr. ferri iodidi, or better still with Easton's syrup. It is the practice of the writer to give a course of Easton's syrup $\bar{5}$ i and iodides combined, $\bar{5}$ ss to $\bar{5}$ i ad $\bar{5}$ i of a mixture containing gr. x iodide of potassium in tabloid form, with occasional

intratympanic injections of paroline and menthol through the Eustachian tube, and he has no doubt that tinnitus, if present, is relieved by administration of hydrobromic acid, as described later. Next in order should be placed *thyroid extract*, commencing with $\frac{1}{2}$ gr. of the extract and the dose gradually raised to 5 gr. *ter die*. Whether this has any permanent effect on the disease is questionable, but the writer has undoubtedly seen cases which have benefited as far as symptoms are concerned.

Local Treatment. The best results have been obtained by *oto-pneumo massage*. A suitable aural speculum is inserted into the auditory meatus and connected by means of a rubber tube to an electrically driven motor attached to which is an air-pump. The rate of piston stroke can and should be carefully regulated, and great care must be exercised in employing the treatment, which at each sitting should not continue over one and a half to two minutes; if the massage increases the tinnitus and produces vertigo, as occasionally happens, it is better discontinued. The principle of the treatment is based on the fact that the rapid alternating rarefaction and condensation of the column of air in the meatus produces corresponding vibrations in the membrane, which are in turn transmitted to the stapedio-vestibular joint, thus tending to impede or retard the ankylosis which is characteristic of the disease. It has been said that there is a tendency to loosen the articulation between the incus and stapes, and this possibility must be borne in mind, but the writer is of opinion that this result is more theoretical than real. Lake has invented a portable oto-masseur which the patient can employ himself. Inflation of air by means of the Eustachian catheter and Politzerization do not produce much result, unless there is coexistent catarrh of the middle ear, for the Eustachian tube and tympanic membrane are usually patent, hence inflation produces no improvement.

Intratympanic injections of hot air or paroline, with or without menthol, are often used, and there is no doubt that this tends to alleviate symptoms in certain cases.

Blistering. In conjunction with, or apart from, the treatment just mentioned, it is the writer's practice to order *blisters* to be applied to the region of the mastoid. Cantharides blistering paper, cut to the size of a threepenny-piece or crescent-shaped, can be applied by the patient at bedtime (iodine solutions have obvious disadvantages) and retained all night. The patient is instructed to apply the small blister to each mastoid alternately once a week; if one ear alone is affected this can be done once a fortnight; improvement may be temporary, but it is sometimes sustained; and

therefore this treatment should always be tried, even though no permanent result can be hoped for.

Apart from the deafness—which as a rule is slight compared to the main symptom of which patients complain, *tinnitus*—the other symptoms calling for treatment are confused feelings in the head and *vertigo*. Tinnitus is nearly always present; vertigo may come on later. Paracusis is always present, but it is rather appreciated by the patient than otherwise, for he finds it better to hear in a noise than not to hear at all.

The treatment of tinnitus medicinally can be comprised in the words *hydrobromic acid*. Quinine and salicylates are contra-indicated, but bromide—not in the form of ammon. or ammon.-sodæ. or potass. bromide, which are depressing, but in the form of dilute hydrobromic acid—invariably produces relief. The writer prescribes—

Acid Hydrobrom. dil. ʒ ss to ʒ i
Tinct. Nucis Vom. ℥ iv
Syr. Limonis ʒ i
Aquam Chlorof. ad ʒ i. Ter die.

The “noises” are relieved, the patients sleep better, eat better, and the acid is a “tonic” to the system. After the tinnitus has been checked a mixture of iodide of potassium is ordered three times a day (10 gr.) and a tabloid of syr. triphosphatum (Easton's syrup), ʒ ss to ʒ i, is taken with each dose of the mixture.

There is one point of practical importance which must be borne in mind. Tinnitus is not necessarily due to disease of the labyrinth or of the middle ear, but cases are often met with, in young women especially, where it has existed for perhaps several months, and where this is due solely to anæmia; there may be a certain loss of hearing, but this is *because* of the tinnitus present, which obscures the hearing. These cases can be cured by administration of iron and suitable treatment. Other cases met with are due to increased arterial tension (contracted granular kidney), and this can be relieved by lowering the blood pressure with Epsom or Karlsbad salts, and iodide of potassium.

In cases of tinnitus associated with a high tension pulse the urine should invariably be examined for albumen. Still, speaking generally, cases of persistent tinnitus, even though no other aural symptoms are present, usually turn out later to be of aural origin. With regard to the effect of intranasal treatment, it may here be said that any condition which tends to lower the patient's resisting power in such a way as to handicap him in life—be it ever so little—should be attended to, and the writer is strongly of the view that such evident

conditions as adenoids and turbinal hypertrophies should be treated precisely as would be done in other cases. This is merely common-sense—and to say that because otosclerosis is still an incurable disease, therefore it is useless “to do anything,” is against the ordinary canons of medical treatment. H. J. D.

ACUTE INFLAMMATION OF THE MIDDLE EAR

Under this term I have included acute middle-ear catarrh, acute middle-ear inflammation (*Otitis Media Acuta*) and acute middle-ear suppuration, because these conditions arise from the same causes and may merge one into the other.

The chief causes are (1) a severe cold in the head; (2) nasal or post-nasal catarrh, especially if associated with adenoids or nasal obstruction; (3) specific fevers such as scarlet fever, measles, smallpox, typhoid and diphtheria; (4) influenza, pneumonia or whooping-cough; (5) the entrance of fluid into the Eustachian tube from bathing or douching the nose; or (6) septic infection through the Eustachian tube secondary to operations in the post-nasal space, or from blocking the posterior nares to arrest epistaxis, or from use of a septic Eustachian catheter or bougie. (7) Finally the middle ear may be involved from without, as in a fracture of the middle ear fossa of the skull or from a traumatic perforation of the tympanic membrane.

Symptoms. The symptoms depend on the intensity of the catarrh or inflammation.

In *Acute Middle-Ear Catarrh*, as the mucous membrane of the middle ear becomes hyperæmic and swollen, and secretes mucus, a feeling of discomfort and fullness of the ear, frequently accompanied by twinges of pain, usually occurs. The deafness may vary suddenly. A characteristic symptom is relief from the stuffy, blocked-up feeling of the ear on blowing the nose, when a crackling may be heard in the ear, and at the same time the deafness may be temporarily diminished or even disappear. If there is much exudation, the deafness may be very pronounced, but may come and go according as the patient lies down or stands up, and with this there may be a feeling of something moving in the ear. This is due to the fluid in the middle ear altering its position. As in every case of a middle-ear affection, there may be tinnitus; autophonia (*i.e.* an increased resonance of the voice in the head) is another subjective symptom, usually most pronounced in acute middle-ear catarrh with exudation.

In *Acute Middle-Ear Inflammation* the onset is usually sudden and accompanied by sharp aching pains in the ear, which may radiate up the side of the head and often down towards

the neck. The pain is worse at night, and is aggravated by coughing, crying, or sneezing; frequently it is unbearable, and accompanied by extreme facial neuralgia. The temperature may reach 101° F., and in children may be considerably higher. As a rule the maximum point of inflammation is reached on the second or third day, when it either subsides, or else rupture of the drum takes place, giving considerable relief. Usually the whole of the middle ear cavity is affected, but occasionally the inflammation may be limited to the attic region.

Signs. In a mild case of acute middle-ear catarrh there may be no change in the tympanic membrane, but frequently the vessels along the malleus and circumference of the drum are slightly injected and the drum itself appears more glistening than usual, and may be of a yellowish-red or brownish colour. If the tympanic membrane is very much retracted, it means that the catarrhal condition has existed for some time. In cases of serous effusion, it is sometimes possible to see the exudation within the tympanic cavity, and on moving the patient's head, the line of fluid may also be seen to alter its position. If the whole cavity is filled with fluid, there is frequently a slight bulging of the membrane, especially of its upper and posterior quadrant.

In acute middle-ear inflammation the tympanic membrane becomes rapidly congested, and is uniformly red with obliteration of the normal landmarks, but the short process of the malleus may be seen as a yellowish-white point. With this there is usually considerable bulging of the tympanic membrane in its upper posterior quadrant, and if the congestion extends along the auditory canal, it may be difficult to say where the meatus ends and where the membrane begins. In influenza, ecchymoses or bullæ containing sanious fluid may be observed.

If perforation is imminent, the membrane will bulge prominently, and appear of a purplish-red or yellow colour at the point where the perforation is going to take place. If the inflammation is limited to the attic, Shrapnell's membrane may bulge outwards over the process brevis, giving an appearance very much like a smooth polypus.

In acute inflammation there may be tenderness on palpation over the mastoid region, but usually limited to its tip.

In Infants. In inflammation of the middle ear there may be convulsions, retraction of the head, vomiting, and other symptoms simulating acute meningitis. If the child is ill from some general cause, such as a pulmonary or gastro-intestinal affection, the ear symptoms may pass unnoticed. There is great restlessness, continual crying, rolling of the head from

side to side, and putting up the hands to the head. Pyrexia may be extreme. These severe symptoms, which may occur without there being any marked changes in the drum head, are probably due to the fact that in the infant the petro-squamous suture still permits of free communication between the vessels and lymphatics of the tympanic cavity and the middle fossa of the cranial cavity.

The relationship of disease of the gastro-intestinal and respiratory tract to middle-ear inflammation has not yet been accurately determined. In all cases, therefore, of these affections, the ears should be regularly examined, especially if there be pyrexia, for which there is no satisfactory explanation.

Treatment. The diet should always be light, but in the more acute cases with pyrexia, only liquids should be given until the acute stage has passed off. A smart purge at the beginning of the treatment is always beneficial.

Even in a case of mild catarrh it is wiser for the patient to stay indoors for two or three days, but he need not be confined to his bed. The ear should not be syringed. It is sufficient to instil into the auditory canal a few drops of ten per cent. solution of carbolic acid in glycerine two or three times a day. The ear should be inspected daily, in case what at first seemed to be a simple middle-ear catarrh may really be the beginning of an acute middle-ear inflammation.

If there is any concomitant acute nasal or post-nasal catarrh, these conditions should be treated. When the catarrh has subsided inflation of the middle ear should be performed in order to restore the patency of the Eustachian tube, which is usually so swollen at its pharyngeal orifice as completely to occlude its lumen; and also to get rid of any secretion from the middle ear. Politzer's method should be employed if both ears are affected, catheterization if one ear only. The hearing should be tested before inflation. After inflation there is usually considerable improvement in hearing, and with this the patient frequently states that the head feels clearer, and that the noises and autophonia have disappeared. As a rule there is a relapse within a very short time, depending on the character and amount of catarrh present. If the secretion is very viscid, there may at first be no improvement, but if filled with serous fluid the improvement may be very marked, for a few hours at any rate. The practitioner should warn the patient of this probable relapse, otherwise he may be disappointed. Provided no earache or untoward symptoms have been produced by the inflation, it should be repeated next day or the day after, according to the duration of the improvement. The longer this lasts, the less frequent are inflations necessary.

The patient, however, should not be allowed to consider himself cured until normal hearing has been retained for at least a month.

In acute inflammation of the middle ear the patient must be kept in bed. Pain can be relieved by giving a Dover's powder at night, and severe headache by phenacetin combined with aspirin. In addition a simple diaphoretic mixture may be prescribed until the temperature becomes normal. The immediate indication is to relieve the pain. For this purpose a ten per cent. solution of carbolic acid in glycerine is most serviceable; or it can be given in sweet almond oil combined with morphia and cocaine. The affected side of the head should be covered with a thick pad of hot cotton wool on which some tincture of opium or chloroform may be sprinkled. The ear should not be syringed, nor are hot fomentations advised, as they tend to increase the congestion. Leeches may be applied in front and behind the ear. This is frequently of benefit, especially in children. After the acute stage has passed, inflation of the ear can be carried out as above stated, but must not be commenced until all the acute symptoms have completely disappeared. It is wiser to wait a few days than to start inflation too soon, as in the latter case a sharp relapse may take place, with a renewal of all the now-subsiding acute symptoms. If, in spite of treatment, the acute inflammation progresses, paracentesis of the tympanic membrane may become necessary. It is indicated under the following conditions—

1. If there is increasing congestion and bulging of the membrane accompanied by pyrexia and pain.
2. If there are any cerebral symptoms, such as drowsiness, vomiting, vertigo, or convulsions.
3. If there is tenderness over the mastoid, and if the paroxysms of pain are so acute as to prevent sleep.

Technique of Paracentesis. The auricle and surrounding parts should be surgically cleansed, and, if not too painful, the auditory canal should be gently syringed with a 1 in 20 solution of carbolic acid. A general anæsthetic of gas should be given, especially if the operator has not had much experience. The pain of paracentesis is exceedingly great, and is only slightly diminished by local anæsthetics; consequently if no anæsthetic be given, the operator must be prepared to incise the membrane with accuracy and decision. Under an anæsthetic more time is given to the operator to make certain what he is doing. If the patient refuses a general anæsthetic, a few drops consisting of

Cocaine, 12 grains,

Aniline oil, 1 drachm,

Absolute alcohol, 1 drachm (Gray's solution), can be instilled into the ear some fifteen minutes

before the operation. It is essential to work by a good artificial light. A free incision is made through the membrane with a paracentesis knife, which is shaped like a tiny bistoury set at an angle to its handle. If in doubt, the practitioner should make the incision through the posterior part of the membrane, beginning low down and extending upwards, so as to incise the membrane midway between the malleus and the circumference right up to its upper margin, and at the same time the soft tissues of the upper posterior wall of the external meatus, close to the membrane. In this way free drainage is given to the tympanic cavity, the attic, and the antrum. If the inflammation is limited to the attic, it is only necessary to incise Shrapnell's membrane. After the first rush of blood and discharge has been mopped away, a small strip of gauze is inserted into the auditory canal, and a pad of sterilized gauze or wool is applied to the ear. The dressing is changed one or more times a day according to the abundance of the discharge.

Common Mistakes in performing Paracentesis.

1. The congested posterior wall of the external meatus is mistaken for the tympanic membrane. If this is done, the meatus will only be scratched and the membrane not punctured.
2. If the patient is not under a general anæsthetic, the incision may be made in too timid a manner; if so, as soon as he feels a prick of the knife, he will jerk the head away, and probably refuse further treatment.
3. The incision is not free enough, consequently it may heal too soon.

Acute Middle-Ear Suppuration.—The intensity of the symptoms depend on the cause of the suppuration. The most acute cases are the result of specific fevers, or of a septic condition of the tonsils and naso-pharynx. There is no definite line between middle-ear inflammation and middle-ear suppuration, but the latter is almost invariably associated with perforation of the tympanic membrane and a purulent discharge from the ear. It is possible, although very rare, to have pus within the middle ear without perforation, as the purulent secretion may pass into the throat through the Eustachian tube.

In acute middle-ear suppuration, perforation of the tympanic membrane, unless paracentesis is performed, usually takes place on the third or fourth day, or even within twenty-four hours, if the result of specific fever or influenza. After rupture of the membrane there is a feeling of great relief with rapid abatement of the fever and head symptoms.

Treatment. The treatment consists in relieving the pain, obtaining free drainage, and employing asepsis as far as possible. At first the discharge is slight, but becomes thick about the

third or fourth day. The profuse discharge usually lasts from one to two weeks, and then gradually diminishes in quantity, becoming thinner and clearer until it ceases between the fourth and sixth week. If paracentesis has not been performed, and the drum has burst spontaneously, local treatment is begun by carefully cleansing the ear of all secretion. Syringing should be avoided unless the discharge is profuse and thick. Sometimes it is necessary to give an ear-bath of a warm solution of hydrogen peroxide before syringing, but as a rule syringing out the ear with one per cent. solution of lysol is sufficient. The ear is then dried with small pledgets of sterilized wool, and a narrow strip of gauze is inserted into the auditory canal to act as a drain. If there is very little discharge, instead of syringing out the ear, it should be carefully mopped out with pledgets of wool moistened with a solution consisting of

Liq. Hydrarg. Perchlor. 5 iii
Sp. Vini Recti 5 ii
Glycerini 5 ii
Aquam ad 5 i.

Each time the ear is dressed, and this may be necessary every two or three hours during the first few days, the ear should be cleansed as above described before inserting a fresh strip of gauze. As the discharge diminishes, the dressings may only have to be changed daily.

The insufflation of powders is contra-indicated as it may prevent the outflow of the discharge, the chief principle of treatment being free drainage. When the discharge has ceased, and the perforation in the tympanic membrane healed, inflation should be practised until the hearing is completely restored.

Complications. Attacks of headache and earache may occur, and are usually due to lack of free drainage from the perforation not being large enough. Even if the membrane has been incised, it should be incised again. Inefficient drainage is frequently due to the perforation being situated at the apex of a nipple-shaped projection of the tympanic membrane; if so, the projecting portion should be snared off or punched off with a pair of aural punch forceps.

Furunculosis, profuse inflammation or eczema of the auditory canal may occur as the result of the discharge. These conditions are best avoided by keeping the ear aseptic and as dry as possible.

Other complications such as acute inflammation of the mastoid process, of the internal ear, or intracranial suppuration are referred to elsewhere.

Even although the cause of the suppuration may be due to the presence of adenoids or

enlarged tonsils, they should not be removed during the acute stage of middle-ear suppuration. This operation should be carried out when the acute stage has passed. H. T.

CHRONIC SUPPURATION OF THE MIDDLE EAR

Chronic Middle-Ear Suppuration.—The chief immediate causes are neglect of treatment in the early stages, insufficient drainage, and persistent post-nasal catarrh or the presence of adenoids. Amongst the main predisposing causes are unhealthy surroundings and poorness of health.

Subjective Symptoms. If the perforation is large and the drainage free, the condition may exist for years without the occurrence of any urgent symptoms, and it is for this reason that the patient rarely seeks treatment unless bothered by extreme deafness or attacks of headache, giddiness, neuralgia, or an increase of the purulent discharge, the result perhaps of a cold in the head. In some cases the first apparent symptom may be facial paralysis due to extension of the bone disease along the facial canal; or symptoms pointing to some intracranial suppurative lesion or septic infection of the lateral sinus may lead to examination of the ear, when all the signs of chronic middle-ear suppuration may be discovered, although the patient may stoutly maintain that he never had anything wrong with his ear in his life. The discharge varies. It is usually slight in amount and very offensive, and may contain clumps of epithelial debris with cholesterol crystals, diagnostic of cholesteatoma. Particles of bone point to bone disease, sanious discharge to the presence of granulations, polypi, or possibly malignant disease.

Objective Signs. On examination of the ear a perforation varying from the smallest size to complete destruction of the drum may be seen. If the bony walls of the tympanic cavity are not affected, the rim of the tympanic membrane usually remains. If a fistula extends into the attic or antrum from its edge, it signifies bone disease.

It is important to diagnose certain conditions, such as a perforation, a scar of the membrane, a polypus, or a bulging membrane.

A perforation is diagnosed by inspection, a view of the inner wall of the tympanic cavity being obtained if it is large. On using Siegle's speculum there is no movement over the site of the perforation, and secretion may be sucked from it. On inflation the characteristic perforation sound is heard.

A scar may be sharply defined from the rest of the membrane, and be confused with a perforation. With a Siegle's speculum movement

of its surface will be observed; on inflation a blowing sound may be heard, but there is absence of the perforation sound.

A *polypus* projects into the external auditory canal, a probe can be passed round its circumference, and it is found to be movable.

A *red and bulging membrane* is usually accompanied by symptoms of acute middle-ear inflammation. Vessels may be seen on its surface, and on touching it with the probe its structure is found to be membranous.

Chronic Attic Suppuration.—This is usually associated with caries of the ossicles. The tympanic membrane may appear normal and be easily overlooked, but careful observation will show a small perforation in Shrapnell's membrane, which may, however, be covered by crusts. The perforation is usually single and situated just in front or behind the malleus, but it may be double. Examination with the probe will confirm whether there is disease of the ossicles or the surrounding walls. It may be accepted, as a general rule, that a perforation situated in front of the malleus means disease limited to the malleus and anterior portion of the attic, but if behind the malleus, probably the malleus and incus are affected, and perhaps also the very walls of the aditus and antrum.

Treatment. It is first essential to determine the cause of the continuance of the disease. A routine examination should be made of the ear, nose and throat, to determine at once whether there is any pathological condition which should be treated, such as the removal of adenoids or nasal obstruction. If the nose and post-nasal space are normal, the continuance of the suppuration must be due to some local condition within the ear itself. If, on the first inspection, the surgeon finds the ear to be filled with pus and epithelial debris, then if there are no urgent symptoms the simplest conservative measures should be adopted. An efficient routine treatment is to syringe out the ear daily with a one per cent. solution of lysol, then dry carefully, and instil a few drops of 1 in 5000 alcoholic solution of biniodide of mercury.

If there is merely a large perforation, and no bone disease, the above simple treatment will often bring about a rapid cure, by rendering the ear aseptic. If granulations are present, they should be touched with trichloroacetic or chromic acid or punched away by means of a curette. A small polypus can be snared off under cocaine anaesthesia.

In attic suppuration a Hartmann's cannula can be inserted through the perforation, and the small cavity washed out with a mild antiseptic lotion.

In a case of a large perforation in which the mucous membrane only is affected, cure may be hastened by the application of astringents

directly to the mucous membrane itself; a solution of silver nitrate from one to five per cent. is most successful. In other cases healing is delayed from pus collecting in the floor of the tympanic cavity, and much benefit will be obtained by inflation through the Eustachian tube, and afterwards sucking out the secretion by means of a Siegle's speculum, or by washing out the tympanic cavity through the Eustachian tube. To do this a catheter is passed in the ordinary way, and by means of a small syringe some warm lotion is syringed through the Eustachian tube into the tympanic cavity.

If the perforation is small probably drainage is insufficient, and the perforation should be enlarged. Together with this, inflation, and suction with Siegle's speculum, should be employed.

Polypi.—They may be single or multiple, and nearly always have origin from the tympanic cavity. There are two chief types—the soft multiple polypi and the large single fibrous polypus. It should always be remembered that a polypus is not a disease, but merely a symptom of disease. It should always be removed. The wire loop of a Wilde's snare is passed over the polypus and the snare is then pushed along the upper border of the meatus until it almost reaches the tympanic membrane. The loop is then tightened and the polypus removed by gentle traction.

Subsequent treatment consists in syringing the ear and instilling spirit drops. Unless the polypus is extremely small and its attachment can be seen and its base cauterized, it invariably recurs, owing to the underlying bone disease. My experience is that in multiple polypi, and even in single polypi occurring in chronic middle-ear suppuration in which the hearing is bad, the best method of treatment is to perform ossiculectomy. This operation has given me the most successful results, both as regards curing the discharge and improving the hearing.

In attic suppuration, owing to the ossicles being affected, and especially if they are bound down by adhesions and causing extreme deafness, ossiculectomy should be advised, unless cure is soon obtained by conservative measures.

Operation of Ossiculectomy. This should be performed under a general anaesthetic. The surgeon must work by reflected light. The operation must be performed methodically, and not in the old-fashioned manner of wildly curetting out the ear without seeing what is being done.

The steps of the operation are: to make an incision round the tympanic membrane to free the handle of the malleus, to pass a sharp ring knife round the malleus up beyond the attachment of the tensor tympani muscle, which is thus cut through, and then to lever out the malleus

by gentle traction. Zeroni's incus hook is then passed into the attic, and by rotating it backwards and downwards the incus is easily removed. The outer attic wall is then punched away with special forceps. The region of the Eustachian tube is curetted, but the rest of the inner wall of the tympanic cavity, especially the region of the stapes, is left untouched.

After-treatment consists in regular syringing, and in instilling spirit drops until the discharge ceases. In most cases there is no recurrence of the polypi. The remains of the drum may cicatrize over, but a perforation, if left, may be large, but does no harm, as the cause of the disease has been removed. If a cure does not take place it means that not enough has been done, and the complete mastoid operation may be indicated. H. T.

ACUTE INFLAMMATION OF THE MASTOID PROCESS

Acute Inflammation of the Mastoid Process is practically always secondary to acute middle-ear suppuration. In some cases, especially after pneumococcal infection, the middle-ear inflammation may have subsided before the symptoms of the mastoid disease show themselves. It is impossible in the early stages of middle-ear suppuration to say definitely whether acute inflammation of the mastoid process will occur or not. The predisposing factors depend on the virulence of the micro-organisms present, the resistance of the patient and the anatomical relationships of the mastoid process and the middle ear.

Symptoms. There is usually a history of acute middle-ear suppuration of some two to four weeks' duration. In spite of profuse discharge there may be a slight rise of temperature in the evening and some feeling of fullness and heaviness in the head on the affected side, accompanied by pain or tenderness over the body of the mastoid process. On the other hand, especially after influenza, the onset of the mastoid inflammation may be exceedingly rapid, necessitating its being opened within three or four days. In these cases there may be intense earache and pyrexia, and in children vomiting, convulsions, or symptoms of cerebral irritation. Again, if the involvement of the bone is a gradual process, and if the line of resistance is not great, for instance, in the pneumatic type of mastoid, there may be no constitutional symptoms at all, the first sign being a swelling behind the ear, due to a subperiosteal abscess. As the surface of the bone becomes involved periostitis develops, with increasing tenderness over the mastoid region, and on palpation the outline of the bone can no longer be made out, its surface feeling smooth

and thickened. Eventually a fistula makes its way through the cortex of the bone, with the formation of a subperiosteal abscess. As this increases in size the ear becomes pushed downwards and outwards. On inspecting the auditory canal the upper posterior part of its inner surface close to the tympanic membrane may be found to be bulging downwards. This is characteristic of acute mastoid inflammation.

In **Bezold's Mastoiditis**—that is, when a fistula has formed through the inner surface of the mastoid process instead of through its outer wall—the pus escapes into the digastric fossa beneath the sterno-mastoid muscle, forming a deeply situated abscess in the neck. This is usually accompanied by an indefinite infiltration of the subcutaneous tissues, giving rise to a tender and semi-fluctuating swelling which is continuous with the mastoid process. As the abscess approaches the surface the skin may become red and cedematous over a considerable distance down the neck, and the head is usually held over towards the affected side in order to relieve tension.

Diagnosis. In a typical case diagnosis is easy, but two other conditions must be differentiated from it: namely, (1) an abscess of the post-aural lymphatic gland, and (2) furunculosis of the external auditory canal.

In the former the diagnosis is certain if there is no otorrhœa, and if on inspection the membrane is found to be normal. If there is middle-ear suppuration, the auricle is found not to project, and the abscess to be situated definitely behind it; and in addition there are no symptoms pointing to mastoid disease.

In furunculosis the diagnosis may be extremely difficult. For the sake of clearness the chief symptoms are tabulated—

FURUNCULOSIS

Onset and course rapid: symptoms most marked at the end of third day.

Pain intense, increased on mastication and movement of auricle and on pressure with finger in front and below tip of mastoid process.

Auricle may be swollen and congested, and may project slightly outwards.

ACUTE MASTOID DISEASE

Onset gradual, not beginning before the third week after the onset of the acute middle-ear suppuration.

No pain on mastication nor movement of auricle, but tenderness on pressure over the body of the mastoid.

Auricle normal, but projects downwards and outwards from the head.

FURUNCULOSIS

There may be pitting of the skin on pressure owing to superficial oedema, which may extend over a large area above and behind the ear.

The external meatus is obstructed by one or more localised swellings which are extremely tender on probing.

The discharge is slight and seems to come from the apex of the furuncle.

On examination with a speculum the drum may be seen to be intact.

If the meatus is not completely obstructed, the hearing may be normal.

In both these conditions, if the diagnosis is doubtful, it is wiser to give an anæsthetic and make a post-aural incision, when not only can the abscess, if present, be drained, but the surface of the mastoid process can be carefully examined.

Treatment. In addition to the general treatment prescribed for acute middle-ear suppuration, the treatment may be divided into "conservative" and "operative."

1. *Conservative treatment* can only be expected to arrest the progress of the inflammation if the bone itself has not yet become actually involved. The tympanic membrane, if not already perforated, should be freely incised, or an existing perforation enlarged.

Cold applications to the mastoid process by means of an ice-bag are advocated by some, but personally I consider them quite useless. In short, conservative treatment is synonymous with expectant treatment. Narcotics may be given to induce sleep, but great care must be taken that their sedative effect does not mask the symptoms of the disease.

In infants, owing to the fact that the squamo-mastoid suture is still patent, free paracentesis may cause all the acute symptoms of mastoid inflammation to subside, but in an adult this is hardly possible.

2. *Operative Treatment.* The object of operation is to expose the antrum in order to permit

ACUTE MASTOID DISEASE

There may be pitting of the skin on pressure due to inflammation of the subcutaneous tissues over which the skin itself is usually freely movable.

The meatus may be swollen from general thickening of its walls.

The discharge is profuse and, on cleaning the ear, may be seen to pulsate.

On examination with a speculum a perforation will be seen.

There is usually marked deafness.

of free drainage, and also to remove any diseased bone. Excepting when the infection has been very virulent, as in diphtheria or scarlet fever, the walls of the tympanic cavity and the ossicles themselves remain longer unaffected than does the mastoid process. For this reason operative treatment is limited to the mastoid process itself, and the greatest care is taken not to injure the tympanic cavity, so that complete restoration of hearing may be obtained.

Operative treatment consists of (1) Wilde's incision or (2) Schwartz's operation.

Wilde's Incision. This is a post-aural incision down to the bone. It is only justifiable in tiny infants in whom a sub-periosteal abscess may exist without there being any definite bone disease.

Schwartz's operation consists in making a free opening through the mastoid process so as to expose the antrum, but without interfering with the tympanic cavity and its contents.

Indications for Operation—

1. If, in spite of free drainage from the tympanic cavity, earache, pyrexia and tenderness over the body of the mastoid process do not abate within two or three days of their onset.

2. If there is an abscess over the mastoid process.

3. If, in spite of free drainage, there are symptoms of meningeal irritation.

4. If there is profuse otorrhœa lasting over four weeks, with "sagging" downwards of the upper posterior wall of the auditory canal.

5. If, in spite of no symptoms, there is no cessation of the otorrhœa after eight weeks.

In this case continuance of the otorrhœa is due to the accumulation of pus in a large antral cavity. The object of the operation is to permit of free drainage, and so prevent the involvement of the bone itself, and to restore the hearing.

In some cases of chronic otorrhœa the simple operation may be advocated, instead of the radical mastoid operation, provided there is no evidence of polypi, granulations or diseased bone, and also if there is no internal-ear disease.

Schwartz's operation differs from the "radical" operation in that the tympanic cavity is not interfered with, no matter how much of the post-meatal wall is removed.

Technique of Operation. The head is shaved over the mastoid region, and the surface of the skin and auricle painted with two per cent. of iodine in rectified spirit or rubbed with iodox. A curved post-aural incision is made half an inch behind the auricle, following its line of attachment. With a periosteal elevator the soft tissues, including the periosteum, are separated from the bone until the posterior margin of the auditory canal is exposed. Points to be noticed are—

Above, the posterior root of the zygoma—in

front, Henle's spine—below and behind, the insertion of the sterno-mastoid fibres. The bone is removed by means of a gouge and chisel, keeping parallel with the direction of the auditory canal until the antrum is reached. If a fistula already exists a probe is inserted and the bone removed along its direction. The opening should be of such a nature that it is funnel-shaped, the apex of the funnel being directed towards the aditus. The antrum is recognized by the smooth lining of its wall, and at its upper and innermost point a bent probe may be passed into the small opening of the aditus leading into the tympanic cavity.

All the cells of the mastoid process which may be opened during the operation should be removed, and, provided the innermost ridge of the bone forming the outer wall of the aditus is left, it does not matter how much bone is removed in order to reach the limit of the disease, even if this necessitates exposure of the dura mater above, the lateral sinus behind, and removal of the tip of the mastoid process below.

If the tympanic membrane has not been freely incised this should be done at the time of the operation, to ensure free drainage. Some fluid should be syringed from the posterior wound, through the aditus, into the tympanic cavity, so that it flows out of the external auditory canal. After cleansing the part a gauze drain is inserted into the auditory canal and the posterior wound is packed evenly from the bottom. The upper and lower angles of the wound may be closed by stitches, but the main part should be left open. A superficial dressing and bandages are then applied.

After-Treatment. As a result of the operation the temperature becomes normal and the pain diminishes, and within twenty-four hours the patient as a rule feels perfectly well. The first dressing, if necessary under an anæsthetic, should take place on the third day, the packing being removed, and the wound irrigated with a mild antiseptic lotion and repacked. As a rule the discharge from the tympanic cavity ceases at once. The posterior wound is dressed every second day, or daily, according as may be necessary, until it has completely healed, usually a matter of about six weeks.

If the outer portion of the posterior wall of the auditory canal has been removed, care must be taken to keep the auditory canal open by careful plugging, otherwise, owing to the separation of the fibrous portion from its bony attachment, stenosis of the auditory canal may occur from its being pushed forward by the packing of the posterior wound.

Results. Usually the hearing becomes normal even before the posterior wound has healed. Continuance of the discharge from the ear means disease of the walls of the tympanic

cavity; non-healing of the wound posteriorly, that all the diseased bone has not been removed, or that some mucous membrane lining the mastoid cells still remains.

Complications of Acute Mastoid Disease.—

(1) Extradural abscess. This may give rise to no special symptoms. If the bone disease extends above towards the tegmen tympani, or backwards towards the lateral sinus, these structures should be exposed in order to prevent such a condition being overlooked. (2) Meningitis, (3) septic infection of the lateral sinus, and (4) intracranial abscess are met with, but are more usually seen as sequelæ of chronic mastoid disease.

H. T.

CHRONIC INFLAMMATION OF THE MASTOID PROCESS

This is usually a sequela of chronic middle-ear suppuration, but may follow on acute inflammation of the mastoid process which has temporarily subsided and not been operated upon, or on which an incomplete operation only was performed, or a Schwartz's operation badly performed.

Symptoms and Course. The tympanic cavity usually shows signs of chronic suppurative disease, such as granulations, polypi, fistulæ, or the presence of cholesteatomatous débris. Frequently there are no symptoms except attacks of headache on the affected side, neuralgic pains, dizziness, or an apparent bilious attack, probably due to some temporary obstruction to the outflow of the discharge.

If pyrexia occurs it is a danger signal, as it may be a premonitory symptom of some impending intracranial complication. Unless an acute exacerbation of the inflammatory process occurs, there may be no external signs of the disease.

Diagnosis. If there are no acute symptoms or external signs, the diagnosis depends on the history and the evidence of disease within the tympanic cavity, especially the presence of fistulæ.

Granulations protruding through a fistula of the posterior wall of the auditory canal have to be diagnosed from a simple polypus springing from the tympanic cavity, and from furunculosis of the auditory canal.

An acute inflammation of the mastoid process superimposed upon the chronic condition has also to be diagnosed from primary acute mastoiditis. Here again the history of the case and the appearance of the tympanic membrane and cavity have to be taken into account.

Treatment. Provided conservative treatment has been faithfully carried out and failed, operative treatment may become necessary to eradicate the disease.

The operation to be performed is the "complete mastoid operation." The "complete" operation consists in converting the mastoid cells, the mastoid antrum, attic and tympanic cavity into one large cavity. To do this the posterior wall of the external auditory canal has to be removed, and with this the outer wall of the attic. The chief difference between this operation and Schwartze's original operation is that in the latter the tympanic cavity and its contents are not interfered with, and that in the complete operation, where this is done, the hearing power cannot be restored to normal.

Indications for Performing the Complete Mastoid Operation. (1) *As a prophylactic measure*, in order to avoid the risk of any future intracranial complication.

If a chronic middle-ear suppuration continues in spite of conservative treatment, the question of operation should be discussed with the patient. If the perforation is central, and if conversation can be heard farther off than twelve feet, the persistence of the otorrhoea may be due to a chronic empyema of the antrum, and Schwartze's operation may be sufficient; but if deafness is extreme, or if the ossicles are bound down by adhesions to the inner wall of the tympanic cavity, the complete mastoid operation may be advised, as it will not make the hearing worse, and cure will be more certain than as a result of Schwartze's operation. Also a complete operation is sometimes justifiable in those cases in which a patient intends going to some country where a sufficiently skilled surgeon could not be obtained to operate if the occasion arose.

(2) The recurrence of polypi and granulations within the tympanic cavity in the upper posterior quadrant. (3) The presence of cholesteatoma. (4) Fistulae of the bony walls of the mastoid process. (5) Recurrent attacks of giddiness, nausea, and headaches radiating up the affected side, these being symptoms of the retention of pus within the antrum or mastoid. (6) Stenosis of the external meatus, preventing free drainage, with periodical symptoms of retention of the purulent discharge. (7) Facial paralysis—this may mean either that there is bone disease around the facial canal, or that the inflammatory process has spread through the Fallopian canal towards the inner ear. (8) Tuberculosis of the middle ear. If the patient's condition permits of it the complete operation should always be done, in order to remove all the diseased bone. (9) In acute inflammation of the mastoid process occurring in the course of chronic middle-ear suppuration. (10) Intracranial suppuration. The mastoid operation should be performed as the first stage of the operation, since otitic intracranial suppuration always has origin by contiguity from

the primary focus. (11) Internal ear disease. During the course of mastoid disease the patient may get marked attacks of giddiness, accompanied by vomiting and lateral nystagmus, most marked towards the affected side. This is due to an irritative lesion within the labyrinth, frequently to a fistula of the external semicircular canal. The complete operation is usually sufficient. In any case, if the internal ear has to be exposed the complete mastoid operation is the first stage of the operation.

The complete mastoid operation should not be attempted except by an expert. Unless all the bone is thoroughly removed a successful result will not be obtained. To remove all this bone is often a matter of difficulty, and, unless in expert hands, of considerable danger to the patient.

The chief difficulties and dangers of the mastoid operation are injury to (1) the facial nerve, (2) the external semicircular canal, (3) the dura mater of the middle fossa and (4) the lateral sinus.

The complete mastoid operation necessitates entire removal of the posterior wall of the auditory canal down to the level of the facial nerve and external semicircular canal at its innermost point. In some cases part of the floor of the auditory canal has also to be removed, and in every case also the overhanging outer wall of the attic.

Operation. The stages of the operation consist in first performing Schwartze's operation, but if the operator be very experienced he can chisel directly into the auditory canal without doing this. Supposing Schwartze's operation be done, the next stage is to pass a bent probe or seeker through the aditus into the tympanic cavity. Whilst leaving it in this position, all the posterior wall can be removed superficial to it, the facial nerve lying below its level. The outer wall of the attic is next removed, so that the roof of the middle ear and antrum form a smooth continuous surface. Any granulations within the ear are gently curetted away, and the malleus and incus, if present, are also removed. I do not believe in leaving the malleus and incus. It is a fallacy to suppose this improves the hearing. If it does do so, it means the complete operation should never have been performed, as Schwartze's operation would have been sufficient. If there are any granulations within the ear or any disease about the ossicles themselves, even if all discharge ceases after the complete operation, the post-suppurative adhesions in the tympanic cavity will bind down the ossicles so closely that hearing will be rendered worse than it would otherwise have been if these bones had been removed.

The final stage of the operation is to form a flap of the fibrous portion of the auditory canal. The edge of the post-aural skin wound should

then be sutured, and the ear packed from the front. Under the following circumstances the posterior incision should be left open, so that the wound cavity may be packed from behind as well as in front.

1. If there is an abscess over the mastoid process.

2. If there is extensive disease of the bone, necessitating exposure of the dura mater and lateral sinus.

3. When there is bone disease of the anterior and inferior part of the tympanic cavity.

After-treatment consists in regularly packing the ear with sterilized gauze, the first dressing usually being necessary on the third day, and then as frequently as may be necessary. In a straightforward case skin grows in over the wound surface so that complete healing takes place within two months. After the tenth day the stitches can be removed from the posterior skin incision, and the patient is then able to go about and, in case of urgency, to attend to his business.

Some advocate skin-grafting. Personally I have had better results without it. The chief reasons for failure of healing after the complete operation are: (1) incomplete removal of all the diseased bone, (2) patency of the Eustachian tube owing to its mucous membrane not having been thoroughly curetted away, (3) faulty after-treatment.

The after-treatment is as important as the operation. The ear should be thoroughly inspected at each dressing. Any exuberant granulations should be touched with chromic or trichloroacetic acid, or if necessary removed with a curette. The recurrence of granulations means underlying bone disease, probably a small spicule, on the exfoliation of which healing will at once take place.

Hearing after the Operation. This depends upon the condition of the ear before the operation. If there is very marked deafness, due partially to internal-ear deafness (such as after scarlet fever), no increase of hearing power will occur. I consider twelve feet off for conversation a good average. In many cases one gets even better results. Sometimes, indeed, the hearing becomes almost normal. In these cases although there has been almost complete deafness before the operation, this has been due to the middle ear being filled up with granulations, on removal of which, if no adhesions occur, the stapes once more is able to vibrate freely in the fenestra ovalis.

Complications. Within two days after the operation the patient should be practically well as regards his general health. The onset of facial paralysis occurring not immediately after the operation is traumatic, from which the patient will soon recover. Facial paralysis

occurring in addition with other symptoms, such as vomiting, nystagmus and internal-ear deafness, means that the labyrinth has become infected, probably from too violent curetting. This may end in meningitis. Subnormal temperature, slow pulse and drowsiness is suggestive of an intracranial suppuration which has existed for some time and which the concussion due to chiselling during the operation has aggravated.

Rigors, and other symptoms of septicæmia, point to involvement of the lateral sinus; photophobia, pyrexia, mental irritation, and vomiting to meningitis. Fortunately it is extremely rare to see such complications after the complete mastoid operation, but the practitioner must always be on the look-out for such possibilities, especially if the convalescence of the patient after the operation does not take a normal course.

H. T.

INTRACRANIAL COMPLICATIONS OF OTITIS MEDIA

Bacterial invasion of the brain and its membranes is an ever-present danger in suppurative disease of the ear and mastoid cells. It may supervene upon acute inflammation of these parts, but more commonly follows chronic disease where carious bone is present. Acute local symptoms grafted upon chronic disease of the middle ear commonly precede the intracranial complications. This circumstance provides difficulties in diagnosis, because many of the symptoms of intracranial extension may be present and due to the local acute condition alone. Thus headache, vomiting, and vertigo may be produced by labyrinthine disease.

The intracranial complications may be grouped under four headings—

1. Extradural abscess.
2. Meningitis.
3. Sinus thrombosis.
4. Cerebral and cerebellar abscess.

It is to be noted that more than one of these complications is commonly present at the same time, for example, a generalized meningitis and sinus thrombosis.

1. **Extradural Abscess.**—In these cases the pus lies outside the dura mater, usually in close contact with the diseased bone. The commonest situation is in or near the lateral sinus groove. These abscesses present few special signs by which they can be recognized, and are most often encountered accidentally during a complete mastoid operation undertaken for the relief of acute symptoms. The presence of such an abscess may be suspected if, in the absence of definite symptoms of sinus thrombosis, a localised area of acute tenderness and œdema is discovered behind the posterior limits of the

mastoid process. Optic neuritis is present in a certain number of these cases, even when unaccompanied by intradural complications. It is probable that this is evidence of increased intracranial pressure due to excess of cerebrospinal fluid, the so-called "meningitis serosa." The *treatment*, which is urgently called for, consists of the free removal of bone over the extradural collection of pus, as well as the complete mastoid operation.

2. Meningitis.—Suppurative meningitis originating from disease of the middle ear proves fatal in the great majority of cases.

The clinical features are those of an acute septic illness complicated with increased intracranial pressure, together with irritative or paralytic affections of the central nervous system. The symptoms, therefore, which make up the clinical picture are fever, headache, vomiting, optic neuritis, irritability and photophobia; unequal pupils and squint; retraction of the head, rigidity of the limbs, and convulsions. Later, as the intracranial pressure increases, stupor supervenes, and the patient passes into a state of coma. Lumbar puncture yields a fluid, under pressure, which is turbid and contains polymorphonuclear leucocytes and micro-organisms.

Treatment. Repeated lumbar puncture has occasionally been followed by good results. Attention must of course be paid to the opening up and disinfection of the primary focus in the middle ear and mastoid process. The operation of sub-temporal decompression and drainage of the subarachnoid space has occasionally been followed by recovery. If the causative organism has been identified, vaccine or serum treatment may be instituted.

3. Sinus Thrombosis.—The lateral sinus, being in close relation with the diseased bone, readily becomes the seat of a phlebitis and septic thrombosis. Extension occasionally takes place along the petrosal sinuses to the cavernous sinus, a complication which is recognized by proptosis and ophthalmoplegia, first on one side and rapidly extending to the opposite side. Headache and vomiting are usually present, and in many cases optic neuritis is also noted. (Edema and tenderness over the sinus and tenderness along the course of the internal jugular vein are also commonly found, and in some instances the cord-like thrombosed internal jugular vein can be felt. But the outstanding features are the symptoms of pyæmia which sooner or later make their appearance, namely rigors, profuse sweating and signs of metastatic abscesses.

Immediate operation offers the only chance of recovery. The first step is to ligature the internal jugular vein in the neck, so as to prevent the further entrance of fragments of septic

clot into the circulation. This is followed by the complete mastoid operation, and the bony opening is continued backwards so as to expose the lateral sinus as far back as the torcular. The sinus is then opened and the septic clot evacuated. Should hæmorrhage occur the central end of the sinus must be plugged, and the wound should be left open so as to allow of frequent syringing and thorough drainage. Vaccine or serum treatment may be employed. Any accessible metastatic foci of suppuration must be promptly dealt with (see *Pyæmia*).

4. Cerebral Abscess.—As a complication of middle-ear disease abscess of the brain is most common in the temporo-sphenoidal lobe, and next to that in the cerebellum. In a series of cases treated at St. Thomas's Hospital the abscess was situated thirty-two times in the temporal lobe, thirteen times in the cerebellum, and three times in both. In these cases other complications were present as follows: sinus thrombosis six, extradural abscess three, and meningitis ten. The abscess is most commonly situated close to the diseased bone. In the case of the cerebrum it usually overlies the roof of the tympanum or antrum, and in the case of the cerebellum it most often lies in the anterior part of the lateral lobe.

The *symptoms* of cerebral abscess, as it most commonly occurs in this connection, are those of increased intracranial pressure, together with certain localising signs. The temperature is very variable. In the more acute cases it may be high, but in the less acute cases it is raised little, if at all, above the normal. The signs of increased intracranial pressure are headache, vomiting, optic neuritis, slow pulse, and drowsiness passing gradually into coma. Of the localising symptoms of temporo-sphenoidal abscess the most prominent is weakness or paralysis of the opposite side of the body. When the abscess is left-sided, word-deafness may be present. There is also a characteristic slowness of cerebration which is of great importance. The patient both hears and understands questions, but takes a long time to answer; when he does so he gives a correct answer. This state must not be mistaken for aphasia.

In addition paralysis of the third cranial nerve is frequently present.

Among the symptoms of cerebellar abscess are to be noted a staggering gait, with a tendency to fall towards the side of the lesion; inco-ordination, giddiness, occipital headache; retraction of the head, which is inclined towards the shoulder on the same side as the abscess, and nystagmus. Weakness of the limbs on the same side of the body may occur, and the deep reflexes tend to be diminished. The respiration may be increasingly slowed until, unless relief of the pressure is afforded, it ceases altogether.

Treatment. The primary source of infection is first dealt with by performing the complete mastoid operation. The bony opening is then extended so as to expose the middle or posterior fossa, according to the situation of the abscess. The dura mater sometimes presents a yellowish appearance in the neighbourhood of the abscess, and if the pus lies close beneath it may be deeply congested or even gangrenous and sloughy. The dura is to be opened as close to the supposed site of the abscess as possible, and an incision made into the brain substance with a scalpel: Exploration with a trocar and cannula is fallacious and is not to be recommended. The abscess having been found, a finger should be gently thrust into the cavity so as to enlarge the opening sufficiently, and a rubber drainage tube inserted and fixed in place by a stitch passed through the dura mater.

P. W. G. S.

DISEASES OF THE INTERNAL EAR

Deafness of Internal Ear origin may be of any grade. When deafness is total, it is always labyrinthine, and is usually associated with some loss of function in the vestibular section of the labyrinth. Such deafness may be recognized by the following features—

Deafness for High Tones.—The patient cannot hear shrill sounds, such as the squeak of a bat or even of a mouse. The exact degree of the condition may be ascertained by a Galton's whistle. The note of a C⁴, or better C⁵, tuning-fork is lost early. For the same reason the watch-tick is relatively badly heard compared with the voice in a quiet room.

Loss of Perception through the Cranial Bones.—The note of a tuning-fork of medium pitch (C¹ or C²), placed on the mastoid is lost by the patient, while it can still be heard on the mastoid of a normal person. Except in high grades of labyrinthine deafness the tuning-fork can be heard by the patient at the external auditory meatus after he has lost it on the mastoid (positive Rinne reaction). The loss of perception through the cranial bones is made more evident by blocking both the patient's ear and that of the investigator firmly by the finger, thus eliminating the effects of any concurrent middle-ear deafness (absolute bone-conduction).

Total deafness in one ear is often overlooked, the fork on the mastoid of the deaf side being heard across the base of the skull in the opposite ear and referred to the deaf ear. Total loss of perception can be demonstrated by the help of Bárány's noise producer in the sound ear; when this is applied the fork is no longer perceived at all on the affected mastoid.

Generally, the subjects of deafness of internal-ear origin hear badly in a noise, and have great

difficulty in hearing in mixed conversation. In a quiet room they often hear surprisingly well. They are very little helped by raising the voice, and cannot hear the telephone. They hear deep voices better than high-pitched ones.

Causation. Labyrinthine deafnesses may be divided in their origin into those due to middle-ear suppuration with secondary infection of the labyrinth, and those due to non-infective conditions of the labyrinth.

Labyrinthine Deafness associated with Middle-ear Suppuration may be partial or total. The partial cases are due to blocking of the round window, to secondary degenerative changes in the cochlea, or to mild inflammation in the cochlea of a non-suppurative variety (serous labyrinthitis). In serous labyrinthitis vertigo is present at the onset, with the deafness. Deafness of this origin is not infrequently found in cases in which all active middle-ear suppuration has ceased, as in long-standing deafness which is being rendered more evident by advancing age. Total deafness in a case of middle-ear suppuration is presumptive evidence of pyogenic invasion of the labyrinth, to be confirmed by total loss of function in the vestibule and canals on the same side. In a considerable proportion of the cases of spontaneous facial paralysis which occur in the course of chronic otorrhœa, there will be found to be total deafness, together with loss of function of the vestibule and semicircular canals, due to general infection of the labyrinth. It is rare for healing to take place in an infected labyrinth except after drainage by operation; the radical mastoid operation is inadequate for the cure of these cases, and the lack of appreciation of this is the cause of a proportion of failures to effect the drying up of a discharge after the radical operation. Occasionally, however, the infected labyrinth becomes obliterated by bone and healing takes place.

Labyrinthine Deafness without Middle-ear Suppuration may be due to a variety of causes. In most cases there is nothing in the appearances of the membrane to enable a differential diagnosis to be made by its inspection.

(a) **Family Degenerative Deafness** develops slowly as a pure labyrinthine affection; it usually begins to be obvious during the third decade, and may advance steadily or may become arrested. It never becomes total. Under physical or mental strain, or in severe illness, it is apt to make rapid progress. It is a true hereditary condition, and is not to be confused with the deafness of families who have been allowed to grow up with untended adenoids. The membranes, unless through accidental conditions, are normal. Some members of a family may have otosclerosis, while others manifest this degenerative family deafness.

(b) In a large proportion of cases of otosclerosis in the later stages, and in some from the very beginning, there is associated with the characteristic middle-ear deafness a labyrinthine element which may overshadow in importance the fundamental condition. It will be detected without difficulty by the usual tests. Its importance is mainly prognostic, its occurrence diminishing the chances of spontaneous arrest of the progress of the disease.

A secondary labyrinthine deafness is also often found in the later stages of chronic catarrhal deafness with middle-ear reactions.

(c) The **Deafness of Old Age** is commonly labyrinthine in type, and depends on arteriosclerotic changes in the vessels of the cochlea. A general arteriosclerosis is usually obvious.

(d) **Syphilitic Deafness** occurs both in the acquired and in the inherited form of disease. Acquired syphilis is the commonest cause of labyrinthine deafness of high grade in adults up to middle age. Its onset is rapid, and it may be accompanied by vertigo. An almost total deafness may result. In inherited syphilis the onset is usually between the ages of ten and fifteen; the loss of hearing is severe, and there is associated loss of function in the posterior labyrinth. A concurrent interstitial keratitis is very common. In all cases of doubt, whether in acquired or congenital cases, a Wassermann reaction should be carried out.

(e) **Toxic Deafness** due to quinine and salicylates is occasionally met with. It is of labyrinthine type. That due to salicylates generally disappears rapidly when the drug is discontinued; that caused by quinine is often in part permanent. Both are accompanied by tinnitus. The heavy abuse of tobacco may also bring about a labyrinthine deafness, generally temporary.

(f) **Labyrinthine Deafness** due to the cumulative effects of vasomotor spasm is often found in those cases of paroxysmal vertigo due to this cause. See later under "Vertigo."

(g) **Congenital Deafness** is sometimes due to maldevelopment of the internal ear. In these cases there may be associated deformity of the middle-ear tract and of the external ear. In the majority of cases congenital deafness is probably central in origin.

Treatment of labyrinthine deafnesses is in the nature of things unsatisfactory. Damage to the cochlea of any standing is incurable; recent inflammatory changes in the cochlea occasionally undergo partial resolution, with improvement in hearing. It is exceedingly doubtful whether any form of local treatment is ever of any help in securing improvement which would not have occurred without interference. It is thus of great importance that the diagnosis should be correctly made, so that the patient's

time and the doctor's credit should not be wasted in a hopeless endeavour. The effort to preserve hearing from further loss is, however, of great importance. Here treatment is for the most part general. Care in diet, a healthy life free from strain and anxiety, the avoidance of pregnancy in women, stoppage of lactation where this is going on, and searching out and remedying all causes of chronic toxæmia are of the greatest value. It is the author's belief that intestinal and oral sepsis are responsible for a large number of cases of labyrinthine deafness. Under improved general conditions and tonics the functional condition of many patients with labyrinthine deafness improves considerably. It is of great importance that the patient should be given as encouraging a prognosis as possible. Mental depression and obsession with the idea of hopeless deafness produce the worst effects. Much needless unhappiness is caused by pessimistic frankness.

The traditional local treatment of labyrinthine deafness is by counter-irritation over the mastoid. It can at least do no harm. Either iodine or Spanish fly may be used, the skin being kept slightly sore for several weeks. In syphilitic cases treatment by mercury and iodide should on general grounds be resumed if it has been suspended. It is held with some probability that the use of salvarsan in recent syphilitic deafness may cause an arsenical neuritis of the auditory nerve and only make the condition worse. The writer has seen good result from the use of salvarsan in syphilitic deafness only very occasionally: he does not recommend the use of pilocarpine in these cases.

The treatment of the cases of labyrinthine deafness with middle-ear suppuration is on an entirely different footing. The deafness is equally incurable, but where there is evidence of general infection of the labyrinth we have one of the clearest of all the indications for operation. Patients in this condition run a continued risk of grave intracranial accidents, those characteristic of the condition being meningitis and cerebellar abscess. The treatment is by radical mastoid operation combined with vestibulotomy. Complete healing of the infected labyrinth almost invariably results, the after-course being that of an ordinary radical mastoid operation. The special risks of the operation are very small; they are of facial paralysis and meningitis. In skilled hands the nerve runs very little danger even of temporary damage. In the author's cases the mortality has been between two and three per cent. from meningitis.

Tinnitus is a troublesome accompaniment of partial labyrinthine deafness, of whatever origin. It can be best controlled by the use of hydrobromic acid (half-drachm doses of the dilute

acid with ten grains of ammonium bromide) given steadily; in some cases the tinnitus seems to be permanently relieved by such a course. With the advance of the labyrinthine condition the tendency is for the tinnitus to die out.

Labyrinthine Vertigo.—Both in suppurative and in non-suppurative conditions of the ear vertigo of labyrinthine origin is common. The condition is never a constant one, but always more or less paroxysmal; the sensation is definitely one of rotation in the majority of cases, either, as is common, in a horizontal plane, or more rarely in a vertical or oblique plane. Either the subject or objects may appear to rotate, according as the position of the assumed fixed point lies external to or within the subject. A mere sensation of uncertainty or of the wavering of objects is not vertigo, and when of labyrinthine origin is the result of past destruction or impairment, not of present irritation. The paroxysms of vertigo are sudden, often of great violence, causing the patient to fall or to grasp hold of things to prevent a fall; they are followed by vomiting in most cases, and may last from a few minutes to several hours. There is no loss of consciousness. Labyrinthine vertigo must be diagnosed from epilepsy, neurosis, ocular vertigo, "biliousness," from eighth-nerve tumour, and from cerebellar disease, tumour or abscess. The diagnosis is often difficult. The epileptic falls, but loses consciousness; there may be tongue-biting and passage of urine. In some cases of petit mal, however, a temporary vertigo is the form which the seizure takes. Rarely has there at no time been a major fit. The patient's memory of the seizure is defective. The neurotic complains of swimminess and indefinite sensations rather than of true vertigo; the associated auditory changes may be absent. Ocular vertigo is also indefinite, and there is complaint of eye-fatigue, and generally astigmatism. In a bilious attack the onset is gradual, nausea or headache precedes the attack of giddiness, there are visual spectra, vomiting brings relief. In intracranial tumour symptoms of pressure, headache, optic neuritis, vomiting independent of giddiness may be expected.

The *causes of labyrinthine vertigo* may be grouped as Infective and Non-infective. The *Infective* examples are almost always associated with chronic middle-ear suppuration, rarely with recent acute otitis media. Vertigo under these conditions may be due to mere superficial infection of the bony labyrinthine capsule, to perforation of the capsule without infection of the cavity of the labyrinth, or to invasion of its interior with partial or complete destruction of the membranous labyrinth. In the two former cases we have to deal with a still functionally intact organ, in the latter with impaired or

completely lost function. The differentiation of these conditions may require the greatest care and experience to carry out properly. The essence of the tests applied is the estimation of the degree of response yielded to measured stimulation of the internal ear, first as regards the cochlea, then as regards the posterior section of the labyrinth. For the former we employ the various tuning-fork tests with Bárány's noise-producer, for the latter the appropriate stimuli are furnished by rotation and the application of heat and cold to the wall of the vestibule. Electrical stimulation has not so far proved of value. The occurrence of vertigo in connection with suppurative middle-ear processes is a serious warning of the advisability of operation; it may be the signal of the urgent need for surgical interference. The extent of the operation, and in particular whether it is to include the opening and drainage of the internal ear, must be determined by the results of testing in the individual case. In general, where there is evidence of diffuse infection of the labyrinth, that labyrinth ought to be drained, unless the labyrinthitis is mild and the loss of function incomplete. Where the mischief is confined to the parts outside the membranous labyrinth, a radical mastoid operation will prove sufficient.

The two most important conditions of labyrinthine infection are **Acute Diffuse Labyrinthitis** and **Chronic Diffuse (so-called Latent) Labyrinthine Infection**. In *Acute Diffuse Labyrinthitis* there is sudden vertigo, pain in the ear and head, vomiting, and fever. For a time the patient is entirely incapable. There is violent spontaneous nystagmus. The special danger of this stage is meningitis. In *Chronic Diffuse Labyrinthine Infection* there may be no symptoms complained of in addition to the discharge, which is always present. On investigation there is found total deafness in the affected ear, combined with loss of all labyrinthine excitability by rotation or thermal stimuli. These patients run a continued risk of any of the usual intracranial complications, but especially of cerebellar abscess. In many cases of chronic diffuse infection, however, there is still vertigo on exertion or with incautious movements of the head. Cases of chronic diffuse labyrinthine infection should be submitted to an operation on the labyrinth by which healing can be secured and the risks terminated, viz. an inferior or double vestibulotomy as the case may require. The results of operation on the labyrinth in these cases are very satisfactory, the ear almost always becoming completely dry, a result which in many cases cannot be attained by any means short of drainage of the labyrinth.

Non-infective Vertigo of Labyrinthine Origin

may be caused by a variety of conditions. The attacks are paroxysmal, but there may be more or less continued unsteadiness. The group of symptoms, vertigo, vomiting, labyrinthine deafness, is still often called Menière's Disease. It may occur in the advanced stages of chronic middle-ear catarrhs with secondary changes in the labyrinth, in syphilitic labyrinthitis, (in the acquired disease, but not in congenital cases), in arterio-sclerosis, and especially in middle-aged and elderly men, often in the absence of raised arterial pressure, apparently as the result of some error of assimilation or metabolism. The attacks may often be largely controlled by careful dieting and the administration of blue pill and potassium iodide for periods of about three weeks at a time.

Tinnitus is often a very troublesome symptom in all diseases of the internal ear. The underlying condition of the cochlea must of course be treated where this is possible. The symptom is however, often amenable to direct treatment, the most useful drug being dilute hydrobromic acid in doses of half to one drachm, combined with ammonium bromide. Some cases are benefited by the administration of minimal doses of quinine, from one-eighth to one-half a grain with the bromide. On no account should cases of tinnitus with labyrinthine deafness be treated by vibration or otomassage.

Hearing Aids are of very small use in labyrinthine deafness. The best by far is a flexible speaking-tube. The voice should not be unduly raised in speaking to these patients, but great care should be taken with enunciation, and there should be plenty of tone in the voice. In quiet surroundings they will often hear fairly well, when they are completely helpless if there is any confusion of noises going on.

C. E. W.

DISEASES OF THE AURICLE

Traumatic Affections (Hæmatoma Auris).—This effusion between the cartilage and perichondrium may occur as the result of a blow or from pressure, as in boxing, football, etc., and is common in the insane—"the insane ear." In the last case a peculiar fact is that the left ear is more commonly or earlier affected than the right. The cause in the "insane ear" is probably degenerative change in the cartilage. The hæmatoma usually appears as a bluish-red swelling on the anterior surface of the helix, which may increase in size in a day or two. It gives rise to little pain and usually subsides without suppuration. After disappearance of the hæmatoma the ear may become permanently distorted—"the shrunken ear."

Treatment. If the hæmatoma is increasing in size pressure may be applied against the skull

by means of a pad in front of and behind the auricle. The prompt application of blistering fluid to the auricular surface is said to avert effusion and minimize distortion. Other treatment is expectant.

Incised wounds, tearing from traction of ear-rings, and abscess following upon piercing are also common.

Malformations (Congenital).—The auricles may be represented by a row of cartilaginous or cutaneous nodules or ridges, with or without atresia of the meatus, or the helix may be united to the tragus in a ridge.

Acquired Malformations result chiefly from perichondritis, hæmatoma auris or frostbite, or ears may be flattened or pushed out by caps.

Treatment is by plastic operations or by fitting an artificial ear.

Cutaneous Affections (Eczema).—This is usually of the seborrhœic type, and associated with seborrhœa of the scalp. It may be very acute, with swelling, redness and weeping, or occur as a more chronic variety, with formation of crusts and fissures, particularly at the junction of auricle and head and in the fossa or the helix. If neglected much thickening may result.

Treatment. In the acute stage only soothing applications, such as lead lotions or a protective powder, should be used. In the more chronic forms Lassar's paste, with two per cent. salicylic acid, or ointments of tar and sulphur of suitable strengths may be prescribed.

Impetigo is common in association with otorrhœa. It is readily curable with a mercurial ointment.

Herpes may affect the auricle; it only requires protection.

Lupus occurs when other parts of the face are affected.

Syphilis occurs, but is rare.

Perichondritis may affect the auricle primarily or may follow furunculosis. It begins as a swelling at the orifice of the external auditory meatus resembling a boil, which spreads till it involves the whole auricle except the lobule. The usual symptoms of acute inflammation are present and the ear stands out from the head. Suppuration results in severe cases, with consequent deformity of the ear. Expectant treatment may lead to resolution, but if pus forms early incision is advisable to avoid extensive necrosis of cartilage.

New Growths (Simple).—The commonest is fibroma of the lobule, caused by ear-rings; sebaceous cysts, angiomas and dermoid cysts also occur.

Malignant.—Epithelioma, sarcoma and rodent ulcer are seen. Treatment is that of new growths elsewhere.

E. P.

III.—DISEASES OF THE THROAT, NOSE AND LARYNX

ADENOIDS

Adenoid Vegetations or post-nasal growths are the names given to hypertrophy of the pharyngeal tonsil.

The term "adenoids" suggests that the growths are multiple and distinct. This is not the case, but owing to this mass of adenoid tissue (which is situated upon the vault and posterior wall of the naso-pharynx) being split up into lobules, these lobules are usually spoken of collectively as adenoids.

As a rule the slight amount of lymphoid tissue which may exist in the post-nasal space at birth disappears in the first few years of life, but may develop to such an extent as to become pathological.

In the majority of cases hypertrophy of the pharyngeal tonsil is accompanied by hypertrophy of the faucial tonsils, but a large amount of adenoids may be present with normal tonsils, and the converse is equally true.

No doubt adenoids have existed as long as any other disease, but more attention has been given to this condition since 1868, when it was first described by Meyer of Copenhagen.

The most frequent period for adenoids to give rise to clinical symptoms is between the ages of five and fifteen. It is, however, by no means rare to find them in infants, and even as "congenital adenoids" in the new-born. After fifteen years of age the adenoids tend to shrink in size owing to increase of connective tissue and diminution of the vascular supply.

The chief causes producing adenoids are a damp climate, the "strumous" diathesis, and any condition which favours post-nasal catarrh.

Opinions vary as to whether adenoids are hereditary or not. Although it is not uncommon in a large family for several members to suffer from adenoids, some hold that this is due to a common environment. This, however, does not explain cases where brothers and sisters, who have been born in different parts of the world, and have been brought up in entirely different surroundings and climates, all suffer from adenoids.

Symptoms. The symptoms vary exceedingly, being dependent on the size, the consistence, and the position of the adenoid vegetations.

In a typical case, say in a child of twelve years of age, the presence of adenoids will at once be suspected by the appearance of the child's face. The open mouth, the projecting and irregular teeth, the short upper lip, the

pinched-in nose, the ill-marked naso-labial fold, the drooping eyelids and indrawn inner canthus, and the stupid, vacant expression of the face, form a picture which is characteristic. This so-called "adenoid facies" is probably due to the changes which have occurred as a result of nasal obstruction from babyhood; although some authorities, such as Francis Warner, consider that the high arched palate and contracted upper jaw are not the result of, but coexist with, adenoids, and are signs of defective development. The appearance of stupidity which most of these patients present, especially if they have reached the stage of adolescence, is partly due to the "adenoid facies," partly to deafness, and partly to the condition known as "aproxesia," which will be referred to later on.

In addition there may be attacks of pyrexia, ill understood, but usually accompanied by mucous or muco-purulent secretion from the post-nasal space. These attacks are due to inflammation of the adenoid vegetations, corresponding to tonsillitis. The post-cervical glands are often somewhat enlarged, and may feel like a string of shot running down the neck. In a certain proportion of cases, some say as high as ten per cent., microscopic sections of the adenoid vegetations show presence of tubercle bacilli or caseous foci, and the possibility of tubercular infection of the post-cervical glands from this cause should be borne in mind.

The mucous membrane of the nose may be swollen, and the inferior meatus may be filled with mucus or muco-pus. The tympanic membranes are frequently retracted, dull in appearance, with slight injection of the vessels, or there may be acute or chronic middle-ear suppuration. If the child is old enough to be examined it may be found to be deaf, sometimes to a marked degree in one ear, but this perhaps has never been noticed. It may here be said that the ears are affected to a greater or less extent in over fifty per cent. of the cases, and, further, that probably about ninety per cent. of ear trouble in children is due to adenoids.

In a mild case there may be no external signs, and the only symptoms may be frequent prolonged colds in the head, and inability to blow the nose, which is often described as "dirty"; between the attacks of cold the child may be well. There may be associated attacks of earache, lasting perhaps only a day or two. With each attack, however, the earache may become worse, or there may be slight deafness, passing off after the post-nasal catarrh

has subsided. In other cases the parents complain that the child is continually coughing and is very liable to cold on the chest. This may be due to catarrh or reflex irritation of the respiratory tract.

In the majority of cases the intensity of the symptoms are proportionate to the amount of adenoids, but in some cases one is surprised at the small amount of adenoids which may have produced marked ear symptoms and nasal obstruction. In such a case the adenoids have probably extended out towards Rosenmüller's fossa and the Eustachian orifices, whilst the obstruction may be due to obstruction *within the nose itself*. This is a practical point which should never be lost sight of, since in some cases the so-called failure of the operation for adenoids is not due to the fact that they have not been thoroughly removed, but because the surgeon did not inspect the nose and at the same time remove the cause of the nasal obstruction, such as part of the hypertrophic mucous membrane of the inferior or middle turbinates, spur, or deflected septum.

Examination of the Patient. In every case of suspected adenoids a routine examination should be made of the throat, nose, ears and post-nasal space. On inspecting the throat the surgeon will probably find the tonsils enlarged, the pharyngeal wall red and studded on its upper part with nodules of adenoid tissue.

Before the diagnosis of "adenoids" is made they should either be seen or felt. In a certain number of cases, if there is a wide nasal passage on one side or the other, they may be seen even by anterior rhinoscopy. This is rare.

Examination is made by posterior rhinoscopy; or by palpation with the finger.

Posterior rhinoscopy should always first be attempted, even in the youngest children, as, if a clear view can be obtained of the post-nasal space, digital examination will not be necessary. Sometimes the post-nasal space is filled with mucus or muco-pus, preventing a good view. In such a case the nose should be gently irrigated with an alkaline solution before examination.

By posterior rhinoscopy the adenoid vegetations may be seen projecting forward as a lobulated mass, sometimes as a central pad, leaving a space between the growth and the Eustachian tubes. In other cases the adenoids appear to be slight in amount and to extend into Rosenmüller's fossa; and in others again the whole naso-pharynx seems quite blocked by the growths. A fair estimate of the amount of adenoids present can be made by seeing to what extent the growths cover the upper part of the posterior choanæ. It should be borne in mind that the image in the mirror makes the adenoids appear somewhat smaller than they really are, as the post-nasal space is seen from below. For

this reason digital examination sometimes gives a better idea of the amount of adenoids present. It also determines the character of the adenoids, whether soft and vascular or hard and fibrous.

Digital examination is performed by placing the child, if very small, on its nurse's knee, or if older whilst sitting on a chair. The surgeon stands on the right side of the patient, encircling the neck with his left arm, so as to prevent movement. With the index finger of the left hand, which supports the left side of the patient's face, the surgeon presses the cheek inwards, so that its tissues come between the teeth. This prevents the patient from biting the operator's finger during examination. The index finger of the right hand is now rapidly passed into the post-nasal space. Instead of the normal, smooth, and rounded vault of the pharynx, an irregular mass is felt.

With a little experience digital examination can be carried out in a second or two, and the educated finger appreciates not only the consistency of the adenoids, but their shape and extent. This examination should be performed very gently, as even slight palpation of the growth may cause bleeding, which the mother of the patient will resent.

Other Symptoms associated with Adenoids. In addition to aural affections, nasal obstruction, cough and bronchial catarrh, there are many other symptoms associated with adenoids, some of which are subjective, others objective, depending on the age of the patient, the amount of the obstruction, and the duration of the latter.

Nocturnal restlessness, night terrors, and night sweats are most frequent. In addition there may be nocturnal enuresis. Usually this is most marked if the child sleeps with the mouth tightly clenched and tries to breathe through the nose, which is obstructed posteriorly.

In babies, mouth breathing is not noticed so much as the inability to suck. As the infant cannot breathe through the nose it cannot suck for the proper period, but continually withdraws the mouth from the nipple in order to breathe. In the attempt to breathe and suck at the same time air is swallowed. This usually produces flatulence and vomiting after a meal; in consequence the baby becomes fretful, ill, and perhaps emaciated.

In older children who have reached the age of learning lessons it is found they are very inattentive, dreamy, and cannot fix their attention on any subject for any time. This condition was originally emphasized by Guye of Amsterdam, who called it "aproxexia."

Some consider this condition to be the result of some pathological effect directly due to the presence of adenoids, but I prefer a simpler explanation, viz. that it is due to deficient aeration of the blood, especially at night-time,

and to slight deafness. Such children are often anæmic and physically weak.

If the adenoids are abundant the voice may lose its resonance and be dead in tone. If the teeth are defective or misplaced there may be lisping or imperfection of articulation. Marked obstruction to respiration in infancy may induce collapse of the lower portions of the lungs and deformity of the chest producing the condition known as "pigeon-breast."

The presence of adenoids has been said to be the starting-point or cause of many other diseases, chiefly neuroses, but in many cases the adenoids are simply coexistent. I have, however, seen cases of epilepsy, chorea, nocturnal enuresis and certain cases of asthma greatly relieved by timely operation.

Diagnosis. In infants the diagnosis of "congenital" adenoids may be assumed if there is mouth-breathing, inability to suck, and if the nose is continually running. Two conditions, however, may simulate this: congenital obstruction within the nose or of the posterior nares (a condition so extremely rare as to be almost negligible) and congenital syphilis. In congenital adenoids the obstruction is usually noticed at birth. In syphilis "snuffling" begins about the third week or later, with excoriation of the nostrils, and usually a definite history is obtainable from the parents, or, if not, the child itself will soon show further constitutional symptoms.

In older children simple nasal obstruction due to maldevelopment of the nose, or to an abnormally small post-nasal space—especially in an ill-marked type of Mongolian idiot—has to be thought of. This is a matter of considerable importance, as a favourable prognosis may have been given on the assumption that the symptoms were due to adenoids only. Such a mistake is inexcusable, as no patient should be operated on for adenoids unless the surgeon himself has made certain, either by posterior rhinoscopy or digital examination, that adenoids are present.

In adults the adenoid tissue is usually more fibrous and hard and, in proportion to the size of the naso-pharynx, slight in amount. Possible differential diagnosis may have to be made between a fibroma, hypertrophy of the posterior ends of the inferior turbinates, post-nasal polypus, or a swelling in the post-nasal space due to early malignant disease or to a gumma.

Treatment. Although it is surgically correct to remove adenoid vegetations if present, I am personally opposed to the view that operation is advisable in every case, however slight. Operation can be advised on two grounds. Firstly on account of the local and constitutional symptoms present, and secondly as a prophylactic measure. I advise operation even

in the youngest child if there is marked nasal obstruction, repeated earache, with or without suppuration and deafness, or if there is evidence of any pulmonary affection which can definitely be proved to be due to the adenoid vegetations.

If, however, the patient has only had a cold for three or four weeks, with a general catarrh of the nose and post-nasal space, and if only a small amount of adenoids with slight enlargement of the tonsils are present, I would recommend conservative measures, because in these cases, after the catarrh has subsided, the so-called adenoids may be found to have almost disappeared, and the nose, pharynx and tonsils to be practically normal.

By conservative measures I mean placing the child in a dry and mild locality, giving a tonic consisting of equal parts of syrup of iodide of iron and compound syrup of phosphate of iron, and, if necessary, gently spraying the nose with a mild alkaline solution or giving a vapour containing camphor and menthol. (For treatment of coexisting aural affections see page 1139 *et seq.*)

The question of the benefit obtainable from breathing exercises is in dispute. The advocates of operation in every case decry breathing exercises, but others insist that they will "cure" adenoids. Both are wrong. Breathing exercises are valuable in very mild cases in assisting conservative treatment, but if the adenoids are fairly large and firm, breathing exercises cannot possibly remove them. In cases in which operation is not urgent I advocate breathing exercises in order to teach the child nasal respiration, which is an important factor in ensuring a successful result after operation.

Once the habit of breathing through the mouth has been acquired, there is usually extreme difficulty in obtaining nasal respiration, even after the post-nasal space has been thoroughly cleared; and if the surgeon does not clearly explain this he may afterwards be unjustly blamed for a disappointing result.

Technique of Operation. The operation may be performed either without an anæsthetic, with local anæsthesia, or under a general anæsthetic. Although in other countries anæsthesia may be omitted, in this country it is considered indispensable on account of the pain and shock of operation. Such omission is, however, justifiable in the case of infants under six months old, in whom the operation is urgent owing to their inability to suck. In hospital practice, on account of its rapidity, and also in other cases in which the other general anæsthetics are contra-indicated, gas-and-oxygen or ethyl chloride may be given. The objection to these anæsthetics is that the period of anæsthesia is too short and uncertain. I prefer full anæsthesia with A.C.E. mixture or chloro-

form. If gas-and-oxygen be given, the patient may either be operated on lying on the table or sitting up in a chair, preferably the latter. With A.C.E. or chloroform the patient should always be recumbent. Opinions differ as to the position of the patient's head. Some prefer the head hanging over the edge of the table, to diminish the risk of blood entering the larynx. As a result of this posture patients often complain of a pain in the back of the neck. I prefer to have the patient lying flat on his back, as close as possible to the right edge of the table, on which side the operator takes his stand. The anæsthetic should be given slowly and quietly until the patient is quite under its influence, but it is wiser not completely to abolish the swallowing reflex. The anæsthetist stands behind the patient, and the nurse stands on the left.

The surgeon first explores the post-nasal space with the index finger of the right hand.

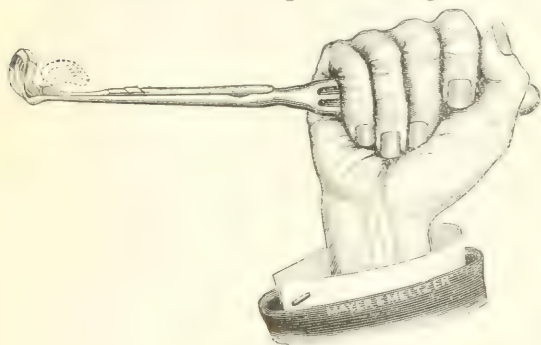


FIG. 1.—Gottstein's Curette (modified)

My routine method is to use a modification of the Gottstein curette for the removal of the principal mass, and a modified pair of Löwenberg's forceps for the further removal of any small fragments.

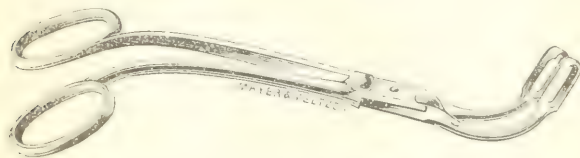


FIG. 2.—Löwenberg's Forceps (modified)

The anæsthetist props open the mouth on the left side with his gag, and with a hand placed on each side of the head keeps it fixed. The surgeon introduces the curette which, as it passes backwards towards the pharynx, is made to act as a tongue depressor. On reaching the posterior wall of the pharynx the curette is passed up behind the palate, care being taken that the uvula is not pressed up in front of it. It is now pulled forwards against the soft palate

in order to make certain that it lies behind the palate and in front of the adenoids. Keeping the instrument in the mid-line, the handle is pressed downwards against the teeth of the lower jaw, so that by this action the cutting edge of the curette is brought into contact with the roof of the post-nasal space. On pushing the curette backwards the upper attachments of the growths are cut through. The handle of the instrument is now raised against the incisor teeth of the upper jaw. This is done with a sweeping movement, which is continued upwards, the upper teeth acting as a fulcrum, and the cutting edge of the curette being brought downwards so as to cut through the posterior and lower attachments of the growth.

As a rule the pad of adenoids is removed *en masse*. The nurse and anæsthetist quickly turn the patient over on to his right side in order to permit escape of blood through nose and mouth, which may be fairly free for a few moments. If the hæmorrhage continues, iced water should be poured over the face of the patient; this almost invariably arrests it. Whilst the patient is still on his side the surgeon should pass his finger into the post-nasal space to see if any further adenoid growths remain. If so, the curette is again introduced and the growths removed.

In adults, and sometimes even in children, the forceps may have to be used in order to complete the operation, as the curette may not have removed the growths completely. To do this the surgeon passes the index finger of his left hand into the post-nasal space, and the forceps, held in the right hand, are passed up with their blades closed into the post-nasal space, the finger acting as a guide. The blades are then slightly opened so as to grasp the piece of adenoid tissue, which can now be removed. This act should be repeated until the surgeon no longer feels any adenoid tissue and the vault of the naso-pharynx is quite smooth.

In a small child the finger and the forceps cannot be passed into the post-nasal space at the same time, otherwise the soft palate may be damaged. The surgeon then examines the post-nasal space with the finger, and forming a mental picture of where the adenoid tissue is situated, passes the forceps up towards this spot. As they are only sharp on their cutting edge, provided they are kept closed until the growth is reached, it is almost impossible to do any harm, but care must always be taken not to include the underlying mucous membrane.

The advantages of the curette are that the adenoids can usually be removed *en masse*, and that no tags are left behind. The advantages of the forceps are that they can be used in cases in which the curette cannot. For instance, owing to the abnormal projection

of the spine of the atlas, the post-nasal space may almost form a *cul-de-sac*, instead of forming a smooth rounded vault. If the curette were used in these cases, not only would it be impossible to remove all the adenoids, but probably the mucous membrane of the pharynx over the atlas would be torn through, especially if the Gottstein curette had a cage with hooks attached to it.

During the actual operation extreme care should be taken that no blood passes into the larynx. This is best achieved by the anæsthetist not allowing the swallowing reflex to disappear. If there are enlarged tonsils they also should be removed at the end of the operation.

After-Treatment. Until there is complete recovery from the anæsthetic the patient should be kept in a semi-prone position, so that if bleeding takes place the blood will tend to escape from the nose and mouth rather than be swallowed or inhaled into the larynx. The after-treatment is simple. The patient may be kept in bed forty-eight hours; the throat, if at all dirty, should be sprayed frequently with a mild alkaline lotion consisting of ten minims of liquor potassæ, three grains of carbolic acid and a drachm of peppermint water, to be mixed with two ounces of warm water. The diet should consist of cold fluids or semi-fluids. If the throat is sore it is usually relieved by sucking ice, and a pleasing method in children is to give them a water-ice.

Douching the nose should not be allowed, as it may set up middle-ear inflammation. It is wiser to keep the patient indoors for two days after getting up, and in the case of children they should, if possible, be prevented from going to school or travelling in public conveyances for at least ten days or a fortnight, as during this period they are very liable indeed to catch any of the prevalent acute specific fevers.

Treatment of the ears should not be carried out until all effects of the operation have disappeared.

H. F. T.

DISEASES OF THE SEPTUM NASI

These may be classified as—

1. Ulceration and Perforation of the Septum.
2. Epistaxis from the Septum.
3. Hæmatoma of the Septum.
4. Abscess of the Septum.
5. Deviations of the Septum.
6. Fracture and Dislocation of the Septum.
7. Adhesions of the Septum.
8. New Growths of the Septum.

Ulceration and Perforation of the Septum.—Ulceration and perforation may occur either in the cartilaginous or in the bony part of the septum. In the cartilaginous portion the most

common type of ulcer is the so-called *traumatic or atrophic*. This usually arises in cases where dry rhinitis is a marked feature, especially if some abnormality of the septum, such as a spur, exists as well.

The method of its production is briefly as follows. A deposit of dust occurs on the anterior part of the septum. In consequence of the dryness of the mucosa this adheres and sets up a certain amount of irritation. Its removal is often brought about by rubbing the nose or picking it with the finger. Further irritation occurs, more dust is deposited and a small excoriation of the mucosa results; this may increase until the cartilage is exposed, which, deprived of its blood supply, gives way and a perforation results.

As a rule the perforation is round, clean-cut with smooth, thin edges, and slowly increases in size until it reaches a diameter about that of the end of the finger.

The presence of a spur facilitates the production of a perforation by catching the dust, and its apex is likely to be the point against which rubbing is directed.

The other form of ulceration which leads to perforation in the cartilaginous septum is that due to *chronic tuberculosis or lupus*.

This first appears as a slightly raised nodular infiltration at the anterior part of the septum, which may give place to a shallow irregular ulcer, the base of which is pale, surrounded by flabby granulations and covered with scaly crusts of dried purulent secretion.

Characteristic apple-jelly granulations are often observed, and, when perforation occurs, may be seen surrounding the edges. The perforation is usually irregular and shows a tendency to increase in size, but does not usually invade the bony septum, although this may occasionally occur.

In the bony septum *syphilis* is usually responsible for the perforation. A gummatous infiltration rapidly leads to ulceration of the mucosa, the underlying cartilage or bone is exposed, eroded and deprived of its blood supply. Sequestra bathed in foul-smelling pus or covered with masses of dried secretion may lie at the bottom of the ulcer, and their separation give rise to an irregular perforation with heaped-up indurated edges which bleed readily. In some cases the perforation may be difficult to localise, as it may be concealed behind a spur, whilst in other cases practically the whole septum, both bony and cartilaginous, may be destroyed.

Symptoms. The perforating or atrophic ulcer may occur without occasioning any symptoms, or may give rise to irritation, slight obstruction and occasional epistaxis.

The symptoms occasioned by an ulcer due to

lupus are not characteristic, and may be confined to the presence of a purulent or mucopurulent discharge, with some degree of nasal obstruction and epistaxis. Syphilitic ulceration and necrosis usually give rise to a peculiarly offensive smell, whilst pain is often a prominent feature, with nasal obstruction due to the formation of tenacious masses of dry crusts which are extremely difficult to dislodge.

A small perforation in the anterior part of the septum may produce a whistling noise during inspiration, but the advent of perforation is usually followed by a diminution of other symptoms, such as nasal obstruction and discomfort, whilst many perforations seem to have given rise to no symptoms and are often discovered accidentally.

Diagnosis. The history, the absence of induration or necrosis, and the coincidence of dry rhinitis and deformity of the septum may help to distinguish the perforating or atrophic ulcer.

The characteristic granulations of lupus, and the presence of the disease elsewhere in the respiratory tract or on the skin may point to this condition, whilst the involvement of bone, the fœtor, pain and the manifestations of the disease in other situations may indicate a syphilitic origin.

Treatment. When a perforating ulcer is in question treatment of the general condition is most important, and dusty occupations, or over-indulgence in alcohol or tobacco should be dealt with. Warm alkaline douches will cleanse the nose, whilst the use of oily sprays will protect the mucosa, prevent formation of crusts, and stimulate the mucous glands. The ulcerated surface may be painted with a solution containing forty grains of dilute nitrate of mercury ointment in an ounce of almond oil.

Lupoid ulceration demands more radical local treatment in addition to the general cleansing measures. The affected area should be well curetted with a sharp spoon, and the galvano-cautery applied to any doubtful spots. Gauze soaked in an oily solution may be used as an intranasal dressing. Further treatment with the galvano-cautery, nitrate of silver or chromic acid may be necessary until the disease is completely eradicated.

Syphilitic ulceration necessitates the use of general antisyphilitic remedies. In addition cleansing lotions, cauterization of the sloughing ulcers with a ten per cent. solution of nitrate of mercury, and the removal of sequestra will relieve the symptoms and promote healing.

Space will not permit more than mention of perforations which may be due to acute infective processes, such as scarlet fever, typhoid fever and diphtheria, or those that may result from unskilful use of the galvano-cautery or after intranasal operations.

Epistaxis from the Septum.—Epistaxis may be a symptom of many diseases, but the fact that in over ninety per cent. of all cases the bleeding point is situated on a definite area of the septum makes it advisable to mention it here.

In the mucosa overlying the anterior part of the cartilaginous septum, about quarter of an inch from the vestibule and quarter of an inch from the floor of the nose, a small knot of dilated vessels may often be seen. This is known as Kiesselbach's area, and epistaxis readily takes place from it when the mucosa over it is abraded. This is most likely to happen when a condition of dry rhinitis is present and crusts deposited on the septum are rubbed or picked off. Bleeding may be severe and, in addition to the usual domestic measures such as lying down and the application of ice to the nose and back of the neck, local treatment may be necessary. Temporary arrest can usually be effected by inserting a plug of cotton wool saturated with cocaine (ten per cent.) and adrenalin into the nose, and compressing the ala of the nose against this for ten or fifteen minutes.

A more radical and satisfactory measure is to cleanse the nose thoroughly with pledgets of wool soaked in peroxide of hydrogen, and to touch the affected area of the septum with the galvano-cautery point. When the bleeding area is more widespread it may be necessary to resect the mucous membrane over a corresponding area of the septum.

In the majority of cases anterior and posterior plugging of the nose is to be deprecated.

Hæmatoma of the Septum.—This is generally due to falls or blows on the nose, but it may occasionally arise after submucous resection of the septum owing to hæmorrhage between the flaps.

The usual complaint is of nasal obstruction coming on after the accident and persisting. On examining the nose a smooth dark-red swelling is seen near the front of each nostril. The swelling is often tense and may occlude the nostril. Examination with the probe will enable the observer to determine that it pits on firm pressure and that the mucosa covering it is continuous with that of the septum.

Treatment. This usually consists in keeping the nose clean by means of warm alkaline lotions and waiting for the hæmatoma to be absorbed. If obstruction is marked it is a better plan to evacuate the hæmatoma, as the chances of infection are not great if care is taken.

Abscess of the Septum.—This is usually due to infection of a hæmatoma following an injury to the nose, but cases have been described which were due to typhoid fever, tubercle, influenza or sinus suppuration.

Symptoms may be absent, but nasal obstruction and a hot uncomfortable feeling in the nose are often complained of.

Examination usually shows a bilateral swelling of the anterior part of the septum which is tender and fluctuating.

Treatment. The abscess should be incised and the pus thoroughly evacuated. The incision shows a great tendency to heal and may need to be reopened or to be kept open by a small gauze wick or a few strands of horsehair. Healing is usually complete in about a fortnight.

Deviations of the Septum.—Comparatively few noses conform with the ideal standard, but in the majority of cases deviations from the normal give rise to no symptoms or disabilities, whilst in other cases symptoms which are apparently remote may be bound up with septal abnormality. The commonest types of deformity are crests and deflections.

Crests usually run more or less antero-posteriorly and occur most often where the vomer articulates with the mesethmoid and with the crest of the maxillæ. In the first situation the direction of the crest is backwards and upwards, and in the second almost horizontally backwards, close to the floor of the nose. A large crest in this situation may come into contact with the inferior turbinate and cause a sense of stuffiness or may prevent the normal nasal secretion being expelled, but in the vast majority of cases crests which are not associated with other septal abnormalities give rise to no symptoms and do not call for any treatment.

Deflections of the septum are usually of developmental origin and are due to unequal rates of growth of the septum and the facial skeleton, especially during the period of the second dentition. Anything which militates against free nasal respiration, such as adenoid vegetations, has a marked effect in the production of deflection.

Deflections occur in the region of the septal cartilage, the perpendicular plate of the ethmoid and the junction of this with the vomer.

The septum may present a simple bulging or convexity to one side, with a corresponding concavity on the other. This form of deflection is known as C-shaped deflection. A more usual form is the S-shaped deflection, in which the bulging is first to one side and then to the other, so that one nostril may be obstructed in front and the other more posteriorly. Deflections are apt to occur in the upper part of the nose, whilst crests usually occur lower down. The two forms of deviation are often combined.

Symptoms. Deviations may produce obstruction to respiration, or may impinge on the outer wall of the nasal fossa and obstruct the outflow of the sinuses and cells which normally drain into the nose.

1. The symptoms due to nasal obstruction are largely bound up with mouth breathing and its attendant consequences, such as dryness of the throat, chronic cough, occasional hoarseness or loss of voice, and undue liability to colds and sore throats. There is often a sense of fullness or stuffiness in the nose, intermittent stenosis, which may alternate from one side to the other, chronic rhinitis, due to hyperæmia behind the obstruction, "dropping" of secretion into the naso-pharynx, inflammation of the naso-pharynx and Eustachian catarrh. In cases where a C-shaped deflection produces obstruction of one nostril the undue patency of the other side may give rise to symptoms of dry rhinitis. In the majority of cases, however, there is a compensatory hypertrophy of the inferior turbinate on the concave side, and no such symptoms are observed.

2. Symptoms due to intranasal pressure—

The commonest and most characteristic symptom, which is due to pressure of the septum against the middle turbinate, is an aching sensation over the bridge of the nose; this may amount to actual pain and may be referred to the region of the supraorbital and infraorbital nerves.

Obstruction to the ostia beneath the middle turbinate may give rise to catarrhal inflammation of the anterior group of ethmoidal cells or of the frontal sinus. This may be evidenced by pain on pressure below the supraorbital ridge near the inner canthus.

Frontal or vertical headache and the presence of a profuse acrid mucoid secretion may be attendant manifestations of the condition.

Symptoms which may call attention to the undue patency of the unobstructed nostril are excessive crust formation and epistaxis.

Diagnosis. This is usually obvious from the intranasal examination, but this latter cannot be deemed complete unless the nasal passages have been effectively treated with cocaine and adrenalin.

Treatment. Some of the symptoms dependent on the nasal obstruction due to these conditions may be relieved by the use of nasal lotions, but in the majority of cases the source of the trouble is more deeply seated and only operative measures are of avail.

Personally I believe in the submucous resection as the ideal operation, and I strongly recommend this procedure on all possible occasions, but a recent experience compels me to admit that in some cases the "Fenster resection" or Krieg-Bonninghaus operation may be necessary.

In the conditions with which I am dealing I am convinced that operative measures directed towards the turbinates are extremely inadvisable.

Fractures and Dislocations of the Septum.—Many observers fail to deal with these conditions, but my experience convinces me that they are by no means uncommon. I have seen many cases where blows on the nose have produced fracture of the septum or dislocation of the septal cartilage. In one recent case ocular and orbital symptoms alone called attention to the condition.

Treatment depends on the nasal condition and is mainly surgical.

Adhesions of the Septum.—These may result from syphilis, tubercle, the infective fevers, or intranasal manipulation. They usually occur between the septum and the middle or inferior turbinate.

Symptoms are mainly absent and *treatment* consists in dividing the band or web with the galvano-cautery and separating the raw surfaces by means of a gauze plug soaked in an antiseptic oily solution.

New Growths of the Septum have been dealt with in a previous section. W. G. H.

NASAL OBSTRUCTION

It is only in recent years that the relationship of nasal obstruction to diseases of the ear and throat has been in any way recognized and appreciated. On this account, perhaps, its importance has been exaggerated by some and underestimated by others, more especially with regard to its more remote effects, such as asthma.

In this short article it is only possible to draw attention to the principal causes of nasal obstruction and to give a general outline of their treatment.

Causes. Apart from adenoids, which in the majority of cases may be considered the primary cause of nasal obstruction in children, and the predisposing cause in adults (see p. 1160), the following may also be given—

1. **Pathological Conditions of the Soft Tissues within the Nose**, such as acute rhinitis, chronic rhinitis, hypertrophic rhinitis.

In these cases the structure of the nose may otherwise be normal. In **Acute Rhinitis** there is simple congestion of the mucous membrane, temporary in character. **Chronic Rhinitis** is usually associated with some narrowing of the nasal cavities frequently due to the previous existence of adenoids. This narrowing not only tends to prevent free nasal breathing, but also to increase the negative pressure within the nose during inspiration, especially if there be any collapse of the *alæ nasi*. With this, also, there is increased secretion, owing to the continued catarrh of the mucous membrane, which in itself also tends to still further irritate the mucous membrane. Further, as a result

of the constant turgescence of the mucous membrane, distension of the venous and cavernous tissues of the inferior turbinate bodies takes place.

Hypertrophic Rhinitis may be considered as a still later stage, being due to true hypertrophy of the submucous tissues.

Other factors predisposing to the above conditions are external irritants, dusty occupations, unhygienic surroundings, and in the later years of life a gouty diathesis.

Hypertrophic rhinitis also may be compensatory, as may be observed in an abnormally wide passage of one side of the nose due to a deviation of the septum to the other side, which it may completely obstruct.

2. **Structural Changes within the Nose.**—Amongst the most common conditions found are a pinched-in nose with collapsed *alæ nasi* and general narrowing of the floor due to a high-arched palate, the result of previous adenoids; dislocation and deviation of the septum; fractures of the nose from external violence, causing depression of the bridge of the nose, or thickening of the septum.

3. **Other Conditions causing Obstruction** are foreign bodies, polypi, growths, and inflammatory or ulcerative lesions due to lupus or syphilis.

The *symptoms* depend largely on the character, the extent, and the situation of the obstruction. Sometimes indeed the patient is unaware of any nasal obstruction, which perhaps is first brought to his notice by his medical man, whose advice may have been sought on account of some ear or throat affection, or even for some less associated trouble, such as headache or asthma. In the majority of cases, however, the patients complain of definite symptoms, such as a very troublesome secretion from the nose, a continual hawking of phlegm from the back of the throat, an uncomfortable feeling that the nose should be cleared but inability to do so in spite of constant attempts. In other cases there is merely a history of colds in the head which cannot be got rid of, frequently associated with headaches or a feeling of pressure across the bridge of the nose. At other times the chief complaint is inability to sleep comfortably owing to the passage of the nose on the same side on which the patient is lying getting blocked, and that when the patient turns over on to the opposite side the upper side clears and the dependent one then gets blocked. Swelling, hypertrophy, or a cyst of the middle turbinate may cause loss of the sense of smell by causing obstruction of the olfactory cleft, or, from pressure and perhaps retention of secretion, may give rise to frontal headaches closely simulating in character the type usually associated with frontal sinus disease.

Examination of the Patient. Before advising treatment it is first necessary to examine the patient in a routine fashion in order to determine what is the actual cause of the nasal obstruction. On inspection some deformity of the nose may at once be observed, such as a dislocation or deviation of the septum, or a deformity due to trauma. The history should then be obtained as to the length of period the patient has been unable to breathe through the nose; whether this has been constant or intermittent, unilateral or bilateral, and also whether there has been any discharge, mucous, purulent or hæmorrhagic in character.

(1) If the symptoms are only of two or three weeks' duration they may merely be due to a severe cold in the head, which will probably be obvious. (a) Apart from a cold in the head, a bilateral nasal obstruction of recent origin may be due to a gumma of the septum or of the inferior turbinates, or to an abscess of the septum, usually traumatic in origin. (b) If one-sided and of recent origin it may be due, in an adult, to the sudden increase of growth of a malignant tumour or of a post-nasal polypus; in a child the most frequent cause is a foreign body, which is usually accompanied by a purulent discharge from the same nostril, with excoriation of the vestibule. (2) In the more chronic cases (a) unilateral nasal obstruction may be due to a deviation of the septum or to a large "spur"; or to the presence of nasal polypi perhaps associated with ethmoidal disease. If the polypi are simple, the result of a mucous membrane inflammation, there may be an excessive discharge from the nose of a thin and mucoid character; but if due to ethmoidal or antrum suppuration it will be purulent. (b) In a long-standing case of bilateral obstruction the conditions most commonly found are a deviation of the septum on one side, with compensatory hypertrophy of the mucous membrane of the other side; a general chronic rhinitis with narrowing of the nasal passages; or a true hypertrophic rhinitis, or polypi on both sides.

(3) If long-standing but intermittent in character, without any other symptoms of "cold" in the head, it is probably due to vasomotor rhinitis or to hypertrophic rhinitis in which there is periodical turgescence of the inferior turbinate bodies. (4) In a young child, if the nasal obstruction is complete and adenoids can be excluded, it is due either to occlusion of the posterior choanæ, the result of a congenital deformity (which is an extremely rare condition), or is the result of scarring and contractions due to congenital syphilis.

The first step in the examination of the nose is *anterior rhinoscopy*; by this means the cause may at once be made evident. On the other hand the diagnosis may not be immediately

possible, owing to general narrowing and congestion of the mucous membrane of the nose, together with the presence of much secretion. In such a case the interior of the nose should be gently cleansed with pledgets of wool on a probe or nasal forceps; and afterwards the nose should be lightly packed with plugs of cotton-wool soaked in a 1 in 2000 solution of adrenalin chloride containing a two per cent. solution of cocaine hydrochlorate. After a few minutes these plugs may be removed and the nose further examined. The action of the above solution is to cause marked ischæmia and shrinking of the mucous membrane and to render its surface anæsthetic. This not only enables a better view of the interior of the nose to be obtained, but also demonstrates how much of the obstruction is due to congestion of the soft parts and how much is due to the bony structures or to true hypertrophy of the submucous tissues—a matter of primary importance to subsequent treatment. A further examination now being made, the diagnosis can be arrived at. If the obstruction is due to a simple congestion of the mucous membrane and the nose is otherwise normal, the passages will be found to be clear and the mucous membrane closely adherent to the underlying bony structures. In a chronic rhinitis there will still be some thickening of the submucous tissues, and in hypertrophic rhinitis the hypertrophic areas will still remain as mobile nodular polypoid fringes along the lower margin of the inferior turbinates, perhaps also of the middle turbinates. If a deviation of the septum, a spur, or a bony cyst of the middle turbinate be present they can now be diagnosed by inspection and by use of the probe; grey-blue polypi may be seen to be coming from the region of the middle meatus, or a foreign body to be lying in the inferior meatus; or (now the congestion has been diminished) the differential diagnosis between the granular surface of lupus or the deep punched-out ulceration of a gumma will be more easily determined. On the other hand, the obstruction may be found to be due to malignant disease, recognized by the hæmorrhagic, purple-stained, friable granulations and polypoid masses springing usually from the upper posterior part of the nasal cavity.

In addition to anterior rhinoscopy, *posterior rhinoscopy* should be also carried out as a matter of routine. This may show the presence of hypertrophy of the posterior ends of the inferior turbinates or of a post-nasal polypus, a fibroma or malignant disease of the post-nasal space or cicatrization suggestive of syphilis.

Treatment may be either conservative or operative. Conservative treatment, when possible, should always first be attempted. It is, however, limited to those cases in which the

obstruction is due to changes in the mucous membrane, as it is obvious that obstruction due to changes in the bony structures cannot be removed except by surgical means. Conservative measures consist in various vapours, sprays and douches for the nose, together with proper hygienic measures, and climatic and medicinal treatment.

In the case of *acute rhinitis* the ordinary household remedies usually are sufficient. Occasionally an attack can be aborted by giving a tablet consisting of camphor, quinine, belladonna and morphia in very small quantities several times a day. If there be marked headache due to excessive congestion of the mucous membrane, the interior of the nose may be sprayed with a solution of 1 in 5000 adrenalin chloride. In other cases, if seen sufficiently early, aconite in one to two minim doses, given every two hours until a sensation of dryness in the throat is obtained, may give surprisingly good results, but it is not recommended unless the patient can be under the personal supervision of the medical attendant. In many cases of simple acute rhinitis very great relief can be obtained by gently washing out the nose with a mild alkaline solution, and then spraying into the nose an oily solution consisting of oil of eucalyptus and oil of cinnamon five minims each, chloretone five grains, menthol and camphor three grains, perchloride of mercury half a grain, "fluol" to the ounce. After the acute stage has passed off the best tonic is a change of air.

In the more chronic conditions more energetic treatment will be required, although in simple chronic rhinitis attention to diet, the giving up of a dusty occupation, the use of an alkaline nose-wash, and breathing exercises to encourage efficient nasal breathing, may make the patient sufficiently comfortable. If, however, such measures fail it may be necessary to cauterize the mucous membrane or to remove its hypertrophic portions.

The electro-cautery is indicated in vasomotor rhinitis or if there is chronic turgescence of the venous plexuses of the inferior turbinate bodies. The object of electro-cauterization is to pin down the mucous membrane to the bone beneath and at the same time to obliterate, to some extent, the venous channels. Further, by doing so the secretion will be diminished. In such cases it is usually sufficient to cauterize the inferior turbinate bodies, but occasionally the anterior tip of the middle turbinate may also require the same treatment. The septum may also be cauterized if, in association with the nasal condition, there is a history of spasmodic asthma. The amount to be done at a sitting depends on the temperament of the patient and the condition of the nose. As a rule it is

best to do one side thoroughly and after a week or ten days' interval to operate on the other side. The operation is carried out under the local anæsthesia of cocaine and adrenalin.

The operation is performed with the patient sitting in an upright position. The surgeon, of course, works by reflected light. The cautery is introduced *cold* into the nose, its point being made to touch the inferior turbinate at its most posterior part. On turning on the electric current the point of the cautery is advanced slowly and evenly until the anterior extremity of the inferior turbinate is reached. The cautery should be at red heat and the tissues should be burnt not superficially but seared as a deep line down to the bone throughout its length. It is usually sufficient to cauterize the mucous membrane in two lines, one running along the inferior margin of the inferior turbinate, the other along its upper surface. As the point of the cautery reaches the anterior margin of the inferior turbinates it should be withdrawn quickly whilst at red heat. If the current is disconnected before it is withdrawn the point will cool and stick to the mucous membrane, which will be torn and bleed on its removal.

The immediate after-treatment consists in puffing in a little anæsthesin to relieve the pain. The normal inflammatory reaction will cause temporary obstruction within the nose, which may produce a certain amount of discomfort; it may be relieved by giving an inhalation of menthol or spraying the nose with a very weak solution of adrenalin chloride. After six or eight days the eschar produced between the line of cauterization can be removed. The nose will then be found to be patent, and the site of the eschar may be painted over once or twice with an oily solution containing nitrate of mercury.

Against cauterization it is said that there is a tendency for synechiæ to occur afterwards. This can only happen if the nose is so narrow that, in introducing the cautery, the mucous membrane not only covering the inferior turbinate, but also the septum, becomes burnt, the surfaces afterwards uniting and so forming adhesions. In such a case, however, the cautery should not have been used. Another precaution before operation is to thoroughly dry the nose before applying the cautery. If the mucous membrane is covered with secretion, scalding of the surfaces near the cautery may take place, even although the cautery is not in actual contact with them. The nose should first be dried by mopping it out repeatedly with pledgets of cotton-wool. In suitable cases the result of cauterization is most satisfactory, but it may not be permanent. The treatment may require to be repeated in a year or so.

In cases of true *hypertrophic rhinitis* cauterization is insufficient. The hypertrophy may exist throughout the length of the inferior turbinate or may be limited to its posterior end. In the former condition, after rendering the part anæsthetic by the cocaine and adrenalin solution, the hypertrophic mucous membrane is simply cut away by a pair of strong angular scissors, no bone being removed. This operation, if carried out properly, is an exceedingly simple one. In the case of enlarged posterior ends they are removed under a local anæsthetic, by passing a snare through the anterior nares; but if a general anæsthetic be given the forefinger of the left hand should be passed into the post-nasal space, in order to guide the snare over the enlarged posterior end. This latter method is preferable if, in addition to removal of the posterior ends, it is also necessary to remove the anterior ends of the turbinates.

Removal of the anterior ends of the middle turbinates is called for if their enlargement, either from hypertrophy of the mucous membrane or from cystic formation, in addition to causing nasal obstruction gives rise to symptoms such as pain across the bridge of the nose or frontal headaches, or if frontal sinus suppuration be suspected. If the headaches are simply due to the hypertrophic anterior ends of the middle turbinates, their removal will cure the trouble. If they are due to frontal sinus suppuration the headaches will continue in spite of this operation if the fronto-nasal duct remains obstructed, but if free drainage is secured a flow of pus will be seen coming from the region of the fronto-nasal duct and the headaches may simultaneously cease. The method I adopt is to cut through the upper attachment of the middle turbinate with a pair of scissors, and then pass a snare into the incision so made and draw the loop tight. In this way the anterior end is removed in the same manner as a polypus.

In these operations the only after-trouble which may occur is hæmorrhage. When avoidable, I never pack the nose with gauze, because its removal usually causes pain and hæmorrhage, and also its presence prevents free drainage. In a plethoric subject in which packing may be considered necessary I use gauze smeared with sterilized vaseline, which renders its removal an easy matter. If amputation of the anterior end of the middle turbinate alone has been done, it is not necessary to plug the whole nasal passage with gauze, but merely to insert a small piece of gauze high up against the wounded surface, thus leaving a free passage for breathing through the inferior meatus.

In many cases of chronic nasal obstruction a deviation of the septum also is present. If the symptoms are such as warrant an opera-

tion, the submucous resection is the proper procedure.

The method of performing this operation was first introduced into this country by the writer (*Journal of Laryngology and Otology*, June 1904). At that time the possibility of a submucous resection was not realized, and the cases which I first had, had been previously cauterized on the side of the obstruction in the hope of diminishing the obstruction. Consequently the mucous membrane on the obstructed side was so adherent to the cartilage that it could not be separated from it, and was removed with the septum.

There is no doubt that the true submucous resection of the septum (that is, removal of as much of the cartilage, vomer and perpendicular plate of the ethmoid as may be necessary, and leaving behind the mucous membrane of both sides, which afterwards are brought into apposition) is the ideal operation and one which I now invariably adopt, yet the method adopted in this resection, from the point of view of surgical procedure, differs very slightly in detail from the one which I originally introduced. In this operation it is frequently also necessary to remove the anterior end of the middle turbinate, or the hypertrophic mucous membrane of the inferior turbinate on the previously patent side of the nose, because although the correction of the deviation will give a free passage on the previously obstructed side, it may cause a narrowing of the previously patent side. In several instances I have seen patients, operated on by others, in which the complaint has been made that whereas the surgeon has freed the obstructed side, he caused obstruction of the previously free side.

If the obstruction is due to nasal polypi the procedure varies according to the cause of the polypi. In a simple post-nasal polypus the best method of treatment is to give a general anæsthetic, to pass the snare back into the naso-pharynx and with the forefinger of the left hand insinuate it round the growth, which may completely fill up the post-nasal space and render this a matter of extreme difficulty. The loop of the snare should be gradually tightened, the point of the snare being pushed up as far as possible so as to get to the root of the polypus. Retraction is then made and the polypus, if not too big, is pulled out through the anterior nares. If this is impossible the root is torn through and the polypus falls into or is pushed into the pharynx and extracted from the mouth.

If there is no evidence of ethmoidal suppuration the polypi may be removed under local anæsthesia, by means of the snare and punch forceps.

If a patient comes suffering from a bilateral nasal obstruction and is willing to have the

polypi removed under a local anæsthetic, the surgeon should see that an air-way is obtained on one side of the nose. Under such circumstances the patient does not object to discomfort or pain; but if he finds, after the operation, which may be unpleasant, even under cocaine anæsthesia, that his nose is still blocked, he will probably not thank the surgeon for his work. If a free air-way is obtained it not only gives relief, but confidence in the future. In skilful hands, and if the patient is of a placid temperament, it is not impossible to remove almost all the polypi from one side of the nose at one sitting, even in extreme cases. If there is ethmoidal suppuration it is advisable, when possible, to give a general anæsthetic and to clear out the nose on both sides by means of punch forceps and Mayer's ring knife. The latter instrument should be used cautiously. On dealing with ethmoidal suppuration it must not be forgotten that there is only a very thin plate of bone separating it from the orbit. Even in the most careful hands this may be injured, giving rise after a few days to a "black-eye." Recently I have seen a patient who had been operated on, elsewhere, to such an extent that not only the ethmoidal region, but also the middle turbinate and the entire floor of the orbit, had been curetted away. As a result there is now a periorbital abscess and sinking down of the eyeball beneath the level of the orbit with loss of sight—a disastrous result.

If malignant disease be suspected it is wiser to have a section of the growth cut and examined before expressing an opinion. In malignant disease of the ethmoidal and sphenoidal region (often simulating polypi) it should always be borne in mind that the extent of the disease is always far greater than that observed by the naked eye. Any operation performed must of necessity be one of extreme severity. Whether such an operation should be performed or not should be weighed most carefully by the surgeon before his opinion is communicated to the patient.

A foreign body within the nose is easily seen and easily removed. It always lies in the inferior meatus. It is simply necessary to pass a hook behind it and pull it out.

In my experience tertiary syphilitic lesions of the nose are not diagnosed as early as they should be. In an adult, suspicion of this should always arise when there is sudden and recent nasal obstruction from no known cause. In some cases the diagnosis is confirmed by external thickening of the bridge of the nose. Usually the gummatous infiltration affects both the cartilaginous and bony septum, causing it to appear red and swollen. On the gumma breaking down the characteristic deep-seated ulceration becomes evident. Similarly, deep

ulceration may be seen running along the edge of the inferior turbinate bodies. In cases of doubt a Wassermann reaction should be taken. Prior to the introduction of salvarsan I found that inunctions of mercury, together with the giving of large internal doses of potassium iodide, rapidly brought about a cure. The insufflation of calomel powder is also of benefit. Salvarsan, unless otherwise contra-indicated, is now given, as it is of the utmost importance in tertiary lesions of the nose to get as rapid a cure as possible, to prevent destruction and necrosis of its bony structures.

Lupus of the nose differs from a syphilitic lesion in its chronicity, its granular appearance, and in the lack of surrounding inflammatory disturbance. The position of the lesion is most frequently in the anterior part of the nose, that is, the part which may be infected by scratching the interior of the nose with the finger. The only treatment for lupus of the nose is to curette away all the lupoid tissue by means of Mayer's ring knife and then to apply nitrate of mercury ointment. Recently, good results have been obtained by giving sodium iodide internally and applying hydrogen peroxide locally. By this means nascent iodine is said to come into contact with and destroy the affected tissue; even if this be so, I consider that the surgical treatment should first be adopted.

H. F. T.

CHRONIC RHINITIS

Chronic Rhinitis and pharyngitis are inseparable, hence it is customary to examine the pharynx and the anterior nares at the same time; the posterior nares should be examined if possible.

The pharynx is the common receptacle of the natural flow of mucus and detritus from the nose, and is in addition exposed to unfiltered air in cases of nasal obstruction. Inflammation of the pharynx and the accompanying cough in nasal obstruction increase the trouble owing to swelling of the vascular mucous membrane. The prominence of the thickened lateral pharyngeal band formally attracted much treatment, especially when the patient's sensations further indicated it as the cause of trouble. Now attention is focussed on any nasal obstruction present; the lateral pharyngeal band so obvious in the pharyngitis of gouty subjects contains the inflamed lymph channels which run down the lateral wall of the pharynx and which commence in the fossa of Rosenmüller. (It was usual to divide these bands with the cautery.)

The causes of chronic rhinitis are deficient nasal respiration, commonly due to adenoids in the young; chronic bacterial infection of the bacillus of Friedländer following acute

conditions; inhalations of particles of dust; over-indulgence in alcohol and meat, especially in gouty subjects; sedentary occupations, constipation, sexual excess and anæmia. Chronic rhinitis is also a frequent concomitant of gastric, cardiac and lung diseases—particularly phthisis.

In the nose the vasomotor swelling of the mucous membrane may be out of all proportion to the amount of inflammation present, and the condition is affected by most of the factors of life; starvation, purging and free perspiration cause the mucous membrane to shrink; alcohol, constipation, and anæmia produce turgescence.

Cold air contracts the mucous membrane and precipitates the moisture from the lung in the nose; on the other hand warm dry air contains irritant dust. Continued respiration of the latter results in dry rhinitis, common in anæmia and dyspepsia, and indicating vasomotor and lymphagogue failure. The narrow nose of a full-blooded gouty individual of sedentary habits is particularly prone to dry or moist chronic rhinitis, and that of cooks and housemaids to rhinitis sicca.

A patient coming from the country to town probably contracts a nasal catarrh if his nose is competent only under favourable conditions, the mucous membrane swells, the nose becomes incompetent, and catarrh after catarrh results. The symptoms of the complaint vary: some complain of a sore throat and running from the nose; others with a large middle turbinal, which, if slightly swollen, causes pressure, are distressed by headache in the glabellar region, or rhinorrhœa and sneezing. Nasal obstruction is the most notable symptom.

The personal equation of the individual is a factor apart from the physical conditions and, just as skins vary, so one patient is prone to dry inflammation, another has pronounced vasomotor reaction, and a third free secretion of mucus and clear fluid.

It is important to treat patients with chronic rhinitis from a general standpoint; some cases may manifest serious disease, though a cold or sore throat is complained of.

On examining the anterior and posterior nares the mucous membrane is seen to be turgid and red; the diminished air-way is further reduced by mucus, liquid or stringy, or even muco-pus. The mucous membrane pits to a probe. Spraying with four per cent. cocaine produces extreme contraction of the mucous membrane and discloses any bony source of obstruction. Chronic moist rhinitis may develop into chronic hypertrophic rhinitis, or into polypoid disease of the middle turbinal, and, as a result of the defective drainage, is a factor in sinus infection in acute diseases such as influenza. Moist and dry

rhinitis may alternate or coexist in the same nose, the dry form in the wide and moist rhinitis in the obstructed nostril in case of one-sided obstruction, or even in the same nostril where the upper and middle meatus are occluded by an enlarged middle turbinal or septal deflection, and where the inferior meatus is exceptionally patent.

Local treatment should commence with the application of a saline lotion to the nose. A powder is made of equal parts of sod. bibor., sod. bicarb., and sod. chlorid.—ammon. chlorid. is sometimes substituted for sod. chlorid. and the patient is instructed to mix one teaspoonful to a tumbler of warm water and directed to spray or syringe the nose. Gentle syringing with a rubber-ball syringe fitted with a coarse nozzle, which cannot enter the nose, is most efficient. The head is bent over a basin, and, while the patient breathes in and out through the mouth, the lotion enters one nostril and passes out of the other. If the head is well bent, and the patient does not blow the nose, no fluid will enter the Eustachian tubes. Oil sprays will sometimes give relief: cocaine, menthol, $\bar{a}\bar{a}$ gr. iv, paroline ad \bar{z} i; or pinol, tr. benzoin co., $\bar{a}\bar{a}$ \bar{m} x, paroline ad \bar{z} i.

An excellent preparation for adults and easy to apply to children, is a paint which is inserted on a camel's hair brush: ung. hyd. nit. dil. \bar{z} ss, ol. amygdal. ess. q.s., ol. amygdal ad \bar{z} i.

Small children object to sprays and lotions, but will themselves apply the paint. If a week's treatment in an infant, by clearing up rhinitis, does not relieve nasal obstruction, then adenoids may be suspected and removed.

A few severe cases will need submucous cauterization (described under *Chronic Hypertrophic Rhinitis*), but operative procedure is usually directed to remove causes of obstruction.

In adults general treatment is perhaps more important than local. The plethoric, and others of sedentary habit, are given calomel gr. $\frac{1}{4}$ or $\frac{1}{2}$ alt. noct. and a tumbler of hot or cold water containing ten grains or more of potassium citrate at night and in the morning before breakfast. Alcohol and excess of sugar and red meat are restricted in the gouty. Outdoor or indoor exercises, especially those dealing with respiration are prescribed. A course of Turkish baths is a good substitute for vigorous outdoor exercises. Well-aired and cool rooms day and night are important, and in fair weather the window should be kept open but draughts avoided. Dyspepsia, anæmia, constipation and defective teeth are to be remedied.

Rhinitis Sicca presents an appearance markedly different from that of moist rhinitis; the nose is competent for respiration. The condition may be established even under normal conditions of atmosphere in very patent noses, and quickly

appears in dry and dusty atmospheres in those predisposed to ordinary chronic rhinitis.

If dry rhinitis continues the mucous membrane crusts and becomes converted into squamous epithelium, leading sometimes to suppuration and atrophic rhinitis. The dry condition allows of the entry of micro-organisms, and will be found of frequent occurrence in conjunction with erysipelas of the face.

The patient complains that he cannot use a handkerchief, and of a sensation of contraction or swelling in the nose; his throat is dry and the nose may be actually obstructed. On examining the anterior nares the mucous membrane appears red, wrinkled and dry; droplets of mucus exuding from the mouths of the glands are often to be seen. Dry patches are obvious on the anterior end of the middle turbinal and the front of the cartilaginous septum, both being points which are exposed to the maximum air current; these are the starting-points of crusting.

Dry rhinitis also exists in noses possessing a patent inferior meatus, along which both the entering and issuing air passes while the middle and upper meatus is obstructed; it is remedied by restoring the upper parts as channels to inspired air.

The dry patch on the cartilaginous septum causes irritation, and in a narrow nose leads to obstruction, consequently the patient picks it with the finger nail. This proceeding may be persisted in till a perforation is made in the cartilaginous septum of sufficient size to admit the finger. In the early stage of the manipulation violent epistaxis may set in, often as the result of a microscopic abrasion. Hemorrhage may come from the inferior turbinal at the same time and has been reported from the middle turbinal. Though this spot is particularly exposed to injury, the blood of "spontaneous epistaxis," which occurs with menstruation, cirrhosis of the liver and kidneys and heart disease, usually comes from this spot.

Treatment. Where finger-nail ulceration has commenced or epistaxis threatens, the dilute mercurial oil or yellow vaseline is to be regularly painted into the nose; calcium lactate may be tried. The patient is enjoined to wear thick gloves at night, to avoid interference during sleep.

Mild cases are treated by applying five per cent. cocaine on a pledget of wool and then gauze soaked in hydrogen peroxide if the bleeding continues. In severe epistaxis it is more satisfactory to destroy the bleeding vessel with the electric cautery.

To accomplish this a good reflected light is necessary. The packing of cocainized wool is removed and the slight abrasion recognized

or brought into activity on manipulation with a probe. A cautery point is applied at a dull red heat; the nose may be then left unpacked, but a loose dressing of the mercurial oil should be applied.

Subsequent treatment is directed towards correcting any abnormality of the nose, with instillation of an oily preparation.

Indiscriminate application of strong caustics and styptics to the nose should be carefully avoided.

An injection of morphia will be found of great help in soothing a nervous or restless patient.

Chronic rhinitis frequently develops into **Chronic Hypertrophic Rhinitis**. The anterior turbinal, instead of pitting to the probe, is resistant and solid; this change is due to fibrosis of the interstitial tissue and even of the venous sinus, and attacks the inferior turbinates; the middle turbinal may be slightly affected, especially when that bone is thicker than usual and the contained middle ethmoidal cell small.

The patient has marked nasal obstruction and a rhinorrhœa of clear fluid which may cause excoriation; pharyngeal catarrh and persistent cough are often present. Enlargement of the posterior end of the inferior turbinal is a frequent cause of chronic middle-ear catarrh and prevents the cure of suppurative processes in the middle ear. Nasal speech, sensation of a foreign body in the posterior nares, and paresis of the palate may be present when the posterior ends are large actually or relatively to small posterior nares.

Chronic hypertrophic rhinitis is pre-eminently a disease of young adults, but may be seen in children and later life.

The swollen anterior end of the inferior turbinal appears as a smooth pink or whitish swelling, while the posterior is white and moriform. Spraying with four per cent. cocaine only slightly reduces the hypertrophic tissue, in contradistinction from simple chronic rhinitis. It is convenient to spray the nose in these cases in order to estimate the amount of hypertrophic tissue present and to facilitate a thorough examination of the nose. The cocaine should be applied after testing the air-way of either nostril and carrying out anterior and posterior rhinoscopy. The appearance of the contracted nose will indicate a suitable course of treatment. On the one hand the hypertrophic changes may have followed a neglected rhinitis in a competent nose, possibly associated with adenoids, or the nose has been originally incompetent from constriction of the anterior nares, abnormalities of the septum, or complete or partial occlusion of the posterior nares. The aim of the surgeon is to establish a competent nose and to treat the primary

rhinitis. Slight cases in wide noses should be treated on the medical lines detailed above, but operative procedure usually is necessary.

In cases where hypertrophy is small and chronic rhinitis marked the galvano-cautery is applied to the inferior turbinal. The submucous is the better method. A pointed cautery heated to dull red heat is plunged into the anterior end of the turbinal and passed along the length of the bone; two or three punctures may be made. Linear cauterization is also used, but requires careful manipulation with an insulating speculum to avoid synechiæ, and healing is not so rapid. Delavan's submucous incision with a narrow-bladed knife is employed by some, but is more difficult to apply than the cautery, while the subsequent reaction is greater. Goldstein's trocar and cannula may be used to apply chromic acid by the submucous method; it is contra-indicated in kidney disease. It is useless to apply the cautery to the middle turbinal.

The anterior ends of the inferior turbinals are easily removed under local anæsthesia; the method of anæsthetizing is described under polypi. A Thudichum's speculum is inserted into the nostril, and the anterior end separated from the outer wall for about half an inch by a snip of Tilley's scissors or cutting forceps; the point of the scissors is directed outwards during this manipulation. The loop of a snare is adjusted to a small size and the wire passed into the cut groove. The point of the snare is moved along the medial aspect of the bone and then against it. The wire is tightened and the anterior end removed; this is Lake's method. The incised ends may also be ablated with Luc's forceps No. 1 or 2—a convenient method under general anæsthesia. Jansen-Struycken punch forceps are effective in some cases under local anæsthesia, when the preliminary incision is unnecessary.

Enlargements of the posterior ends are most successfully removed under gas, preferably with Lake's turbinotome, which is hooked over the end or adjusted by means of the finger in the posterior nares; a snare may be employed but is more difficult to manipulate and removes less tissue. Some patients will submit to this operation under local anæsthesia; five per cent. alypin obviates the contraction consequent on cocaine and suprarenal anæsthesia. A snare loop is bent downwards from the convex edge and a second time outwards from the flat plane; by this manœuvre the loop, when passed over the posterior end, can be drawn outwards on tightening the wire. This method requires practice.

Occasionally the hypertrophic tissue, though energetically treated, grows again. I removed the whole of the hypertrophic tissue from a

girl aged eighteen by snaring the posterior end and then tearing the tissue from the bone; it was freed from the anterior end by scissors. The treatment of her chronic rhinitis was neglected and she reappeared a year later with an obstructed condition almost identical with her first appearance. Such cases are rare, and it is important not to remove too much inferior turbinal; the whole of the inferior turbinal should only be totally removed in cases of exceptional contraction of the nares, when Carmalt Jones' spokeshave will be found an efficient instrument.

Physiological ventilation is better obtained by resecting an obstructing middle turbinal than by a too severe treatment of the inferior turbinal, for in this last case dry rhinitis may attack the too patent inferior meatus, while the superior meatus is in a condition of obstructive rhinitis. A hypertrophic fringe dependent from the bone may be neglected and the bone treated according to the amount of obstruction present; in wide noses the anterior end is removed with Luc's forceps; in narrow noses the whole bone is removed with Carmalt Jones' spokeshave, aided by the finger in the posterior nares, or with a Luc's forceps gripping the posterior lip. Both these operations are better carried out under gas. Many rhinologists remove the middle turbinal under local anæsthesia (see *Nasal Polypi*), when the attachment of the bone is divided with angular scissors or cutting forceps and the bone snared; this manipulation is not easy in the narrow nose, where removal is usually needed.

It frequently happens that a submucous resection of the septum, resection of the turbinals and removal of adenoids have to be carried out, and are better performed on one occasion under general anæsthesia than in a series of manipulations, which depress the patient physically and mentally.

Finally every care must be used to avoid transferring the patient from the Scylla of an obstructed nose to the Charybdis of a dry one. The post-operative treatment is similar to that in use after the removal of polypi; generally speaking, noses which have been prepared with a local anæsthetic and in patients coming from a distance should be plugged; the plug must be removed next day. It is advisable to put the patient on a course of treatment for rhinitis.

Lupus.—Lupus of the nose is frequently seen as an extension from the cutaneous surface, but exceptionally it is found in the nose alone. The infection commences at the anterior part of the septum, which is exposed to finger-nail damage, and spreads to the floor of the nose and on to the inferior or middle turbinal. The early stage is characterized by the usual brown nodules, which coalesce and ulcerate. Accord-

ing as the nose is moist or dry the granulomatous tissue appears hypertrophic or dry; the latter is the commoner type. It will be found satisfactory, before deciding if a crusted nose is lupoid or in a condition of suppurative rhinitis, to direct the patient to spray the nose with ten-volume hydrogen peroxide lotion, to wash out with the three-salt lotion, and to apply a mercurial oil with a brush or wool mop. In a week's time the surgeon will be able to see the exact extent of the disease and note the characteristic edge. The cartilaginous septum is soon destroyed, but the bone is uninjured. Syphilis destroys bone as well, is usually rapid, and involves a large area at a time; it is accompanied by free discharge, or an intolerable smell and dead bone. Finger-nail perforation and that due to bichromate dust have to be distinguished.

If the skin of the face is involved X-ray or Finsen light treatment should be used to give the best cosmetic results, and the internal nares be exposed to the active rays at the same time; though not always satisfactory, I have seen complete cures follow X-ray application. Less satisfactory cures may be completed with punctate cauterization, the preparation for which with suprarenal extract and cocaine permits of very accurate definition of the extent of the disease.

In other cases, where the disease is extensive and the patient shirks attendance, the nose is similarly prepared with a suprarenal extract and cocaine and the diseased mucous membrane curetted with a sharp spoon under general anæsthesia. Hydrogen peroxide lotion is applied, and later, before the patient is lost sight of, any doubtful spots are touched with the cautery. Unluckily, however much care is taken in limiting operative interference to the diseased area, the resulting scar crusts, and dry rhinitis calls for almost continuous treatment with lotions and oils.

An iodine ointment may take the place of the mercurial oil.

Arsenic should be given internally in all cases.

Vestibular Boils.—Furuncles are liable to appear in connection with the hair follicles of the vestibule, and are either diffuse or circumscribed. The condition may become severe, extensive œdema closing the eyelids and the temperature being raised. The hairs of the offending follicles are pulled out, the nose sprayed with saline lotion and the mercurial oil frequently applied and continued for three months in the diffuse cases. In the more severe cases boracic fomentations are supplied and the patient kept in bed; incision should only be undertaken when the focus is definite or the general state demands it.

Delayed convalescence may be due to a slough, which should be localised and syringed

with hydrogen peroxide lotion, and when loose extracted with forceps or pressure. Quinine in moderate doses should be given internally.

E. A. P.

ATROPHIC RHINITIS

Atrophic Rhinitis is characterized by atrophic changes in the mucous membrane of the nose, and later on of the turbinate bones; the nasal passages becoming abnormally wide. In consequence of the atrophic changes in the mucous membrane, the secretion is altered in character and lessened in quantity, so that it dries up and forms crusts. These decompose and have a characteristic smell, whence comes the name "ozæna."

So far no definite cause for these changes has been discovered, although they are often associated with disease of the accessory sinuses. This disease is most frequently met with in women, the smell being generally most marked during the menstrual periods.

The sufferers are often anæmic, ill-nourished and dyspeptic, due to swallowing the pus from the nose.

Both local and general treatment are therefore required, but the local treatment is of primary importance. The nose must be thoroughly cleansed and kept cleansed; this is best done at first by the practitioner himself. Peroxide of hydrogen (ten vols. per cent.) should be sprayed into the nose, or applied on pledgets of absorbent wool, in order to soften the crusts and allow of their removal without causing the mucous membrane to bleed. The crusts should then be removed by spraying or syringing with a warm alkaline lotion, consisting of a teaspoonful of common salt or sea-salt, or bicarbonate of soda, to a pint of water; in most cases it is necessary to use a pint or even more.

During the syringing the patient should be directed to hold the head over a basin and breathe in and out through the open mouth. The liquid will then pass up one nostril and down the other, without running into the Eustachian tubes or down into the larynx.

For self-use Wyatt-Wingrave's modification of Higginson's syringe is the most convenient.

After the nose has been washed out it should be examined with a good light, and every particle of debris gently removed with swabs of absorbent cotton.

The accessory sinuses should then be examined, and if found to be diseased will require appropriate treatment (see *Accessory Sinuses*). The practitioner should carry out the nasal washing himself, as often as is necessary, until the patient has learnt to do it effectively.

After cleansing the nostrils they should be completely plugged with strips of gauze or

absorbent cotton. There is no advantage in using gauze impregnated with strong antiseptics. The plugging compels the patient to breathe through the mouth, and prevents the secretion becoming dry and forming crusts, but does not cause the throat to be any more uncomfortable than it was before, as the nose has lost its power of warming and filtering the air. This simple treatment should be carried out for at least a fortnight, so as to give the nose a complete rest. After the first two weeks various applications may be made to the nose with a view to exciting its secretory action. Stuart Low strongly recommends the use of mucin to supply the place of the normal secretion, because it is hygroscopic and bactericidal. It is supplied as an elixir, and it can be also used internally.

Another substance which has the same properties is glycerine, and it may be usefully combined with iodine (five grains to the ounce), and also with iodide of potassium (eight grains to the ounce), or ichthyol in a ten per cent. solution. The patient can best apply these remedies by means of a feather dipped in the solution, put into the nostril and gently turned in all directions.

If after several weeks or months of this treatment the patient is not much better, the following more drastic methods may be adopted. First, after douching, a solution of cocaine (ten per cent.) and adrenalin (1 in 4000) may be sprayed up the nose. When this has taken effect orthochlorophenol in glycerine may be gently applied twice a week. It is best to begin with a weak solution, five per cent., as it occasionally causes great smarting; if well borne the strength can be gradually increased to twenty-five per cent. Secondly, formalin may be applied, beginning with a half per cent. solution, and going up to three per cent.

The constitutional treatment consists in improving the general health, and combating the anæmia by tonics, diet, fresh air and exercise. The best tonics are syrup of iodide of iron, or a combination of iron, arsenic and strychnine; the syrup of the hypophosphites or glycerophosphates is also very useful, as well as maltine and cod-liver oil.

The diet should contain abundance of fat and oil; anything that tends to be excreted by the mucous membrane and to dry it up, such as dry and salted fish and meat, should be avoided. Low advises a diet that contains mucin, such as oysters, eels, snails and sweetbreads. Those who cannot obtain sufficient outdoor exercise should practise breathing exercises three or four times a day, and sleep with the window open both in winter and summer.

When a definite cause, such as affection of the accessory sinuses, can be found and removed

the disease may be quickly cured, but otherwise it is often very chronic, and local treatment must be carried on persistently. In many cases the plugging can be done away with after some months, but the washing out may have to be carried on for years. By this means the crusts and smell are prevented, and the patient's life made more comfortable both to herself and to her friends.

To the worst cases the hope may be held out that the crusts and smell will disappear as age advances.

G. C. C.

FOREIGN BODIES IN THE NOSE

Foreign bodies in the nose are most frequently found in children; in adults they are comparatively rare.

They may be pushed in through the anterior nares, or pass into the naso-pharynx during a fit of vomiting.

In children such miscellaneous articles as boot buttons, trousers buttons, pieces of slate pencil, the india-rubber tip of a lead pencil, peas, beans, glass beads and small pebbles have been found; and recently the writer removed a small hairpin from the nose of an hysterical woman.

The history given is generally one of discharge from one nostril which has persisted for so long that the mother has been forced to the conclusion that it cannot be due to a mere cold. In the later stages it may become bloodstained and purulent.

A very offensive smell is occasionally the symptom which first attracts attention.

Foreign bodies are usually found in the inferior meatus, about half an inch from the entrance, and when smooth may not give rise to any objective symptoms for a long time. Their removal is not always easy, for cases are constantly occurring where several ineffectual attempts have been made.

Three precautions should be observed before attempting to extract the foreign bodies.

1. The little patient should never be frightened.
2. Every examination should be made with a good light.
3. The foreign body should be seen before attempting to remove it.

A general anæsthetic may be required for a young child who will not keep its head still or has been frightened, and the examination and extraction should then be made at the same time. Should the first attempt at removal fail, and the body be pushed further in, it renders the next attempt more difficult, often putting the child into such a state of terror that he refuses to allow the nose to be examined again.

In older children who have sufficient sense to allow the head to be kept steady, the unobstructed nostril should be closed with the finger,

and the nose blown forcibly. The discharge should then be gently wiped away, and the nostril dilated with a speculum.

It is not always possible to see the foreign body at first, owing to the growth of granulation tissue, which the irritation of its presence has caused to spring up around it. A solution containing four to five per cent. of cocaine, and 1 in 4000 of adrenalin should then be applied by means of small pledgets of absorbent cotton, or by gently spraying a little into the anterior part of the nostril.

When this has had time to take effect, the patient should again blow the nose, when in some few cases the foreign body may be blown out.

If the discharge and swelling still prevent the foreign body from being seen, the former should be wiped away, and more cocaine applied until a good view is obtained. Its size and situation should then be defined by means of a probe or a pair of long angle forceps. If it is not in close contact with the floor of the nose the best instrument to use is the smallest pair of Luc's nasal forceps, of which the ends are either fenestrated, or cupshaped. The lower end can be gently inserted under the foreign body, and the upper blade be brought down parallel on to the top of it.

Even if the object be round and smooth, the cupshaped or fenestrated ends will prevent its slipping. Should this instrument not be available, a flexible probe bent at right angles, or a strabismus hook or Lister's ear hook, or a stout hairpin, should be passed through the middle meatus, and the bent portion be brought down behind the foreign body. Unless this has ulcerated through the septum, the edge of which acts as a point of resistance, gentle traction will succeed in dislodging it.

After removal, a little peroxide of hydrogen, ten vols. per cent., should then be applied to the nose and forcibly blown out, the opposite nostril being closed at the same time. An alkaline wash should be used for several days, and if there be abrasion of the mucous membrane, or ulceration through the septum, the application of an ointment containing six per cent. protargol will hasten the healing.

Ordinary polypus or dressing forceps should never be used, as they are apt to slip off the foreign body, and push it further in, especially if it be round, smooth and hard.

Rhinoliths, or nasal stones, are formed of phosphates and carbonates around a nucleus, which may consist of blood or hardened mucus, or some foreign body which has been vomited into the nose.

They are very rare in children.

Their presence is usually indicated by an offensive unilateral discharge. When small

they can be removed like other foreign bodies, when large they may have anchored themselves into the recesses of the nose so securely that they must be crushed and removed in separate pieces.
G. C. C.

NASAL POLYPI

Polypi of the Nose constitute a fertile source of nasal obstruction in adult and occasionally juvenile life.

The popular term "Hard Polypus" is applied to chronic hypertrophic excrescences growing from the inferior turbinal and enlarged middle turbinal due to distension of the middle ethmoid cells.

"Malignant Polypus," a disused name, indicated the appearance of sarcomatous tissue in the nose; it is readily distinguished by the tendency to bleed, and its pressure-effects.

Mucous Polypi are usually restricted to one or both middle turbinals primarily, but may involve the superior turbinal or protrude from the ethmoid cells or the antrum, the frontal or sphenoidal sinus.

In every case of nasal obstruction, discharge or chronic catarrh the anterior and posterior nares should be methodically examined by a good reflected light; it is often helpful, after estimating the degree of obstruction to inspiration, to spray with four per cent. cocaine in order to contract the mucous membrane, turgescence from the ever-concomitant rhinitis, and to remove any source of discomfort in the manipulation of a probe. By these means polypi are readily discovered, even in a narrow nose, their attachment traced, and possibly the source of pus, if present, located. Typical polypi are white, smooth and pear-shaped; they are adherent by their pedicle to the middle turbinal. In size they vary from minute white excrescences to rhizome-like masses three inches or more in length, projecting from the nose or into the posterior nares. Mucous polypi never displace the main structural bones of the nose, but may push aside the septum and turbinals. Degeneration and retention cysts of large size may be present. There is a tendency to affect certain families. Polypi which protrude from the nose and are exposed to dry conditions have a red granular surface; they have become vascularized.

Polypi are the result of a general or local inflammation of the nose on the ethmoid and other regions composed of thin bone covered by a thin membrane representing mucous membrane and periosteum. The other essential for their development is a moist atmosphere; accordingly polypi are not seen in dry noses where rhinitis sicca and atrophic rhinitis obtain.

There are all grades of intensity of the inflam-

mation, dependent on the organism present and the vasomotor reaction and resistance of the patient. In the very acute cases occasionally seen, especially in children after scarlet fever, the patient is ill; there is an acrid nasal discharge with fever, and rhinoscopy reveals white polypi; the probe grates and penetrates a softened ethmoid. The polypi in such a case are really granulations arising from necrotic bone. Panethmoiditis may appear; the skin at the base of the nose becomes red and œdematous, and infection of the cerebral veins may lead to a fatal result.

On the other hand there are cases so insidious in their onset that polypi are not recognized until causing obstruction, and the patient only reluctantly admits intermittent catarrhs.

Intermediate cases give a history of numerous attacks of catarrh of varying intensity, with discharge of clear fluid, muco-pus or yellow pus; in fact they have suffered from different degrees of chronic rhinitis. The symptoms of polypi are referable to the inflammation and pressure of the affected parts, which are much affected by the varying vasomotor conditions, and to the present and remote effects of nasal obstruction.

The symptoms of rhinitis are present in variable intensity. Paroxysmal rhinorrhœa with sneezing may be the complaint. Headache referred to the region of the glabella and nasal bones, or a sensation of overweight in the head may distress the patient. Sometimes asthma develops, and though in most cases removal of the polypi benefits the patient, this is not a certain cure. A troublesome and persistent cough in old people frequently leads to the recognition of polypi. Or progressing, the catarrhal affection may extend to the bronchi and lung alveoli, causing bronchitis, emphysema, and all the results of stress on the right heart. The congested nose of the temperance lecturer may be due to polypi and not to drink.

Occlusion of the lachrymal duct may lead to epiphora; ineffective attempts to blow the nose, together with loss of taste and smell, distract the patient.

It is easy to watch the process of polypus formation, for this is a matter of days or years, according to the intensity of the inflammation.

The mucous membrane of the nose is swollen, dark red, and in a state of chronic rhinitis. Small white upheavals of œdema are visible over the middle turbinal. The catarrh subsides and the condition improves, only to be followed by another attack which advances the growth of the polypi. When these have definitely formed local treatment seems of little avail. Eventually the middle turbinal becomes a mass of polypi and softened bone.

The amount of pus present varies in different

cases. Occlusion of the ostia by polypi and turgescence of the mucous membrane may precede infection of the antrum, frontal sinus, or sphenoidal sinus. Accordingly cases of polypi with persistent discharge of pus should be suspected to have these complications. Apart from all this, primary disease of the antrum or of the frontal sinus gives rise to polypi which project into the middle fossa and are bathed in pus. Extensive suppuration of the ethmoid and neighbouring cells may commence in this way.

In old people the disease often takes a mild course, and one or two polypi with little degeneration of the bone presents a condition which is very amenable to treatment.

The *treatment* of mucous polypi may be discussed under four headings: *Prophylactic*; *Radical*; *Palliative*; *Post-operative*.

Prophylactic Treatment. Chronic rhinitis is always present in the typical case of polypi. Polypoid degeneration may be regarded as the result of inflammation of the middle turbinal and allied structures in a narrow or obstructed nose; further, when polypoid changes have commenced, medicinal treatment is only moderately successful. Accordingly it is very important to treat every case of chronic rhinitis on its merits (*loc. cit.*), and if a middle turbinal causes headache or other symptoms of distress, to remove the whole or anterior end, according to the amount of air-way required.

Radical Treatment. When a middle turbinal in the early stages of degeneration does not yield to medicinal treatment it is wise to remove it; total removal is the most effective. I have observed in a case where a small piece of the posterior end was left, that this underwent polypoid degeneration.

In ordinary cases the middle turbinal with the polypi should be removed, and any other affected part dealt with at the same time.

The nose is painted half an hour previously with cocaine hydrochloride (gr. $\frac{1}{2}$), dissolved in fifteen minims of adrenalin solution or epinine, to render light anæsthesia sufficient and to exclude any trouble from hæmorrhage.

The patient is placed in the semi-prone position with one shoulder raised and the head turned laterally, or in the sitting posture with the legs resting on a chair. Gas and ether followed by a little chloroform give the best results; the position recommended reduces venous bleeding, which is sometimes troublesome in the prone position. A speculum is introduced and, if the middle turbinal is not concealed by polypi, the posterior end of that bone is seized with Luc's forceps No. 2. When the nose is crowded with polypi a thin dressing forceps is inserted and the polypi are removed; the forefinger in the posterior nares assists this

manœuvre. The nose is then mopped out and Luc's forceps applied to the middle turbinal. In many cases it is easier to deal with the polyp and middle turbinal together, especially in narrow noses; to effect this, Jones's spokeshave is useful. It is well to ascertain that the instrument is hooked over the posterior end of the bone. The nose is temporarily packed and examined through the speculum. Any polyp springing from diseased cells are treated in detail; the most satisfactory instrument for this purpose is Meyer's ring knife, bent to a suitable shape. The anterior ethmoidal cells in the region of the hiatus semilunaris and bulla ethmoidalis are more commonly diseased, and it must be remembered that neglect to deal with these will make the operation a failure both in relieving nasal obstruction and eradicating the disease. It is also necessary to recollect that the cribriform plate is on a level with the glabella; no cut must be made upwards, only outwards. Luc's forceps or artery forceps are useful in removing tags.

Where a large polypus projects into the pharynx, polypus forceps applied with the finger of the other hand in the posterior nares will readily bring away the growth.

Some surgeons advise the use of a local anæsthetic only, and the removal of the diseased bone and polypi by means of nibbling and gripping forceps; this method is not so generally satisfactory as the above, but is employed in recurrent cases.

Bleeding is checked by spraying with peroxide of hydrogen, (10 vols.), and the nose packed with bismuth gauze saturated with liquid sterile yellow vaseline, or thin rubber protective packed in with gauze. The packing is removed next day, when the nose is sprayed with hydrogen peroxide and syringed with warm saline lotion. Ung. hyd. nit. dil. $\frac{3}{4}$ ss., ol. amygdal. essent. q.s., paraff. liq. aa ad $\frac{3}{4}$ i, sprayed or painted into the nostrils, adds to the patient's comfort. Severe headache is a frequent complaint; this may be relieved by washing away clots with saline lotion. Aspirin in suitable doses is also useful. The patient gets up in four days, but should be cautioned against blowing the nose.

At the time of the operation the posterior end of the inferior turbinal, if causing obstruction, is removed with Lake's turbinotome; but care must be taken to avoid removal of too much turbinal, which is apt to lead to a dry nose and possibly atrophic rhinitis. The above operation is not advisable in patients over sixty-five, except in special cases.

Palliative Treatment. In some cases where immediate relief of the obstruction is required, and the radical operation is inadvisable, removal with a snare under local anæsthesia is practised.

In old people where two or three large polypi are present without marked bone disease this procedure is unattended with recurrence.

To avoid discomfort during manipulation the nostril is first sprayed with four per cent. cocaine, and five minutes later small pledgets of wool moistened with ten per cent. cocaine, eucaine or novocaine, diluted with an equal part of adrenalin solution or epinine, are packed round the base of the polypi. These may be readjusted in ten minutes. Care should be taken that none of the fluid is swallowed and not much of the solution employed. In twenty minutes the requisite anæsthesia is obtained. Heath's snare is adjusted so as to encircle the polypus with as small a loop as possible. The point of the snare is passed to the base of the growth and the wire gradually tightened. The polypus is removed by a dragging motion, which brings away a small piece of the middle turbinal. The nose is lightly packed with vaseline gauze, which is removed next day, and similar after-treatment to that described under the radical operation instituted.

Acute necrosis of the ethmoid should be treated on general surgical lines. The nose should be sprayed with peroxide of hydrogen and gently syringed with the "three-salt lotion" (warm), sod. bibor., sod. chlorid., sod. bicarb., aa $\frac{3}{4}$ i ad. O ss. aq. At the right time the middle turbinal with other fungating tissue should be removed, and free drainage of the infundibulum and nares obtained.

The operation should be carried out under a general anæsthetic, and the posterior nares should be plugged with a sterile marine sponge, wrung out of saline, with the object of excluding the foul débris from the lungs. It is better to spray and not syringe in all these cases, for a mass of hydrogen peroxide froth is most uncomfortable to the patient.

Post-operative Treatment. The patient should be warned of the possibility of recurrence, directed as to a course of treatment, and advised to submit himself to re-examination from time to time. Avoidance of recurrence depends on the skill of the operator and other factors discussed above. It is of primary importance to treat the rhinitis which may persist. Recurrence of polypi from a middle turbinal which has been left in an obstructed meatus is common, except in the chronic cases found in old people. But in some cases, even where the middle turbinal has been removed, the trouble has already spread to the anterior ethmoidal cells although it is not obvious at the time of the operation, and although though all bone softened by osteitis has been carefully removed with Meyer's ring knife. The anterior ethmoidal polypi soon obstruct the infundibulum and cause headache and involvement of the frontal sinus,

and even interruption of the air entry, with increase of the symptoms of chronic rhinitis.

Recurrent polypi are best dealt with under local anæsthesia, except in those cases where extensive erosion is necessary, when general anæsthesia is demanded. After one operation the nose is more readily packed and more tolerant. The larger polypi are snared; the smaller ones are torn away. The diseased cells of the bulla ethmoidalis and hiatus semilunaris are then nibbled away with Grünwald's forceps. Some apply the cautery to the affected part, or formalin on a small pledget of wool, or even trichloracetic acid, but their efficacy is doubtful, and probably more mucous membrane is destroyed than disease arrested.

It is possible that ionization with dilute solutions of zinc sulphate may diminish the bacteria and give the nose a better chance of recovery. It is well to reiterate the importance of leaving sufficient inferior turbinal in a nose of moderate capacity when the middle turbinal has been removed to avoid the production of chronic rhinitis. The aim should be to restore the normal hygiene of the nose with a little more patency of the airway than is normal. Irritative nasal injections should be avoided; the three-salt lotion may be used night and morning, and the ointment at night. Some patients derive benefit from adding one or two drops of carbolic acid to the tumbler of three-salt solution, especially when pus is present. In this case half an ounce of hydrogen peroxide lotion may be added to the tumbler. If, in spite of this treatment, pus continues, suppuration in the accessory cells may be suspected and a careful examination made to locate the source. Pus with crusts may be due to a too free removal. The treatment of atrophic rhinitis should be applied to these cases.

E. A. P.

DISEASES OF THE NASAL ACCESSORY SINUSES

Acute Inflammation and Suppuration.—Acute inflammation of the accessory sinuses of the nose occurs as an extension of inflammation

from the mucous membrane of the upper respiratory tract, especially from that of the nasal cavities. The mucous membrane of the sinuses is continuous through the natural openings of the sinuses with that of the nasal mucosa. It follows, therefore, that an acute rhinitis may spread into one or other of the sinuses by direct extension of the inflammatory process. This frequently happens in the course of a "cold in the head," and especially so where the infection is due to bacillus influenzae.

Other infections, such as those due to pneumococcus, streptococcus, staphylococcus, M. catarrhalis, etc., or a combination, are frequently

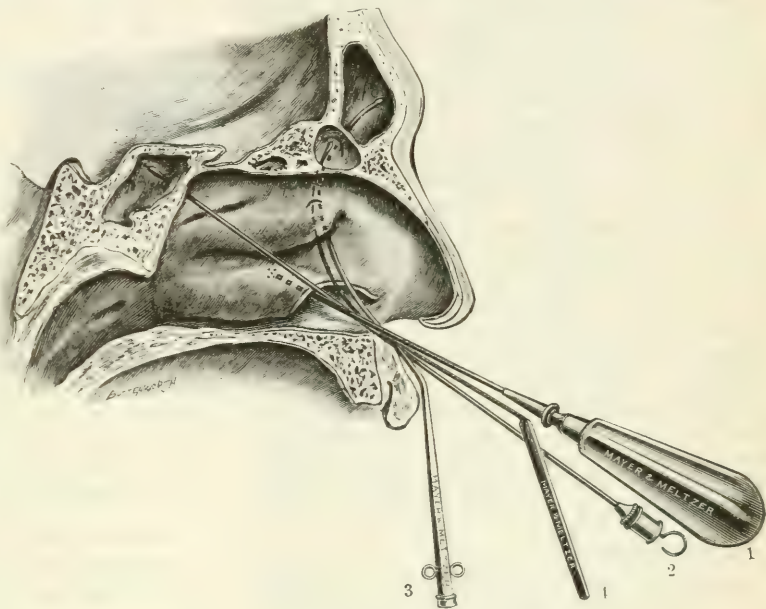


FIG. 1.—View of Outer Wall of Nose.

1. Lichtwitz's trocar and cannula in position for puncture of the maxillary antrum (the anterior end of the inferior turbinal has been removed).
2. Sphenoidal sinus catheter passed into the sphenoidal sinus.
3. Frontal sinus catheter in position (note that the instrument lies against the upper lip).
4. Frontal sinus probe which has entered a large fronto-ethmoidal cell instead of the frontal sinus (note how the instrument stands out from the nose).

responsible. When the natural openings become occluded by swelling of the mucous membrane and free drainage is prevented, urgent symptoms are liable to occur. Acute infections of the maxillary antra stand somewhat apart, as they are often caused by infection through a tooth socket. Infections of the sinuses may occur as complications of the acute specific fevers, such as scarlet fever, typhoid, etc. The inflammation may be mild, so that catarrh only of the mucous membrane occurs, or it may be more virulent, causing actual pus formation. In the former case slight headache or a feeling of oppression over a cavity during the course of a "cold in

the head" is noticed. In the latter case severe headache, photophobia, and lachrymation may be experienced.

Symptoms. During influenza or an acute rhinitis the temperature rises higher, with more marked constitutional symptoms, when a sinus becomes involved. The nose is often obstructed owing to swelling of the turbinals, and throbbing pains are felt in the forehead and eyes, or in the case of the maxillary antrum over the cheek bones. A rigor may usher in the attack.

In affections of the sphenoidal sinus and posterior ethmoidal cells the headache is often over the vertex or occipital region. A mucopurulent discharge from the nostrils is noticed and this soon becomes markedly purulent.

Diagnosis. The above symptoms, with tenderness over the frontal sinus, malar region, or inner side of the eye, or orbital plate, are suggestive. The presence of a streak of pus under the middle turbinal, which returns rapidly on mopping with a piece of wool, establishes the diagnosis of an acute sinusitis. If one or more of the posterior set of sinuses is affected the pus appears in the olfactory cleft, or on posterior rhinoscopy above the middle turbinal or on the posterior pharyngeal wall. If treated properly most acute cases recover completely, so that the mucous lining of the cavity returns to its normal condition. If not treated they frequently undergo spontaneous cure, but sometimes lead on to chronic disease. Death does not as a rule occur in first attacks but may happen when an acute exacerbation supervenes upon a chronic suppuration.

Chronic Suppuration—

Symptoms. Pain in the head may be absent, the only symptoms complained of being long-continued nasal discharge, nasal obstruction, post-nasal catarrh, or frequent colds in the head. The symptoms vary much in nature according to whether the sinus or sinuses drain freely. If they do not drain freely pain in the head or face are complained of. The pain is often periodic, being relieved when the opening becomes free and the purulent contents of the sinus flow away, which often occurs between the hours of 9 and 11 a.m. When the sinus empties itself a bad smell is often noticed by the patient, but usually not by his friends.

A unilateral purulent nasal discharge is very suspicious, but the pus often drains backwards, especially at night, and is swallowed. Post-nasal catarrh may then be the only symptom complained of, and it is produced by the irritation of the pus on the pharyngeal mucosa.

Constant or intermittent nasal obstruction is often produced by swelling of the turbinals or the presence of nasal polypi. The pressure of the swollen middle turbinal against the septum

may produce pain at the side of the nose. So-called attacks of neuralgia are often due to undiagnosed sinus disease.

Diagnosis. The diagnosis is established by the same physical signs in the nose as in acute cases.

Complications. The constant swallowing of pus is apt to produce chronic dyspepsia. The patient frequently presents an unhealthy earthy appearance and is apt to be mentally depressed and irritable and unable to concentrate his attention. Myocardial degeneration may result from the long-continued poisoning.

A chronic irritating cough may be produced by the irritation of the secretion at the back of the throat. Chronic pharyngitis, laryngitis and bronchitis are not uncommon. Complications may arise in that one sinus may infect another, so that several are affected. The condition is then known as multisinusitis, or pansinusitis when all are involved.

Eye complications such as orbital cellulitis or optic neuritis may occur, or conjunctivitis, or lachrymal sac abscess, from obstruction and infection of the nasal duct.

Ear complications occur if infection travels up the Eustachian tubes: it may cause Eustachian catarrh or suppurative otitis media.

Cranial complications—meningitis from infection from the ethmoidal cells, cerebral abscess in the frontal lobe from the frontal sinus, cavernous sinus thrombosis from suppuration of the sphenoidal sinuses, are very grave and not unknown complications.

Acute Sinusitis of the Maxillary Antrum—

Etiology. There may be a carious tooth projecting into the floor of the cavity, or an alveolar abscess may burst into the latter, causing acute infection of the cavity, or the infection may be caused by the extension of an acute rhinitis through the ostium maxillare.

Symptoms. In acute suppuration of the maxillary antrum there is usually neuralgic

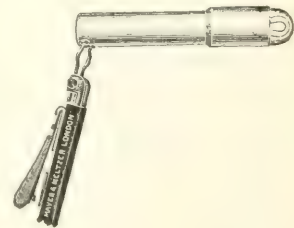


FIG. 2.—Transillumination Lamp for the maxillary antrum.

pain about the eye and forehead on the affected side. There is a dull bruised aching feeling in the cheek and often throbbing. The nose feels blocked. These symptoms are relieved by a

discharge of pus or muco-pus and return as the sinus becomes distended again.

If due to tooth infection the second bicuspid or first molar are the most usual offenders, although other teeth may be the cause. Crowned teeth

caused by old suppuration, or to changes in the bone such as hyperostosis, etc., when there



FIG. 4.—Lichtwitz's Trocar and Cannula.

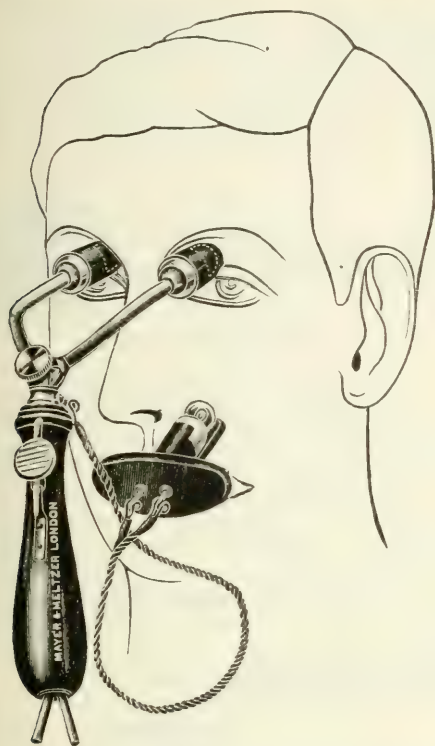


FIG. 3.—Combined Transillumination Lamp for the frontal sinuses and the maxillary antrum.

should always be regarded with suspicion in a case of antral suppuration.

Diagnosis. Besides the above symptoms, pus is seen as a streak under the middle turbinal on anterior rhinoscopy, and it returns after being wiped away. If a guarded five-volt lamp (see Figs. 2 and 3) is introduced into the mouth, while the patient's head is covered with a camera cloth or he is in a dark room, a crescent of light is normally seen under each eye. This disappears if the antrum contains pus, and so "darkness on transillumination," as it is called, affords a valuable test for antral suppuration. It is also valuable when negative, although suppuration is not then absolutely excluded. Darkness on transillumination may be due to

thickening of the mucous membrane, or to pus present. A tooth-plate, if present, must be removed before applying the test, as the latter causes dullness on transillumination. On obtaining absence of the crescent on transillumination, the diagnosis should be confirmed by puncture and washing out the sinus. The inferior meatus is rendered anæsthetic by a piece of wool moistened with ten per cent. cocaine placed under the inferior turbinal. After waiting ten minutes the antral wall is punctured through the thinnest part of the inferior meatus, *i. e.* through the maxillary process of the inferior turbinal. This is effected by means of Lichtwitz's trocar and cannula (Fig. 4). The point of the instrument is placed under the attachment of the inferior turbinal, one and a quarter inches back from the anterior nares along the inferior meatus. It is then pressed upwards and outwards against the outer wall of the nose and readily enters the antral cavity. The trocar is removed and the cannula, which remains in its place, is attached to the bulb and tube (Fig. 5) and air is blown through. Pus, if present, is blown through the ostium and appears in the middle meatus. The sinus is now washed through in the same manner with normal saline solution and so cleansed of its purulent contents. This establishes the diagnosis. In the early stages of an acute antral inflammation, before the formation of

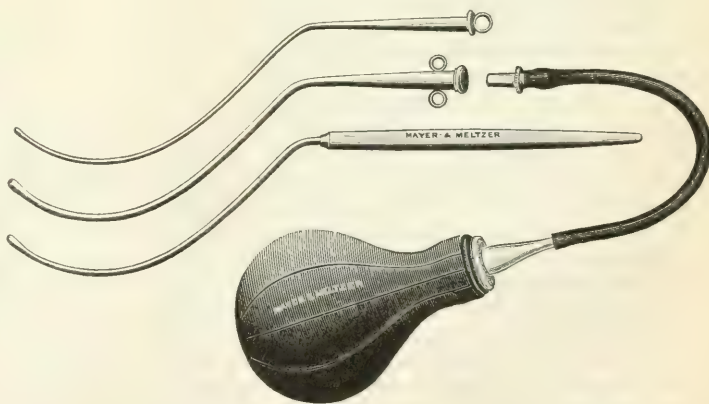


FIG. 5.—Frontal Sinus Catheter and Probe, with bulb and tube for washing out the frontal sinus.

pus, this should not be done, as the mucous membrane is swollen and almost obliterates

the cavity, and puncture and lavage is then very painful and produces no result.

Treatment. Any tooth which may be a causing factor should be removed. Drainage should be facilitated by: (1) a steam nasal inhalation of menthol gr. x with tr. benzoin co. $\frac{3}{4}$ i (one drachm of the mixture to one pint of boiling water), to be used every hour; (2) by applying equal parts of ten per cent. cocaine and adrenalin to the middle turbinal region; (3) posturing—that is lying in such a position that the ostium maxillare is the most dependent part of the sinus; (4) dry heat, which is soothing and of great benefit. This is applied by means of a hot water bottle or electrically heated pad to the face, or placing the head in a radiant heat bath. Aspirin (10 gr. four-hourly) helps to relieve the pain, and a smart purgative should be given.

The above treatment generally suffices in acute antral suppuration.

If after several days free drainage is not obtained, or the diagnosis is uncertain, the cavity may be punctured and irrigated as above described. A hole may be drilled (at the time of removing the tooth in cases of dental infection) through the tooth socket and the cavity irrigated daily through the opening, which is kept open by a screw stud.

This latter method is open to the objection that mixed infection may be introduced into the antral cavity from the mouth. Several washings by means of Lichtwitz's trocar and cannula may be necessary to effect a cure. If the case becomes subacute despite the above treatment and the discharge does not disappear, operative measures must be employed (see treatment of *Chronic Suppuration of the Maxillary Antrum*).

Chronic Suppuration of the Maxillary Antrum.—There may be, and often are, few symptoms. A post-nasal catarrh, together with general malaise, may be present, but more usually the patient complains of a "chronic cold" or frequently recurring colds in addition to more or less nasal obstruction. Pain, if present, is supra- or infra-orbital, or there may be a dull ache at times in the cheek of the affected side. A bad smell in the nose may be noticed from time to time. Hyperæsthesia of the skin of the cheek sometimes occurs.

Diagnosis. On rhinoscopic examination the middle turbinal may be seen to be unhealthy and swollen. If the antrum is full of pus at the time of examination, a streak will be seen descending under the middle turbinal. This may be brought out by posturing. On wiping it away a fresh bead appears. On transillumination the crescent is lost on the affected side.

On puncture pus will be washed out, and is often very offensive, especially in cases of dental origin. These establish the diagnosis. The cavity may be empty at the time of examination, so it should be examined more than once when suggestive symptoms are present.

A large single polypus in the post-nasal space known as an antro-choanal polypus is sometimes associated with polypoid degeneration of the antral mucous membrane. If traced, its stalk will be found entering through the ostium maxillare and attached to and arising from the mucous membrane lining the antrum.



FIG. 6.—Tilley's Burr.

Treatment depends on the condition of the mucous membrane. In long-established cases this degenerates and becomes polypoid and converted in parts into sloughy granulation tissue. Simple lavage or drainage will not then be of any avail. If the case is a comparatively recent one, intranasal drainage should be used in preference to a hole drilled through a tooth socket. The latter encourages mixed infections and often turns a curable case into an

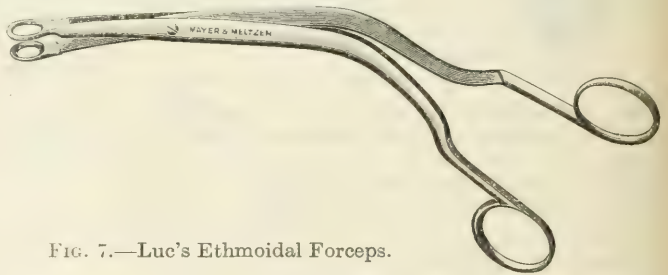


FIG. 7.—Luc's Ethmoidal Forceps.

intractable one and should be employed only where age, infirmity or other cause renders operation inadvisable.

Puncture and lavage by means of Lichtwitz's trocar and cannula with dilute iodine solution, (one drachm to the pint) will often effect a cure without operation. Where pus does not stop secreting under this treatment after five or six washings every other day operation should be considered.

The Intranasal Operation. The anterior end of the inferior turbinal is removed in the usual way, and the inner antral wall is cut away down to the floor of the nose, so as to make an opening as big as a two-shilling piece. This is effected by Tilley's burr (Fig. 6) and Luc's forceps (Fig. 7). This intranasal opening affords free

drainage and generally effects a cure in recent cases where streptococci cannot be found in the discharge.

The Caldwell-Luc operation is advocated in chronic or long-standing cases and in those which have resisted other forms of treatment. It gives excellent results. The anterior end of the inferior turbinal is removed. An incision is made in the gingio-labial fold over the canine fossa and the soft tissues, including the periosteum, retracted. The anterior wall of the antrum is opened by chisel or gouge so as to admit a view of the cavity. All unhealthy mucous membrane and any polypi are removed and the inner wall of the antrum cut away down to the floor of the nose, so as to make a free opening. This procedure is aided by direct inspection from the nares and the cavity. The tissues of the cheek are allowed to fall back in place, and the mucous membrane is sometimes secured by a stitch. The post-nasal space is plugged during the operation, but no plugging is needed in the nose or antral cavity after the operation. The subsequent treatment consists in washing out daily with an alkaline and antiseptic lotion by means of a catheter and bulb such as that shown in Fig. 5 for washing out the frontal sinus. Co-existent ethmoidal disease is dealt with by curetting or by removal of the ethmoidal cells with Luc's forceps at the same time.

Acute Frontal Sinusitis.—This occurs through infection from the nose and presents a fairly typical clinical picture. Owing to the position of the infundibulum, the frontal sinus is able to drain more easily than the maxillary antrum.

Diagnosis. In addition to the general symptoms there is pain and tenderness over the frontal sinus area and under the supraorbital margin. Pus is seen as a streak at the anterior end of the middle turbinal. If the antrum of the affected side is clear on transillumination, the diagnosis of acute frontal sinusitis is very probable. The diagnosis can be made certain if a frontal sinus catheter can be passed.

Transillumination of the frontal sinuses may be tried, but is very uncertain (see Fig. 3). The middle turbinal is often much swollen and congested. Later the upper eyelid may become swollen and the skin over the frontal area red and oedematous. The pus may burst through the frontal bone and point in this region.

The case should be treated as early as possible, according to the general lines laid down under acute inflammation of the maxillary antrum, but if the pain and constitutional symptoms get worse and swelling of the eyelid occurs, no time should be lost in removing the anterior end of the middle turbinal under cocaine or gas. This promotes bleeding and relieves the congestion, as well as removing a mechanical obstruction to drainage. It also allows of the

easier passage of a frontal sinus catheter and the washing out of the sinus (see Figs. 1 and 5). Irrigation of the sinus should then be carried out daily and will generally effect a cure in genuine acute cases where there has been no previous chronic disease. If the case is not seen until reddening and oedema of the frontal area has taken place or pus is pointing in this region, an external operation must be at once carried out.

Operation. The anterior end of the middle turbinal being removed, an incision is made along the inner half of the eyebrow and the anterior wall of the sinus removed. The infundibulum is enlarged so as to allow of free drainage into the nose. No attempt to perform the radical operation should be made, the object being to secure free and adequate drainage. No stitches are inserted and the cavity is left open and lightly packed with gauze.

Chronic Frontal Sinus Suppuration.—Supra-orbital headaches, with some tenderness at the inner side of the eye and supraorbital plate and over the frontal sinus area, together with other symptoms of chronic sinus suppuration, are present.

Diagnosis. Pus may be seen at the anterior end of the middle turbinal. Often there are signs of suppuration in the ethmoidal cells, especially the anterior ones. A frontal sinus catheter is passed after cleansing the nose, and if pus is washed out the diagnosis is complete.

It is generally possible to pass the frontal sinus cannula in cases of disease of the sinus, owing to coexistent disease and breaking down of the anterior ethmoidal cells. Frequently the probe or cannula grates as it passes over bare bone. In a healthy sinus it can be passed only in a much smaller percentage (see Fig. 1).

Transillumination of the frontal sinuses may be tried (see Fig. 3), but the results are very unreliable, and a stereoscopic X-ray should be taken. This usually gives reliable results, and also gives the operator a knowledge of the area and extent of the sinus, which is important, as the size of the sinus determines the amount of the deformity after operation, and the patient can be warned what to expect in this respect.

Treatment. The presence of chronic suppuration in the frontal sinus does not of necessity denote the advisability of a radical operation. From the position of the infundibulum the cavity drains well unless obstructed by the middle turbinal. In diseased sinuses, as already stated, the expert can usually pass a frontal sinus catheter and wash out the sinus. Frequently free drainage and regular lavage will bring about arrest of the discharge and disappearance of frontal headaches, etc., or reduction of the symptoms to a minimum, so that the patient does not suffer inconvenience or ill-health.

Persistent headaches, general malaise, profuse

and persistent discharge, and loss of health, in spite of local treatment suggest the desirability of the radical operation. If an acute exacerbation occurs with reddening and swelling of the skin of the frontal area or oedema of the lids, an external operation must at once be performed.

The Radical Operation of Killian. This consists in an external opening as for the acute cases, but the incision is prolonged downwards at the inner canthus. For description see textbooks. Suffice it to say that the anterior wall is completely removed and the unhealthy mucous membrane taken away. Any unhealthy anterior ethmoidal cells are dealt with. The floor of the sinus is also taken away, so that the orbital fat bulges up at the cavity and helps to obliterate it. A bridge of bone on which the periosteum has been preserved is left along the supraorbital margin, so that a depression is to some extent obviated. For other operations, such as Watson Williams' osteo-plastic operation, see textbooks. The radical operation is not free from mortality, especially in those cases where an acute attack has supervened on a chronic condition, and as it has been found that lavage often alleviates or cures, a somewhat conservative line is being adopted with regard to the treatment of chronic disease of the sinus.

Coexistent suppuration of the antrum or ethmoidal cells should always be dealt with. The antrum often acts as a reservoir for pus passing down from the frontal sinus, without actual chronic disease in the latter.

Inflammation of the Ethmoidal and Sphenoidal Sinuses.—The ethmoidal cells may be associated with the larger sinuses in acute or chronic suppuration, or may occur without involvement of the antrum or frontal sinus. In the presence of severe symptoms and signs of acute sinusitis, where disease of the frontal sinuses and maxillary antra have been excluded, exploration of the ethmoidal cells or sphenoidal sinuses may be necessary. The anterior ethmoidal cells can be explored after removal of the anterior end of the middle turbinal.

It is not always easy to differentiate between sphenoidal sinus suppuration and that of the posterior ethmoidal cells. When the posterior set is diagnosed as being the seat of suppuration, the middle turbinal must be removed; the sphenoidal sinus can then be investigated and, if healthy, the ethmoidal cells alone are responsible by a process of exclusion.

Acute ethmoiditis may occur in acute specific fevers, especially scarlet fever or as a sequela of influenza.

Ethmoidal Suppuration.—When this occurs as an acute condition it requires the ordinary treatment of acute sinusitis. Acute ethmoidal suppuration may point towards the orbit and require external incision, but free opening and

drainage of the suppurating cells within the nose should be effected.

Symptoms. In long-established or chronic suppuration the symptoms are as for other chronic sinus suppuration. They are chiefly catarrh, colds, neuralgia, general malaise and crust formation in the nose.

Ethmoiditis frequently exists without disease of other sinuses. In chronic ethmoidal suppuration of the anterior cells, pus and granulations are seen under the middle turbinal, which is generally unhealthy or polypoid. Multiple nasal polypi are frequently present.

Diagnosis. It is best to exclude suppuration of the maxillary and frontal sinuses. The diagnosis is established by rhinoscopy aided by a probe after cocainization, when soft broken-down tissue and bare bone can be felt.

Where the posterior set of ethmoidal cells are affected, posterior rhinoscopy shows pus or crusting in the post-nasal space with discharge issuing from above the posterior end of the middle turbinal.

On anterior rhinoscopy pus may be seen between the middle turbinal and the septum.

Treatment. Conservative treatment consists of the use of a nasal wash (for formulæ see below), together with oily sprays to prevent crust formation, and the removal of any polypi which may be present. Radical treatment consists in removing the portion of the middle turbinal covering the affected cells and biting away their walls with Luc's forceps (see Fig. 6), or gently curetting away diseased cells and granulations with a Meyer's ring knife. In an extensive case the whole of the lateral mass may have to be thus treated. The procedure is not without risk, as death from meningitis has followed the operation, as also has orbital cellulitis from too vigorous curetting. The patient should be told that several operations may be necessary in a case of extensive disease.

Suppuration may continue after the radical operation, owing to some of the highest cells being unable to be reached without danger, and they consequently have to be left; or from secretion from the frontal or orbito-ethmoidal cells, which can only be dealt with by a radical frontal sinus operation.

Sphenoidal Sinus Suppuration.—This is frequently associated with suppuration of the ethmoidal cells, especially with those of the posterior set.

Symptoms. Occipital headaches, together with signs of suppuration of the posterior set of sinuses, occur. Eye symptoms, such as transitory scotoma or retrobulbar neuritis may be present and first call attention to the necessity of investigating the sinus. In cases of atrophic rhinitis the opening of the sinuses can be seen by anterior rhinoscopy, but in a fairly normal nose

it is generally necessary to remove the whole of the middle turbinal in order to bring the ostium into view. An attempt may be made to press

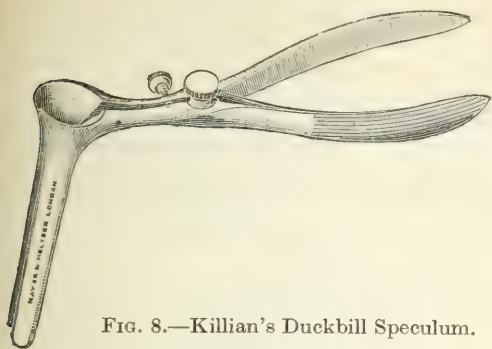


FIG. 8.—Killian's Duckbill Speculum.

the middle turbinal aside with a Killian's duckbill speculum (Fig. 8), in order to explore it by means of a sphenoidal sinus cannula. The cannula must be passed upwards and backwards from the floor of the anterior nares at an angle of about forty-five degrees to the floor of the nose. The opening is 6.5 to 7.5 cm. from the anterior nares and is hidden from view by the middle turbinal. The cannula passes across the latter and by manipulation its end, which is slightly bent outwards, may be made to enter the ostium in favourable cases.

On inspection pus will be seen issuing from the opening and protruding granulations may be present. The cannula is passed under strong illumination and the sinus washed out, when pus can be demonstrated if present. By posterior rhinoscopy, pus and crusting in the post-nasal space, and especially pus issuing

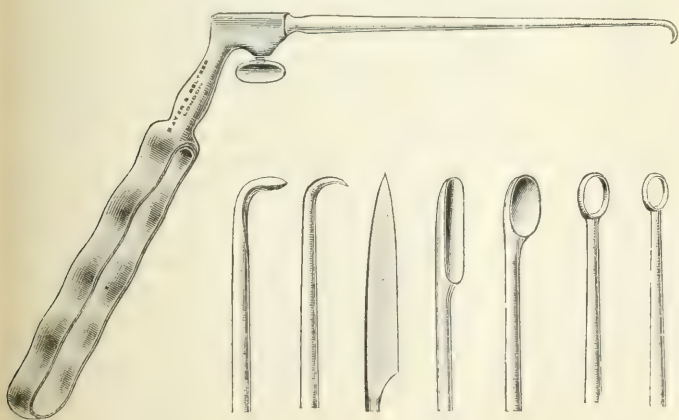


FIG. 9.—Hajek's Hooks.

from the choanæ above the posterior end of the middle turbinal, is said to be diagnostic; but the same appearance may be produced by

suppuration of the posterior ethmoidal cells or a Tornwaldt's abscess.

Treatment. When the presence of pus or granulations in the sinus demonstrates an unhealthy one, free drainage should be established, and to this end it is generally advisable to remove as much of the anterior wall as possible. The natural opening is slit-like, with pouting lips of mucous membrane at its margins, and does not drain well. By means of Hajek's hooks, (Fig. 9) and a sphenoidal sinus forceps (Fig. 10) the outer wall is broken down and cut away. A powerful illumination and a nose clear of obstructing polypi or middle turbinal are necessary. Great care must be taken owing to the relation of the sinus with the cavernous sinus and optic nerves, and the anterior wall should be taken away rather in a direction downwards and inwards. Gentle curetting may be used to get rid of granulations, but here again great caution is necessary. Finally it is

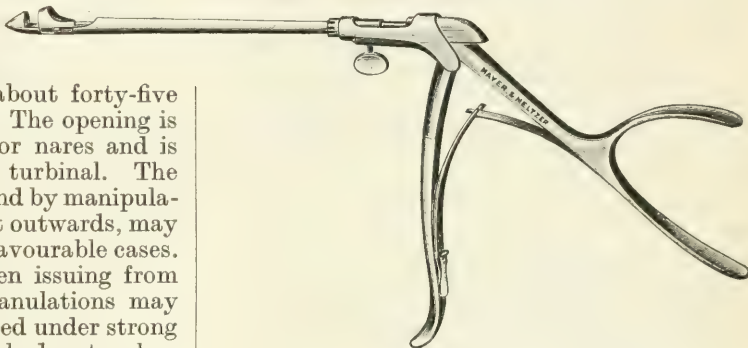


FIG. 10.—Sphenoidal Sinus Punch Forceps.

well to mop out the cavity with a strong solution of silver nitrate. This operation can be done under local anæsthesia. It should not be attempted until the other diseased sinuses have been treated and the middle turbinal removed.

Mucocele.—A cystic degeneration of the mucous membrane of a sinus sometimes takes place. The sinus wall becomes distended by the contained mucus and is apt to cause pressure symptoms. The mucus often becomes purulent and very offensive. The orbit is encroached upon, especially when the ethmoidal cells or frontal sinus are affected, and the eye is thus pressed outwards and diplopia produced. In mucocele of the frontal sinus the bony wall of the latter may be eroded, with exposure of the dura mater and meningitis.

A cystic formation may occur in the middle

turbinal, causing obstruction in the nose or neuralgia from pressure against the septum.

Treatment. If a sinus is affected by mucocele, a radical operation is indicated. A cystic middle turbinal should be removed if it causes symptoms.

Tumours.—The accessory sinuses of the nose are sometimes the seat of benign tumours. These are usually osteomata or osteochondromata.

Hyperstosis of the superior maxilla may involve the antrum.

Malignant disease, in the form of carcinoma, sarcoma or endothelioma, occurs.

The maxillary antrum is most commonly affected. Malignant disease of the maxillary antrum tends to cause swelling of the cheek, bulging of the hard palate and nasal obstruction from the mass bulging or coming through the inner antral wall, and so encroaching on the nasal cavity. There is pain from involvement of the superior maxillary division of the fifth nerve.

There is frequently pus in the cavity, so that there are the physical signs of sinus suppuration, in addition to the bulging of the walls. Probing the nose often causes hæmorrhage. Lachrymal sac suppuration frequently accompanies malignant disease of this sinus.

Malignant disease of the frontal sinus is rare.

When occurring in the sphenoidal sinus, bad headaches and optic atrophy occur.

Treatment. The treatment of malignant disease of the sinuses comes under the head of general surgery.

Formulae for nasal washes and nasal spray—

FORMULA I

Glycerin Thymol Co. B.P.C.

- R Sodii Bicarb. gr. 87½
 Sodii Bibor. gr. 175
 Sodii Benzoat. gr. 70
 Sodii Salicylat. gr. 45
 Menthol gr. 2½
 Thymol gr. 4½
 Eucalyptol ℥ 13
 Ol. Pini ℥ 5
 Ol. Gaultheriæ ℥ 3
 Alcoholis ʒ ss
 Glycerini ʒ ii
 Liq. Carmini ℥ 50
 Aq. Destillat. ad. ʒ xx
 Fiat solutio.

One part of the solution to be mixed with two parts of hot water before using. This forms a soothing and antiseptic nasal wash.

FORMULA II

- R Sodii Chlorid. gr. v ss
 Sodii Sulphat. gr. i ss
 Sodii Phosphat. gr. ¼
 Potass. Chlorid. gr. ⅔
 Potass. Sulphat. gr. ¼
 Potass. Phosphat. gr. ⅓
 Menthol gr. ⅓
 Fiat tabella. One dissolved in a tablespoonful of water.

This makes a convenient isotonic nasal lotion.

FORMULA III

- R Menthol gr. x
 Eucalyptol ʒ ss
 Ol. Cinnamomi ℥ v
 Ol. Pini Pumilio ʒ ss
 Benzoin aquol (Rogers)
 Fiat nebula.

An oily spray for preventing crust formation in the nose. G. S.-H.

NASAL NEUROSES

In the small space at my disposal it is not possible to do more than indicate a few of the more common types of neuroses.

Neuroses may be classified as (1) olfactory, (2) sensory, and (3) reflex.

In the first, or olfactory, group **Anosmia** is the most important, in that the loss of the sense of smell is usually combined with the loss of taste of flavours. The main underlying causes are (a) nasal obstruction, whereby the olfactory particles in the air are prevented from reaching the olfactory mucous membrane, (b) affections of the olfactory mucosa or peripheral nerve endings, and (c) central lesions such as disease or injury of the olfactory tract or nerve.

(a) *Obstructive Anosmia* may be due to deflections of the septum, hypertrophic conditions of the mucosa, polypi, foreign bodies, or tumours of the nose. These can best be treated by the removal of the obstruction. Even when the sense of smell has been in abeyance for some years successful results may be obtained.

(b) *Essential Anosmia* (*Affections of the Olfactory Region*) may occur in connection with acute rhinitis of whatever origin, atrophic rhinitis, nasal syphilis, tubercle or various toxic poisons. The prognosis is not good and chief reliance is placed on the administration of strychnine, quinine or arsenic. Anti-syphilitic remedies and the removal of any toxic conditions will be necessary in cases depending on these causes.

(c) *Central Anosmia* may be produced by fractures in the anterior fossa, intracranial tumours or gummata, tabes, syringomyelia and in some cases hysteria. General treatment and the

removal of the cause afford the best chances of recovery.

Hyperosmia (Increased Sensitiveness to Odours) occurs chiefly in connection with hysteria, and treatment should be directed to the general condition.

Parosmia (Perversion of the Olfactory Sense) is mainly caused by hysteria, neurasthenia, tabes or epilepsy, but great care must be taken to exclude local conditions such as accessory sinus disease, syphilitic necrosis, or disease of the tonsils, throat or lungs.

In the second, or sensory, group affections of the nerves of ordinary sensation are by no means common.

Anæsthesia may be functional, or the result of some chronic affection or intracranial tumour.

Hyperæsthesia may be due to many causes and is closely bound up with the next group.

The third, or reflex, group contains several important conditions, and mention must be made of hyperæsthetic rhinitis or hay fever, vasomotor rhinitis or paroxysmal sneezing, nasal hydrorrhea, and nasal asthma.

Hay Fever depends on a predisposing idiosyncrasy, a hyperæsthetic condition of the nasal mucosa and some local irritant. Of these factors the last one is the most important, and is usually due to the pollen of certain grasses or flowers.

The attack usually occurs at a definite season of the year (early June), when the grasses concerned reach maturity. It is often ushered in by a sensation of burning or itching at the inner canthus of the eye, succeeded by a severe irritation in the nose, paroxysms of sneezing and a profuse watery discharge. Later the secretion may become mucopurulent and the nasal mucosa so congested that nasal respiration is almost impossible.

Profuse lachrymation, conjunctival congestion with photophobia and frontal headache usually accompany the nasal symptoms. The symptoms take two or three days to develop and often show a remittent or intermittent character. In some cases definite asthmatic attacks may occur and a general condition of malaise is not unusual.

The duration of the attack is usually about three or four weeks, but may be as much as three months.

Diagnosis. This is usually a simple matter. The history of the case, the season of the year, the character of the discharge and the condition of the nasal mucosa are so characteristic that errors are unlikely to occur.

Prognosis. This should be guarded, as personal idiosyncrasy is often an important factor. Cases in which some definite obstructive lesion of the nose is present are often thought to be favourable. The tendency to the disease often

diminishes or even disappears after the age of forty-five.

Treatment. Prophylactic measures usually consist in removing the patient to some place where the active pollen is absent. This may be effected by a prolonged sea voyage during the whole hay-fever period, or a stay at some mountainous resort where the vegetation is sparse, or at some places where the flowering time of the grasses is considerably earlier or later than is the case in England.

General measures may be directed to improving the constitutional condition, especially if anæmia, constipation or digestive troubles are apparent. For the local symptoms innumerable remedies have been tried. Adrenalin in the form of a spray (1 in 5000 to 1 in 1000) or ointment is often very useful, and although the effect is often transitory no harmful results appear to occur from its prolonged use. I have seen some good results after the use of chloretone and adrenalin ointments, and can further recommend the use of quinine sulphate (1 in 800) in the form of a spray.

Pollantin, a preparation from the serum of horses which have been inoculated with the toxic principle of the pollen of certain grasses in accordance with Dunbar's theory, seems to be useful in some cases, especially if it is used in the early stages and care is taken to apply it properly. As a result of its widespread advertisement in the daily papers the majority of patients will scarcely need its recommendation.

Watson Williams recommends the prophylactic use of biniodide of mercury (five per cent.). This should be sprayed into the nose on one occasion at the beginning of the season.

The application is painful and should be preceded by the use of cocaine and followed by a hypodermic injection of morphia.

Killian advocates painting special areas of the nose with trichloroacetic acid.

Surgical measures are usually directed to the correction of intranasal abnormalities, to the removal of the turbinates (Lack) or the bilateral excision of the tubercle of the septum (Yonge).

Vasomotor Rhinitis or Paroxysmal Sneezing is closely bound up with the preceding affection, but does not appear to have any relation to a particular season, whilst the sneezing attacks tend to show a regular periodicity, such as early morning, in their occurrence.

Constitutional treatment is often useful and drugs which have a tendency to diminish secretion are of value.

Pills containing quin. sulph. 1 gr., arsen. iodid. $\frac{1}{16}$ gr.; or ext. belladon. $\frac{1}{12}$ gr., strychn. sulph. $\frac{1}{80}$ gr., atrop. sulph. $\frac{1}{150}$ gr., may be prescribed.

Local measures are concerned with the relief of the sneezing fits, and inhalation of strong

ammonia or iodine liniment has been advocated in this connection.

Surgical measures often produce excellent results, and I have found that deep linear cauterization of the inferior turbinates has produced good results, whilst Yonge strongly advocates bilateral excision of the tubercle of the septum.

Nasal Hydrorrhea.—This is a comparatively rare affection and is characterized by a profuse watery discharge from the nose without any marked local changes. It usually affects adults and occurs in those who are susceptible to hay fever.

The diagnosis is based on the character of the fluid and the absence of intra-nasal signs. St. Clair Thomson has laid great stress on the differential diagnosis between this condition and that of cerebro-spinal rhinorrhœa.

The treatment is generally similar to that for hay fever. The administration of strychnine and atropine (see above) may be useful, whilst Lake has found benefit from the use of calcium chloride.

Nasal Asthma.—There is considerable evidence to show that in many cases intranasal conditions and asthmatic attacks are closely connected.

Since the time of Voltolini the correction of gross intranasal abnormalities has been undertaken with successful and unsuccessful results as regards the asthmatic condition. More recently many rhinologists have advocated the application of the galvano-cautery to hyper-sensitive areas in an otherwise normal nose and have claimed complete cure or amelioration of the asthmatic condition thereby. The procedure is empirical and uncertain, but in view of the many successful results that have been obtained it is certainly justifiable in obstinate cases.

Some years ago I had the opportunity of treating fifty cases of severe asthma (in many of whom marked eosinophilia was observed) by this method. The immediate results were almost always satisfactory, but only ten per cent. appear to have been permanently benefited over a period of five years.

General medical treatment of the condition should always be carried out. W. G. H.

NEW GROWTHS OF THE NOSE

These may be classified as follows—

Simple. Papilloma; fibroma; angioma; enchondroma; osteoma.

Malignant. Sarcoma; carcinoma; endothelioma.

Simple Growths—

Papilloma is a rare form of growth, but not perhaps so rare as the list of recorded cases

would seem to show. True papilloma is sometimes confused with papilliform hypertrophies of the mucosa of the turbinates and septum, but the latter are comparatively common, and microscopic examination will show that they are not covered by squamous epithelium, as is the true papilloma. The anterior portion of the septum is the commonest site and the growths may be either sessile or pedunculated. They may give rise to symptoms of nasal obstruction and epistaxis. The best method of treatment is to remove them with a snare and to scrape and cauterize the site of origin. If imperfectly removed they show some tendency to recur.

Fibroma is extremely rare in the nose. When present it may give rise to marked obstruction and may even expand the bony passages. It usually grows from the periosteum of the outer wall, but it may arise from the roof or septum. In some cases it projects into the postnasal space.

The growth can usually be removed by means of the snare, but cases have been recorded in which the growth was so large that an external operation had to be undertaken.

Angioma is a very vascular tumour which is rather uncommon. It usually springs from the septum near the tubercle, but it may arise from the inferior turbinate or from the floor of the nose.

Epistaxis is often a prominent symptom, and signs of nasal obstruction may occur. The presence of a red vascular tumour growing from the anterior part of the septum which readily bleeds on being touched points to this type of growth. Several cases have been recorded under the name of "bleeding polypus," but this designation should be discarded.

Treatment consists in removal with the snare and cauterization of the base with the galvano-cautery.

Enchondroma is a rare tumour which is said to arise most often from the ethmoid. It may produce obstruction and rhinitis, but does not usually bleed. The treatment consists in its removal.

Osteoma is also rarely found in the nose. It arises high up, and may expand the bones or project into the orbit and produce ocular symptoms. The hardness of the growth is its chief diagnostic characteristic. Removal may be attempted by intranasal methods, but if the tumour has extended into the accessory cavities an external operation will be required.

Malignant Growths—

Sarcoma is the most common type of malignant growth. It usually has a preference for the upper part of the nose, more especially the ethmoid labyrinth, but it may occur lower down and originate from the septum.

In the early stages unilateral obstruction, catarrh and occasional epistaxis are present, but the symptoms progress rapidly and a foul, bloody discharge, with intense radiating pain and marked deformity of the nose, may indicate the serious nature of the affection. When the growth originates in the antrum or other sinuses symptoms may be absent for a long time. On examining the nose it is common to find a large fungating friable mass which bleeds readily on manipulation and is often partially obscured by purulent secretion and cedematous mucosa or polypi. In earlier cases the friability and great tendency to bleed should excite suspicion.

Treatment must be directed to as thorough a removal of the growth as is possible. As the upper part of the nose is usually involved some form of external operation may be necessary. A procedure which I have found very satisfactory is to gain access to the nose by Rouge's method and to curette the regions involved very thoroughly until all growth has been removed. In one case (in which no recurrence has occurred up to the present) it was necessary to resect the septum and clear out the antra as well.

The prognosis is more favourable than might be expected.

Carcinoma is of less common occurrence than sarcoma. The symptoms are practically the same as those of sarcoma and call for the same method of treatment.

Endothelioma cannot be considered as a clinical entity—the nature of the growth is usually revealed by the microscope.

W. G. H.

THE BACTERIOLOGY OF THE NOSE AND THROAT, WITH SPECIAL RELATION TO VACCINE TREATMENT OF DISEASES OF THESE REGIONS

It is now generally recognized that the great majority of the diseases of the nose and throat are due to the invasion of these regions by bacteria of various kinds. Treatment, therefore, to be effective, must be directed towards the elimination of such micro-organisms, and the methods now employed include not only antiseptics, but also more specific measures such as vaccines and sera.

A vaccine is made by suspending a known number of sterilized bacteria in some neutral fluid. This is injected hypodermically and acts by stimulating and reinforcing all the natural defensive mechanisms of the body.

One of the most important of its known effects is to produce an increase in the formation of antibodies; in other words, a person who has been vaccinated successfully is enabled to manufacture sufficient of these protective

substances to neutralize the poison of his infection and is cured.

The effect may be obtained after a short period or after many years. In the latter instance vaccination is only partly successful, the antibody production is weak, and a chronic infection results. If the infection is a virulent one the production of antibodies must be very active or death may supervene.

A vaccine therefore differs fundamentally from a serum, since the latter, when introduced into the body, either acts as an antidote to the bacterial toxins circulating in the blood, or in some cases has a direct effect upon the bacteria themselves.

It is not within the scope of this article to enter into a detailed account of work done elsewhere on the bacteriology and vaccine treatment of diseases of the upper air-passages. The following account is the result of my personal experience of vaccines. The greater part of the bacteriological investigation has been carried out by Dr. M. H. Gordon, to whom I am indebted for much valuable advice and assistance.

The methods employed consist of—

1. *The Collection of Secretions.* Before taking a specimen from the nose, the vestibule is carefully cleansed to prevent contamination with superficial organisms. The nasal secretion is then obtained by a platinum loop, forceps or a swab of sterilized wool wrapped round a probe. In the case of an accessory sinus the nose is first syringed with normal saline solution and a weak cocaine and adrenalin mixture is applied to the opening of the suspected sinus, so that the discharge shall escape more easily. If this fails, the secretion is aspirated through a cannula, or an exploring needle is inserted into the sinus and the discharge expelled into a sterilized bowl by the injection of air or normal saline solution. For rough examinations it is sufficient if the patient blows his nose into sterile gauze. If the secretion is not examined at once it should be placed in a closed bottle or tube containing sterilized saline solution to prevent it from drying. Secretion is obtained from the naso-pharynx by suitable forceps or swabs, the tongue being depressed with a spatula, so that mouth organisms are excluded. An excellent instrument has been devised by Mr. C. E. West for this purpose. It consists of a silver tube with a curved end through which runs a wire carrying a swab; the whole appliance can be easily sterilized. When passed into the naso-pharynx or larynx, the swab is pushed out and withdrawn again within the tube before removal of the instrument. Post-nasal secretion or sputum may be obtained by spitting if the mouth is first cleansed by repeated gargling with sterile water.

2. *Examinations of Secretions*—

(a) *By Films.* These are stained by ordinary methods (e. g. gram-fuchsin) to determine whether organisms are present and to gain a rough idea of their nature and relative numbers. In infections of the upper air-passages it is not by any means uncommon to find that only one type of organism is present in films (pure infection). It is not, however, always practicable to identify the bacteria or to form an estimate of their virulence by means of films alone.

(b) *By Cultures.* Whenever possible the collected secretion is smeared at once on a series of agar or blood-agar plates or tubes. These are incubated at a temperature of 37° C. for twenty-four hours or longer, the various organisms requiring different periods for their growth. On examining these cultures at the end of this interval we have found—

(i) A pure culture. This is rare, but it has been noted occasionally in infections with most of the organisms. A number of my cases have had the same organism present in their secretions for more than two years whenever an examination was made. This is particularly frequent in my experience with influenzal and streptococcal infections, which are very persistent.

(ii) A mixed culture, where two or three organisms have grown in quantity, is more common. The fact that some bacteria grow more readily than others must always be remembered and the prevalence of the organisms judged by the number and not the size of the colonies present.

(iii) A mixed culture in which there are more than three different organisms is common in diseases of the throat, but rarer in nasal infections.

(iv) A sterile culture has never been found excepting in influenzal infection of the nasal sinuses. Films may show an organism like the typical influenza bacillus, but this is often difficult to grow and repeated cultures on many different media may remain sterile.

(v) It must be remembered that cultures may be contaminated by organisms which are not connected with the disease.

3. *Blood Cultures* have rarely been employed in connection with these chronic infections.

4. *Serum Diagnosis*, which includes bacteriolysis, agglutination and opsonic index tests, have also been little used.

5. *Preparation of Vaccines.* It is unnecessary to describe all the methods which have been employed. The bacteria which form a vaccine can be killed by heat or by the action of some chemical agent such as concentrated galactose, ether or phenol. Another method consists in incubating the suspension of bacteria in saline

solution or distilled water at 37° C., the result being that after a short time the organisms are killed and undergo autolysis. The vaccine may be put up in sealed glass capsules, each containing a known number of organisms suspended in normal saline solution (1 per cent.) and phenol ($\frac{1}{2}$ per cent.).

In almost all my cases autogenous vaccines have been used in preference to stock preparations. In many instances mixed vaccines containing one or two kinds of bacteria have been injected.

6. *Dosage.* There is evidence to show that after an injection of vaccine there is a definite period during which the quantity of antibodies circulating in the blood is decreased. This is called the "negative phase," and may last for a few hours or for many days. The degree of the reaction depends on the size and virulence of the dose and the resistance of the patient. As a rule in twenty-four hours the patient passes into the so-called "positive phase," the duration of which is variable. On account of the uncertainty of these reactions it is impossible to state definite rules for every case, but the first dose in the ordinary course of treatment depends largely on the vaccine which is used, and the following figures are a rough guide.

				Millions
For	Influenzal vaccine	the primary dose should be	1 to 5	
"	Streptococcal	"	"	5
"	Pneumococcal	"	"	5
"	Coliform	"	"	5
"	Diphtheria group	"	"	5
"	Friedländer	"	"	10
"	Catarrhalis	"	"	10
"	Staphylococcal	"	"	25
"	Tuberculin	"	"	1
				30,000 mg.

The second dose should be twice as large as the first unless reaction is too marked, and each succeeding dose should be doubled as far as seems reasonable.

The injections should be made into the subcutaneous tissues of the outer side of the forearm or the back of the arm above the elbow. In women the back of the shoulder or the outer side of the thigh may be preferred. Care should be taken that the syringe is sterile and that the injection avoids the main cutaneous nerves.

7. *Intervals between Doses.* As a general routine the doses are given once in each week, and for preference on Saturday, so that there shall be an interval of at least twenty-four hours before the patient returns to active work. During this period it is advisable that no active exercise be taken (Wright); I believe that better results are obtained when the patient remains indoors, though it is unnecessary in most cases

to rest in bed. After a sharp reaction an interval of ten to fourteen days should be allowed, and when treatment is continued for long periods one injection in each month may be sufficient. To get a patient under the influence of vaccine rapidly, increasing doses are given on three succeeding days (Fornet and Müller). This is a safe method when starting treatment, as it is possible to inject a small first dose and increase it if no reaction is obtained. When very small doses are used the interval between them may be less than a week.

8. Reaction—

(a) *At the Site of Injection.* Slight swelling of the subcutaneous tissues and redness of the skin for an inch round the prick are the common signs after twelve hours. On the next day the parts are stiff and tender and movement of the limb may be painful. When inflammation is acute the dose has been too large. The local signs usually disappear after forty-eight hours, and most patients can take active exercise after twenty-four.

(b) *General Symptoms.* The most important is lassitude. The patient feels slack and unfit for work, generally within six hours of injection. This feeling may persist for twelve to twenty-four hours, after which there may be a feeling of exhilaration. Some people are enthusiastic, therefore, and confident from the beginning of the treatment; but though they may insist at one time that they have never felt so well for years, the feeling is generally temporary.

The pulse and temperature are rarely affected, and headache, nausea and shivering are exceptional. Occasionally the patient is prostrate for as long as a week. I have seen a lady who was hysterical and almost suicidal for two or three days after an autogenous influenzal vaccine. This is the main reason why the patient should rest and not attempt to work for twenty-four hours after his preliminary doses.

(c) *Exacerbation of Local Symptoms.* It is by no means uncommon for the patient to complain that his vaccine has made the local condition worse. Thus in cases of sinusitis the discharges may be definitely increased for a few days or a week after the injection. This result, which is most frequent in the earlier stages of treatment, is undoubtedly a favourable sign, and in such a case one may expect that ultimately there will be definite improvement in the local condition.

A sharp reaction is a favourable sign, but suggests caution. A rather smaller dose and a slightly longer interval than that contemplated will allow the patient to recover from his negative phase.

9. *Duration of Treatment.* Though I have

seen patients so much improved after three doses that they thought it unnecessary to continue the treatment, I believe that most cases require six to eight injections. It is a great mistake to give one or two doses and then jump to the conclusion that the treatment will do no good. After the full course of eight doses the secretion should be re-examined, because it frequently happens that there is a definite change in the infecting organisms.

There seems little doubt that some bacteria are more difficult to dislodge from the upper air-passages than others. In sinus cases, for instance, it has been noticed that *M. catarrhalis* and pneumococci disappear more quickly than streptococci; in such instances it is necessary to change the vaccine so as to correspond with the organism present, and it is probable that treatment will only succeed if vaccination is continued for long periods.

My rule has been to observe carefully two factors, namely, the general health and weight of the patient, and to continue treatment when progress is satisfactory in these respects.

10. *Selection of Cases.* Theoretically there is no reason why vaccine treatment should not be tried for any infection in the upper respiratory tract, whether it be acute or chronic in nature. The cases which have seemed to me most likely to be improved are those in which a definite infection can be demonstrated. Several examinations may be required, as in some cases the earlier investigations are very inconclusive. When, however, it can be shown that the same organisms are constantly present, I should be hopeful of doing good to the patient concerned. Under this category may be included patients suffering from—

Colds.—There are many people, both children and adults, who suffer from repeated "colds in the head" and pharyngitis; in some of them the same infection can be demonstrated with each attack, whilst in others the colds are due to successive new infections. Organisms such as the pneumococcus, influenza bacillus, micrococcus catarrhalis and bacillus coryzæ segmentosus are most frequently met with. They may be found in pure or mixed culture. Many of these cases can be cured by careful vaccination. When a patient has gross mechanical or structural lesions of his nose, such as deflected septum, polypi or sinusitis, the outlook is not so hopeful, but it is possible to relieve many in this class who are too old or too ill to submit to more radical forms of treatment. The same is true of patients with irritable coughs when the trouble is caused by inflammation of the pharynx or elongation of the uvula, for in these also there is often an infection with influenza, pneumococcus or catarrhalis organisms.

Laryngitis and Bronchitis.—I have had little personal experience in the use of vaccines for acute laryngitis and bronchitis, but there is reason to believe that many pure infections occur, and this is certainly true of the more chronic forms. I have been much impressed by the prevalence during the last two years of pneumococcal and influenzal infections of the larger air-passages, and I feel sure that there are many general physicians who are not aware that they are so common. The influenzal bacillus may infect the whole respiratory tract, so that the patient suffers for years from a muco-purulent secretion in the nose, the nasal sinuses, naso-pharynx, larynx and trachea; such a patient constantly catches colds, which make him feverish and cause him naturally to think of tuberculosis; the secretion in these cases from nose, pharynx or trachea may be swarming with influenzal bacilli. They may be diminished by vaccine treatment, with great benefit to the patient. The other common organisms are the streptococci, micrococcus catarrhalis (rarer in nose) and staphylococcus, and many of them can be benefited by vaccines. Even in the bronchitis of phthisis there is often a definite secondary infection, and I have seen three people, two with streptococcal and one with influenzal secondary infection, who were much improved by autogenous vaccines.

In chronic laryngitis with repeated loss of voice, both in singers and speakers, I have seen good results follow vaccine treatment.

Chronic Tuberculosis.—After treating a fair number of cases of lupus of nose, pharynx or larynx, and chronic tuberculous cervical glands, I am distinctly a believer in the effectiveness of tuberculin, carefully administered. I do not advise it for tuberculous laryngitis.

Bronchial Asthma.—My experience is limited to two cases, the one slightly, the other markedly improved by a vaccine containing a catarrhalis-like organism. The results published by Dr. Carmalt Jones show that the question deserves attention.

Hay Fever.—In spite of enthusiastic reports on the results of vaccine treatment of this complaint, I have not used it. I have seen cases which had been treated by others, but they did not appear to be definitely improved.

Sinusitis, Rhinitis and Pharyngitis.—A large number of cases have been investigated in my department, such as—

(a) Cases in which the secretion is purulent, including suppurations of the antrum, frontal, ethmoidal and sphenoidal sinuses. Some infections have been pure, especially those caused by the streptococcus, bacillus influenzae and staphylococcus aureus, but mixed infections are more common and are associated with a variety of organisms, such as the pneumococcus,

Friedländer's bacillus, members of the diphtheria group, catarrhalis and coliform bacilli, in addition to the above. It is rare to find more than three organisms present at the same time, and there are often only two. Bacillus influenzae and staphylococcus, for instance, seem to thrive excellently together, to the exclusion of other forms of growth. The flora may change at different times.

The results of vaccine treatment have been very unequal; a few cases seem to have been cured after other methods had failed; streptococcal and influenzal infections appear the most difficult to treat with success.

(b) Cases in which the secretions are mucoid or muco-purulent, including catarrhal conditions of the nose and naso-pharynx, infections of the nasal sinuses and patients suffering from loss of smell and taste. In these the same bacteria have been found as in the former class. That smell and taste may be recovered after a few doses of vaccine I have no doubt; that some catarrhal affections may be relieved seems equally certain, whereas with chronic sinusitis results are still very unconvincing. I have, however, seen a few remarkable cures and believe that the question requires further investigation.

(c) **Atrophic Rhinitis.**—Though the cause of the disease is doubtful, the most prevalent organism is Friedländer's bacillus, generally in great quantity and often associated with some other organism. The results of inoculation with Friedländer vaccines have been disappointing in my cases, even when treatment has been continued for long periods.

General Considerations—

1. What is the danger of treatment by vaccine?

I have been asked this repeatedly by medical men, and it was obvious that they were nervous lest their patients should suffer. Some of them had already a distinct dislike of the treatment because they had never seen any good come of it: others had been told of some patient who had been made ill by such treatment; or they thought that a rash had been caused by it. The same indefinite ideas may be met with in the patients concerned, and some of them refuse obstinately to have injections, particularly those of neurotic disposition. They are constantly worrying as to whether it will do them harm. In such cases I always ask what has suggested the possibility, and generally hear of some indefinite case where the patient seemed worse after treatment. When pressed for details they have no proper facts. It has never occurred to these people that it is a case of *post hoc* rather than *propter hoc*. Cases have been reported where vaccination is said to have led to disastrous results, but they are rare, and, per-

sonally, I have seen no case of a chronic nature in which the patient was made permanently worse by injections of autogenous vaccines, with the one exception of tuberculin, nor have I seen any complications. Some of our patients have not responded in the expected manner; for instance, an injection of a first dose of fifty million autogenous staphylococcus aureus made a gentleman with chronic rhinitis ill for a week, but he was very much better afterwards. This personal resistance and response I regard as the most important factor. It varies immensely in different individuals. If the patient does not react, vaccine treatment may do him no good, but it does him no harm.

2. Why does a vaccine fail, then?

It is not entirely the patient's fault. First, a wrong vaccine is often used because the most obvious organism is selected for inoculation without proof that it is the cause of the symptoms. Again, there seems reason to believe that if two vaccines are made from the same patient at different times, one may have a higher curative value than the other. The doses given introduce another source of error. At present we know next to nothing about this question. Dr. Gordon has told me of a patient who had been vaccinated repeatedly for furunculosis with no result, but when he gave a dose of 10,000 millions of her staphylococcus the patient was much distressed for a few hours, but the furunculosis disappeared. The same is true with regard to the duration of treatment. Many patients give up trying because they have not the patience and the doctor has not the confidence to persuade them to continue. Again, in diseases of the upper air-passages in which bacteria are concerned, the micro-organisms are chiefly situated in the secretions on the surface of the mucous membranes, and are therefore to some extent removed from the immediate action of the blood.

3. Can vaccines cure or improve a patient?

I do not hesitate to say Yes! My experience is that it is easier to improve the general health than the local condition. Time after time a patient has told me how much better he feels, although the local appearance was the same. It is natural to think of faith-healing, and doubtless the vaccine is as good in this respect as the bottle of medicine. Allowing for this, I am still convinced that vaccination has a definite curative value in my department, and I do not believe that my patient with asthma was cured by faith. Up to the present there has not been a vast amount of attention paid to this particular work, but I believe that we are making headway.

4. What is the duration of immunity?

It is impossible to answer this question at present. When one thinks of influenza, tonsil-

litis, bronchitis and many other diseases which affect people time after time, the first impression is that immunity will be very short. On the other hand, preventive inoculation in general is being more used for other forms of disease every year. Thus antityphoid vaccination is to be made compulsory in the United States army, and 76,000 men are to be inoculated. Lieutenant-Colonel J. R. Kean observed when reporting the results of treatment of 16,000 troops in Texas by typhoid prophylaxis, that although this force had been for more than three months exposed to heat, dust, mud, flies and all the other vicissitudes of camp life, only one case of typhoid fever had developed up to June last. "The medical authorities of the army," he said, "are much elated at this great feat of preventive medicine, which they hope will bring into common use a procedure of as great sanitary importance to the American people as was the discovery of the method of preventing yellow fever." W. D. H.

DISEASES OF THE ORO-PHARYNX

ACUTE INFLAMMATORY AFFECTIONS OF THE PHARYNX

Under this heading the following varieties of acute inflammations will be considered:—(1) Simple or catarrhal, (2) Septic, (3) Traumatic, (4) Toxic. It must, however, be remembered that the pharynx constantly shows pathological changes, often indistinguishable at first from one or other of these inflammatory conditions, in many of the acute infectious fevers.

Acute Catarrhal Pharyngitis is generally only part of a more extensive catarrhal infection of the nose, larynx and trachea. Onset is sudden and duration seldom exceeds forty-eight hours. The mucous membrane is at first dry and vividly red, the redness fading off into the unaffected areas. Later there is excess of secretion and in bad attacks slight swelling and oedema, especially of the uvula. At first there is usually some general disturbance, but it is never very marked.

General treatment is that of an ordinary "cold." Locally, a gargle of permanganate of potassium or bicarbonate of soda, followed by spraying with menthol (gr. xv to an ounce of paroleine), will afford relief and may shorten the attack.

Acute Septic Pharyngitis.—Broadly speaking, this may assume one of two types, the superficial or the deep. The superficial is as a rule a comparatively mild infection, the deep is always grave and not infrequently fatal. Locally it results in acute oedema, suppuration, destructive ulceration or gangrene.

All forms of septic pharyngitis are due to infection with pathogenic organisms, most

frequently the streptococcus pyogenes, and pathologically they are identical with similar conditions in the larynx and with angina Ludovici. The severity of the disease and the region affected depend on the virulence of the poison and its point of entry.

The *superficial* form is commonly associated with bad sanitary conditions. It also occurs in almost an epidemic form in hot, dry seasons, when the air is laden with polluted dust. Its onset is sudden and marked by more malaise than occurs in acute catarrh, and the temperature may rise to 100° or 101° F. The local symptoms are also more severe and much more persistent, often lasting a fortnight or three weeks. The mucous membrane is of a dark rather than vivid red in colour, and is sometimes almost a dusky purple, and it tends to remain dry during the whole course of the attack. Again, the swelling of the palate and œdema of the uvula is more extensive than in simple catarrh, and the posterior wall of the pharynx is more often involved.

The *treatment* consists in a preliminary dose of calomel or some other drastic purge, followed by large doses of the tincture of perchloride of iron (℥ xx t.d.s.). Removal from unhealthy surroundings, a liberal and nutritious diet, and in some cases stimulants, are important. Locally in the very early stages one application of perchloride of mercury (1 in 100), which should be made by the surgeon himself, may cut short the attack. If the case is not seen till later, a gargle of permanganate of potassium (gr. $\frac{1}{8}$ to the ounce) or sanitas (℥ xxx to the ounce) should be used frequently, and the throat should be painted night and morning with a solution of resorcin (dr. i ss to the ounce). In the later stages simple astringent paints, such as chloride of zinc (gr. vii ss to the ounce), will help to clear up the remaining inflammation.

The *deep* varieties, as before stated, are much more serious and often prove fatal; moreover, they frequently extend beyond the pharynx into the larynx, into the neck or even into the mediastinum. In the pharynx the infective process may extend both superficially and deeply, and lead to great destruction of the parts, whilst constitutionally it produces the most profound disturbance, usually of an asthenic type.

Exposure to cold, diabetes, chronic alcoholism, chronic septic conditions of the nose, teeth, mouth and pharynx are among the most important predisposing causes. The onset is sudden and marked by a rigor, followed by a rise of temperature and accompanied by great pain in the throat and dysphagia. The temperature may rise to 103° or 104° F., though in some of the worst cases it does not exceed

101° F. The whole pharynx soon becomes swollen and œdematous and of a dusky red colour, and the uvula often attains an enormous size from œdematous infiltration. The tonsils, which are usually involved, become swollen and red, and are often covered with a thick tenacious purulent secretion. This condition of the parts may persist for a few days, and then the infective process may become arrested and the patient may make a fairly rapid recovery. On the other hand, one of the graver complications, already mentioned, may supervene. The œdema may spread to the larynx, causing obstruction and necessitating tracheotomy; suppuration may occur, causing an abscess which may track down the neck; deep destructive and extensive ulceration may cause great loss of tissue, whilst finally large portions of the palate and tonsils may be destroyed by gangrenous sloughing. These local changes are accompanied by septicæmia and often pyæmia, with purulent secretions in the joints and serous cavities, and as a rule the patient quickly becomes prostrated and delirious and then comatose.

The *general treatment* must be directed towards maintaining the patient's strength pending the arrest of the local process. The latter may be hastened by the administration of large doses of tincture of perchloride of iron (℥ xxx every four hours), and in some cases by the injection of a polyvalent antistreptococcic serum, especially if given early in the course of the disease. By the way of *local treatment* in the early stages the throat should be painted by the surgeon with a strong antiseptic, such as perchloride of mercury (1 in 100), and cold compresses should be applied to the neck. If the disease advances, hot compresses should be substituted and the air the patient breathes should be moistened by steam medicated with tr. benz. co. (dr. i to O i). The throat should be kept clean by gargling or swabbing with mild antiseptic solutions. If there is much discharge, ulceration or sloughing, a useful method is to turn the patient on the side and flush out the pharynx by syringing with a weak solution of permanganate of potassium. If œdema is extensive it may be sprayed with adrenalin solution (1 in 5000) every hour, but the possible necessity for tracheotomy must be borne in mind. If ulceration is marked the surface should be cleansed and painted with carbolic acid (1 in 60). Sloughs should be encouraged to separate by the application of hydrogen peroxide. Finally, if an abscess form, the pus should be evacuated as soon as possible. In some cases this may necessitate incisions in the middle line of the neck or behind the sternomastoid. Whatever local treatment may be adopted great care must be exercised not to

exhaust the patient, and the danger of general anæsthesia in cases of septic poisoning must be remembered.

Membranous Pharyngitis.—This is another form of pharyngitis, generally due to some pathogenic organism, though it may result from any intense local irritant, such as steam, boiling water or corrosive fluids. By far the commonest cause is infection with the Klebs-Loeffler bacillus (see *Diphtheria*). It is characterized by the formation of a false membrane on an inflamed mucosa, which varies in consistency, but is generally difficult to separate, and when separated leaves an eroded surface. Except in traumatic cases it is wiser to treat the case in every way as one of diphtheria (*q.v.*).

Vincent's Angina is associated with a spirillum and fusiform bacillus, and is characterized by the formation of greyish-white necrotic pseudo-membranous patches on the surface of the mucous membrane. The tonsils are most usually affected, but patches may also occur on the uvula, soft palate and palatal pillars, and also on the gums around decayed teeth, with corresponding infected areas on the buccal mucosa. The necrotic tissue is soft, but adherent, and if removed leaves at first a bleeding abraded surface, and later distinct ulceration. The necrosis may extend deeply, causing considerable loss of tissue. The submaxillary lymphatic glands are often enlarged. The onset is usually marked by slight febrile disturbance and often by discomfort and some pain in the throat. It runs a mild but slow course, unless, as sometimes happens, there is superadded septic infection. Cases are recorded in which Vincent's Angina has spread to the larynx and even to the lungs, causing a fatal termination. The treatment consists in applying antiseptics to the necrotic patches, in keeping the mouth and pharynx cleansed with solution of permanganate of potassium, in suitably treating any diseased teeth, and in attention to the general health.

Traumatic Pharyngitis may be caused by injury from flames, boiling fluids, steam and corrosives, such as carbolic or mineral acids, from swallowing hard irregular substances or from the impaction of foreign bodies. The resulting inflammation may be simple, suppurative or membranous, and may result in sloughs, gangrene or deep-seated abscess.

Toxic Pharyngitis.—Various drugs taken internally will produce inflammatory changes in the pharynx. Antimony, mercury and belladonna may be especially mentioned, but iodine, arsenic, copper and lead also have the same effect in a less degree.

CHRONIC INFLAMMATORY INFECTIONS.

The peculiarity of these affections is that the visible changes bear no definite relation to the

symptoms. Marked changes may produce no symptoms, slight changes may be accompanied by the greatest distress and worry. This is so much the case that it seems doubtful whether these affections should be looked upon as diseases in themselves, or as but a part of some more general dyscrasia. When the symptoms are pronounced the patient is almost invariably found to be dyspeptic, rheumatic, gouty, anæmic or neurotic, and these conditions must be treated before any permanent relief of the local symptoms can be expected.

The morbid changes in the pharynx may be aggravated and possibly caused by (1) frequent attacks of acute pharyngitis, (2) obstructive, catarrhal or suppurative disorders of the nose, (3) septic conditions of the teeth and gums, (4) damp and changeable climates, (5) local irritants, such as dust, vapours, condiments, alcohol and tobacco, (6) misuse and over-use of the voice. The resulting changes are usually described as general chronic pharyngitis or "relaxed throat," granular pharyngitis or clergyman's throat, lateral hyperplastic pharyngitis, and elongated uvula.

In **General Chronic Pharyngitis** the mucous membrane is thickened, congested, of a dark red colour, and often covered with a film of tenacious mucus. It is especially associated with dyspepsia, and more particularly with alcoholic dyspepsia. The chief symptoms are soreness and dryness of the throat, with irritation, hawking and coughing. In slight cases the local treatment consists in washing the throat with sodium chloride (dr. i to O i), followed by a spray of menthol (gr. xv to paroleine $\frac{3}{4}$ i), or by Mandl's fluid applied as a paint. In more obstinate cases the surgeon should himself apply perchloride of iron (gr. cxx to the ounce) or chloride of zinc (gr. xxx to the ounce) two or three times weekly.

Granular Pharyngitis is due to localised hypertrophy of the lymphoid tissue on the posterior wall of the pharynx. It is associated with anæmia in young girls, with dyspepsia in the middle-aged, and with over-use and misuse of the voice in clergymen and other voice-users. Pain, aching, discomfort, the sensation of a foreign body, pricking and dryness are amongst the subjective symptoms complained of. Singers and speakers also mention a veiling of the voice, tiredness of the throat and aching of the neck on any vocal effort. As a rule temporary relief may be given to the local symptoms by stimulating or slightly astringent applications used as paints or sprays, or administered in lozenges or pastilles if the digestion is good; but the quickest way to give relief is by the judicious use of the electric cautery. One or two of the most conspicuous granules should be painted with cocaine and the cautery lightly applied.

As the beneficial action is probably due to counter-irritation, it is not necessary or advisable to destroy much tissue. Over-cauterization leads to a dry scarred pharynx, and the cure may be worse than the disease. If one application is not sufficient, one or two more granules should be lightly burned after a week's interval. Should the cautery not be available, good results may be obtained by the application of chromic acid fused on a probe. It must be applied quite lightly, as its action continues after the probe is removed.

In **Pharyngitis Hyperplastica Lateralis** the lymphoid tissue situated just behind the posterior pillar of the fauces and covering the salpingo-pharyngeal folds becomes enlarged and shows as a red thickened band. It is especially associated with rheumatism and gout, and often gives rise to much pain, which radiates from the throat down the neck to the shoulders. Other symptoms are very similar to those of granular pharyngitis. In some cases this condition is associated with post-nasal catarrh. Relief may be given to the symptoms by the application of pig. Mandl or the menthol spray, but in some cases it is advisable to cauterize the swollen bands in one or two places in the manner just described for granular pharyngitis.

Elongated Uvula.—The uvula may be very considerably elongated without any other change whatever in the pharynx; on the other hand, it may be enlarged, reddened and thickened as a part of a general pharyngitis. In both cases it very rarely gives rise to any special symptoms, though just occasionally it may be the source of an irritable cough, worse on lying down. The cough, however, is much more usually the result of accompanying dyspepsia, consequently the uvula seldom, if ever, requires removal. The *treatment* must be directed towards the general pharyngitis and the dyspepsia. This is usually sufficient, though rarely it may be advisable to amputate the uvula. Cocaine is applied and the uvula grasped with a pair of special forceps, held forwards and divided about a third of an inch from its base with angular scissors in such a way that the cut surface looks backwards. Afterwards the mouth should be frequently washed with Condyl's fluid and, should there be much pain, a pastille of bismuth and morphia should be slowly dissolved in the mouth.

In all four varieties of chronic pharyngitis the general treatment of the patient is far more important than the local. The latter may give relief to the symptoms, but the results are purely temporary unless the underlying condition is successfully treated.

Chronic Pharyngitis Sicca differs from other forms of chronic pharyngitis in that it is always secondary to changes in the nose. It may be

due to nasal obstruction of whatever origin, to rhinitis sicca or to atrophic rhinitis. The treatment must be directed to these causal conditions.

SYPHILIS

The pharynx may be the seat of the **primary sore**, which is sometimes situated on the soft palate or faucial pillars, but more usually on one of the tonsils. It gives rise to an indurated swelling of considerable extent, in the centre of which is a greyish ulcer. There is early and marked enlargement of the glands at the angle of the jaw. It must be distinguished from the various forms of acute inflammation and from epithelioma and a breaking-down gumma. The general treatment is as for a primary sore elsewhere, and locally the surface of the ulcer should be kept clean with an alkaline gargle or spray followed by an insufflation of iodoform.

Secondary Syphilis nearly always involves the pharynx. Erythema, mucous patches and superficial ulceration are its three manifestations, of which erythema is the first to appear. The tonsils become swollen and of a dull red colour, and on the soft palate on either side of the base of the uvula are symmetrical bluish-red crescentic patches with sharply defined edges. This appearance, though it is sometimes seen in the later stages of a septic pharyngitis, is extremely suggestive of secondary syphilis. Stiffness and slight soreness of the throat may be the only symptoms, and as the nose is often involved at the same time they are usually attributed to a slight cold. They persist, however, instead of passing off in a day or two, and there is dryness rather than excessive secretion. In this and other secondary lesions the isolation of the *spirochæta pallida* is a valuable diagnostic aid, should their nature be in doubt.

Mucous Patches occur on the posterior wall, the tonsils and fauces, whilst the lips and buccal mucosa are often simultaneously affected. They are round or oval, from a quarter to half an inch in diameter, raised above the surface of the mucous membrane, and bluish-white or opalescent in appearance. They are persistent and tend to recur in crops till quite late in the course of the disease. They give rise to much pain and dysphagia.

Secondary Ulceration.—Kidney-shaped ulcers, symmetrically situated, usually on the tonsils, are described as occurring quite early in the course of secondary syphilis. Mucous patches may become abraded and leave an ulcerated surface. From one to four years after infection superficial ulcers are again not uncommon, but as these are probably due to breaking down of superficial gummatous infiltrations, they should

be looked upon as an early tertiary manifestation.

Treatment. The usual constitutional treatment for syphilis should be adopted without delay. In the first instance, at any rate, it seems advisable to rely on mercury, that well-tried remedy, but in obstinate cases, and when Wassermann's reaction remains positive in spite of pushing the mercury, the injection of salvarsan may be tried.

Erythema does not require any *local treatment*, but when mucous patches are present the pharynx should be washed with equal parts of lotio nigra and garg. pot. chlor. three or four times daily. If this and the general treatment do not rapidly induce healing, each mucous patch should be dried carefully and painted with chromic acid (gr. xxx to the ounce) or with bichloride of mercury (gr. x to the ounce). Secondary ulcers should be treated in the same way.

Tertiary Syphilis.—Gummata, ulcerations, scars and adhesions must be considered.

Gummata may be circumscribed, diffuse or nodular. The circumscribed gumma varies in size from a bean to a walnut and occurs in any part of the pharynx; the diffuse gumma may infiltrate the posterior wall or velum; nodular gummata are multiple and generally confined to the soft palate, and often closely resemble lupus. Circumscribed and diffuse gummata as a rule break down with great rapidity and, being in themselves painless, ulceration has generally occurred before advice is sought.

Ulcerations may be superficial or deep. The superficial variety is due to the breaking down of a gummatous deposit in, and confined to, the mucous membrane, which leads to serpiginous ulcers covered with yellowish-grey muco-pus. They occur on the soft palate, posterior wall and tonsils. The deep variety is due to the breaking down of an ordinary gumma, which causes a deep punched-out ulceration with clean-cut walls, and with pus and debris covering its base. If untreated it extends until the whole of the original gumma has broken down, and so may cause great destruction. A gumma infiltrating the velum may break down on its naso-pharyngeal surface and may be overlooked until a perforation suddenly occurs, as at first there may be only redness and some impairment of movement to be observed through the mouth.

Scars and Adhesions.—Tertiary syphilis only too frequently leaves great damage behind it in the shape of scars, cicatricial contractions and adhesions. These may require plastic operations, but it is as a rule better to leave them alone, as recontraction and fresh adhesions are only too frequent and the final condition is often worse rather than better.

The diagnosis of tertiary syphilis is usually easy, but in a few cases much difficulty may arise in excluding tubercle, lupus and malignant disease. Wassermann's reaction test, bacteriological examination of the discharges, the microscopical examination of a portion of the diseased tissues and the result of treatment will one or all set the diagnosis on a sure footing.

Treatment. Tertiary syphilis of the upper respiratory tract does not yield so surely and quickly as it does elsewhere to iodide of potassium alone. It is, therefore, always advisable and often essential to combine with it the administration of mercury in some form, and the best response is generally obtained by inunctions, though the intramuscular injection of metallic mercury also gives very excellent results. In some cases where these older methods are slow or fail, salvarsan may be tried. The immediate results are generally effective, but it has not been in use sufficiently long to judge of their permanency.

No local treatment is required for an unbroken gumma. Superficial ulcerations are treated in the way recommended for mucous patches. Deep ulcerations must be frequently cleansed with alkaline lotion or Condy's fluid, and then insufflated with iodoform, to which orthoform can be added if there is much pain.

TUBERCLE

The pharynx may be involved in acute miliary tuberculosis, and in the course of pulmonary phthisis, and in rare instances it may be primarily infected.

In **Miliary Tuberculosis** the velum, faucial arches and uvula are chiefly affected. The mucous membrane quickly becomes intensely injected and cedematous and numerous miliary tubercles are deposited just beneath its surface which tend to coalesce, break down and form irregular shallow ulcers, giving rise to intense pain. The disease runs a rapid course, and almost invariably ends fatally. The *local treatment* consists in keeping the parts clean by means of alkaline lotion, in relieving pain and easing dysphagia by insufflation of orthoform, and by limiting the diet to semi-solids.

In **Pulmonary Phthisis** the most constant change is anæmia of the soft palate. The mucosa is extremely pale, and beneath its surface dilated vessels can be plainly seen. In addition to this discrete tuberculous ulcers may occur. They are irregularly round or oval, shallow with undermined edges, covered with dirty grey necrotic debris, beneath which are pale granulations. The surrounding mucous membrane is pale and of a bluish-grey colour. They are met with in very acute cases of phthisis or towards the end of a more chronic case, and their

occurrence is always of very grave import. Their treatment is as described for the miliary form, but if the patient's general condition will admit of it, an attempt may be made to induce healing by the application of the electric cautery or of pure chromic or lactic acid.

Primary Infection of the pharynx generally takes the form of tuberculous infiltrations. These slowly tend to break down and form indolent ulcers which are often covered with pale pink exuberant granulations. They are most commonly seen on the tonsils or posterior pillars. They run a chronic course and there is no marked line of distinction between such infiltrations and lupus.

Local treatment will often induce healing. Infiltrations should be destroyed by means of the electric cautery and ulcerations should be curetted and pure chromic acid applied. Later the surface should be painted with iodine (one part in five of spirit) or lactic acid (fifty per cent). *The general treatment* of all these conditions is most important and must be carried out simultaneously with the local treatment.

Lupus.—The soft palate, uvula and anterior pillars are the parts most often affected. They first become thickened and then soft pale nodules appear on the surface. These nodules slowly ulcerate, healing in one part and breaking down in another, but eventually causing extensive destruction of both superficial and deep tissues. The mucous membrane surrounding the diseased area is always unusually pale. When the process is arrested and healing is complete, there is often great deformity from cicatricial contraction.

Treatment. Lupus of the pharynx will sometimes yield to the internal administration of increasing doses of arsenic without any local treatment, but should the latter be necessary, curettement and cauterization must be adopted.

NEW GROWTHS

Various forms of **Innocent Tumours** may be met with in the pharynx. In their order of frequency the following may be mentioned:—papilloma, fibroma, adenoma, angioma, lipoma and dermoid cysts. If causing inconvenience or increasing in size, they must be dealt with on usual surgical principles.

Malignant Growths of the pharynx, apart from the tonsils (*q.v.*), are rare as a primary affection, though they often extend thither from neighbouring regions. Carcinoma, sarcoma and endothelioma, however, may all occasionally commence in the palate, faucial pillars or the posterior wall. Epithelioma of the soft palate is the commonest of the malignant growths originating in the pharynx. Sarcoma and endothelioma commence as distinct tumours, which later break down and ulcerate. Epithelioma

commences as an infiltration, which quickly breaks down and forms a typical malignant ulcer. The glands of the neck become rapidly involved.

At first symptoms may be absent, so that advice is not sought till the size of the growth interferes with the functions of the part or ulceration causes pain shooting to the ear.

It is often difficult to determine by inspection the exact nature of the malignant growth and sometimes to exclude syphilis, therefore if operation is contemplated it is advisable to confirm the diagnosis by microscopical examination of a portion of the growth.

Treatment. Removal should be undertaken when it seems possible to get the whole of the growth and all the infected glands away. The particular operation will vary with the size and position of the growth. It may usually be reached through the mouth, with or without splitting the cheek, or through the lateral wall of the pharynx. A preliminary laryngotomy is nearly always advisable, and often ligature of the external carotid. Should operation be out of the question, cleansing the pharynx and relieving pain is all that can be done. Orthoform locally and morphia hypodermically should be freely used.

NEUROSES

Spasmodic motor neuroses, such as choreic and rhythmical movements, are met with. The latter are generally associated with some grave central lesion.

Paralysis of the palate may be due to disease of the nerve of central origin, to pressure in the course of the nerve, to peripheral neuritis or to traumatism. Peripheral neuritis following diphtheria is the commonest cause and often occurs when the original infection has been so slight as to be overlooked.

The sensory neuroses met with are anæsthesia, hyperæsthesia and paræsthesia. Anæsthesia may be due to some central lesion, to pressure on the nerve or to peripheral neuritis, but the others are usually associated with chronic pharyngitis and its causal general conditions (*q.v.*).

Herpes is characterized by small vesicles, chiefly on the palate and uvula, which quickly lose their epithelium and form small, round, well-defined, though quite superficial, ulcers with a greyish base and with some surrounding inflammation. The appearance of the vesicles is often preceded or accompanied by intense pain, and there may be a slight rise of temperature.

Treatment. Rest, change of air, a generous diet and tonics are indicated, whilst locally an alkaline gargle and menthol spray should be advised.

Uticaria, pemphigus, impetigo and lichen may occasionally affect the pharynx.

Keratosis.—This affection is due to a keratosis of the invaginated epithelium of the lymphoid follicles and tonsillar crypts, bound up with which is a free growth of *leptothrix buccalis*, hence its old name, pharyngo-mycosis. It is characterized by small, milky white, firmly adherent, feathery outgrowths scattered over the tonsils and base of the tongue, with a few on the posterior wall of the pharynx. It is generally mistaken for lacunar tonsillitis. The only symptoms are a sensation of roughness in the throat and a sour taste in the mouth, though the appearances often cause the patient considerable alarm. Reassurance and an alkaline mouth wash are generally all that is required, though if necessary the general health should receive attention. The condition may last several months, but eventually disappears, and active local treatment only does harm.

Foreign Bodies.—Pins, needles and fish-bones may penetrate and lodge in the pharyngeal walls, tonsils or base of tongue. They are often very difficult to find, and a careful search should be made by vision, by probing, and by digital palpation. Large substances, such as a bolus of food or false teeth, may become impacted in the lower part of the pharynx and require removal with finger or forceps.

Retro-Pharyngeal Abscess is usually due to suppuration of the retro-pharyngeal glands as a result of septic or tuberculous infection carried thither from the pharynx or naso-pharynx. It may also be due to spinal caries or to wounds of the pharyngeal walls. It causes pain, dysphagia and often dyspnoea. There is a fluctuating swelling to one side of the back of the pharynx, accompanied by fullness or even marked swelling in the neck behind the sternomastoid. The *treatment* consists in opening the abscess as soon as possible, either through the mouth or by an incision behind the sternomastoid. In cases due to spinal caries, in very young children with a very large abscess, and when there is distinct fluctuation in the neck, the incision should be made behind the sternomastoid and the abscess reached by careful dissection. In all other cases the oral route may be adopted. The risks involved are entrance of pus into the larynx at the time of operation and subsequent septic pneumonia; therefore, local anaesthesia should, whenever possible, be used in preference to general anaesthesia, and in infants it is better to employ neither. The patient should be placed on his side with the head low and the face directed downwards; a good view of the swelling should be obtained, and a sharp-pointed sinus forceps should be plunged into it, opened and withdrawn. All instruments for performing

tracheotomy should be at hand in case of necessity.

Hæmorrhage from the pharynx is extremely rare in any quantity except there be some definite and extensive disease present. The rupture of dilated veins may give rise to streaking of saliva or expectoration, but in the absence of serious lesion the source of an extensive hæmorrhage must be sought elsewhere.

C. A. P.

DISEASES OF THE TONSILS

Acute Tonsillitis.—The acutely inflamed tonsil may be very enlarged—*Parenchymatous Tonsillitis*, or the outstanding feature may be the presence of scattered croupous exudation from the mouths of the crypts, with or without marked enlargement—*Lacunar* (otherwise called follicular) or *Discrete Exudative Tonsillitis*; or the tonsillar surface may present a large patch of false membrane which is usually due to the Klebs-Loeffler bacillus, *True Diphtheritic Tonsillitis*, but which may exceptionally be due to the presence of some coccus or bacillus, *e. g.* pneumococcus, Friedlander's or Vincent's organisms—*Pseudo-Diphtheritic Tonsillitis*. The first two and the fourth of these varieties are not specific, but are probably always associated with microbial infection, often of a multiple character, and are usually more or less contagious. Tonsillitis forms one of the multiple lesions of scarlatina and of measles. It is also antecedent to every quinsy.

Tonsillitis is most frequently met with between puberty and the thirtieth year, but may occur at any time. Insanitary surroundings, pyorrhoea alveolaris and bad teeth generally, previous attacks, especially in connection with the exanthemata, chronic lacunar deposits, the rheumatic state, and a debilitated condition of the system predispose to acute tonsillitis. A malignant epidemic form, with ulceration, known as "putrid sore throat," is probably a thing of the past. When the attack is very acute there is fever, 100° to 103° F., with a quickened pulse and sometimes rigors, though the latter usually points to the formation of an adjacent peritonsillar abscess (quinsy); the constitutional symptoms are correspondingly severe, general malaise, headache and muscular pains in the back and limbs. The general symptoms, in fact, are often suggestive either of rheumatism or of influenza, and it is not always easy to determine whether the disease is merely tonsillitis or not. There is local pain in the fauces, increased by efforts of deglutition, the pain occasionally shooting up to the ear. The tongue is coated, salivation may be increased, and occasionally there is an accompanying glossitis or stomatitis. The

glands at the angle of the jaw may be tender, but are not such a prominent feature as in scarlet fever, diphtheria, quinsy and septic pharyngitis.

The voice is generally affected by reason of the tumefaction of the palate and of accompanying pharyngitis. There is often marked constipation, the urine is high-coloured, charged with urates and scanty on account of the tendency to avoid taking much to drink by reason of the pain and discomfort. There is every gradation from the severe type to a mild catarrhal one, with moderate swelling and slight pain and discomfort on swallowing. Albumin is found occasionally, when there is high fever, but, in contrast to scarlet fever, in tonsillitis it is usually a late symptom. The spleen is often enlarged; whether this is due to the fever or to the virulence of the poison in the circulation is undetermined. No reliance can be placed on the presence of albumin in the differential diagnosis as regards diphtheria; if, then, the cryptic exudations tend to coalesce and a suspicion of diphtheria is raised, the bacteriological culture test should at once be resorted to, the case meanwhile being isolated. In suspected scarlet fever, *i. e.* where the rash has not yet appeared, there should rarely be any real doubt if it be borne in mind that in scarlet fever the prevailing feature is the vivid scarlet flush (apart from the general rash) of the face and of the throat, tongue and buccal mucosa. The "strawberry tongue" is characteristic. In true scarlet fever cases the rash, however, soon appears to clear up a diagnosis which is usually obvious enough to the expert in its absence.

The tendency in former times was to concentrate effort on the local rather than on the general constitutional treatment. To-day strong antiseptic pigments are considered worse than useless, because not only do they not reach the septic crypts, but they increase the pain. This is generally correct, but in the very early stage of cases of recurrent tonsillitis the writer always instructs his medical patients to apply pure guaiacol, after previous cocaineization, to the surface of each tonsil in order to endeavour to abort the attack, a not unusual sequence when the lesion is still superficial. Gargling is painful and probably useless, even if the patient makes a conscientious effort to carry it out. Warm mouth washes of listerine or glycothymoline tend to cleanse the mouth and the teeth and are always soothing. Atomized cocaine is disappointing in small doses, and may affect the heart and cause insomnia in large ones, and it causes a feeling of increased tumefaction. Alkaline sprays are useful when there is much ropy mucus clogging the fauces. Demulcent and anodyne pastilles sometimes do good;

antiseptic lozenges are probably useless, and when they do appear to relieve—as, for instance, the carbolic acid lozenge—the effect is due to the analgesic rather than to the antiseptic action of the drug. Chloretone, orthoform and morphia insufflations are not so useful in very painful cases of tonsillitis as they are in throat conditions where the surface is broken and ulcerated. External hot applications are always comforting, however applied. Leiter's cold coil was once almost a routine measure in the practice of some throat specialists, but hot water is now substituted for the cold. Relief of pain during the taking of fluids is sometimes afforded by the individual in attendance on the patient standing behind him or her and making firm pressure with the hands on the ears and side of the jaws during the act of deglutition. Although the general treatment is so much more satisfactory than any local symptomatic treatment, yet it can be summed up in a few words, *viz.* an initial purge of calomel followed by a saline, the frequent administration of aspirin or allied drugs, and a cautious resort to a hypodermic injection of morphia and atropine to procure sleep and relief from excessive pain. Therapeutic inoculation should be resorted to where the disease is due to a specific organism, *e. g.* antitoxin in diphtheria, or a stock serum, followed by an autogenous vaccine in severe or recurrent cases where micro-organisms, such as either the pneumococcus, Friedlander's bacillus, the influenza organism or streptococci are found to predominate. The rheumatic factor in some cases must be borne in mind.

During convalescence, especially in anæmic subjects, iron preparations may be needed. Each convalescent, however, will require treatment according to the special indications of the case; but as relapses are not uncommon, and as the state of debility often leads to the recurrence of other dormant troubles, it is well to bear in mind that to continue treatment during the stage of recovery and after is not the least important function of the practitioner in dealing with a case of severe tonsillitis.

Quinsy (Palatal or Peritonsillar Abscess) is the popular name for an acute tonsillitis plus a peritonsillar or epitonsillar (palatal) abscess.

An acute intra-tonsillar abscess is extremely rare, the writer having only met with two unequivocal cases; the reason is to be found in the structure of the gland, which is riddled with crypts or lacunæ, whereby the discharge of inflammatory products out of the mouths of the lacunæ is facilitated. In cases of acute tonsillitis, however, an extra-tonsillar abscess often forms in the palate above the superior pole of the tonsil, and sometimes externally and posteriorly between the planes of the pharyngeal portion of the deep

cervical fascia. Acute tonsillitis with a super-added adjacent peritonsillar abscess constitutes a quinsy. Infection is supposed to penetrate the capsule into the epitonsillar (palatal) tissues from the *crypta magna* or "tonsillar recess," which opens into the supratonsillar fossa. Some authors consider that an abscess may occasionally form in the "recess" itself by the blocking of its mouth by parenchymatous swelling accompanying acute tonsillitis.

The *symptoms* of quinsy are those of acute tonsillitis with others superadded, depending largely on the anatomical situation of the swelling or abscess; these include limitation of movement of the lower jaw and head and neck generally, dysphagia and odynphagia and dribbling from the mouth. There is more severe pain than in acute tonsillitis, and it radiates up to the ear and down the neck. The patient often looks and feels desperately ill, more especially when there are fever and rigors. The objective signs are fairly constant; both tonsils are inflamed and enlarged and block the faucial isthmus, and there is often scattered exudation from the crypts. In unilateral abscess a large swelling is seen occupying more than half the palate; the uvula is oedematous, and the anterior pillar bulges forwards and inwards; the corresponding tonsil is displaced inwards so as to pass beyond the mid-line, touching its fellow; there is also usually a displacement downwards towards the base of the tongue. The patient is unable to drink, eat, expectorate or cough without pain, and, as sleepless nights are super-added, complete mental and physical prostration soon results in severe cases. These symptoms rapidly disappear after evacuating the pus by an incision through the anterior pillar or through the most prominent part of the bulging palate. Incising the tonsil itself is useless, and endeavouring to evacuate the abscess by means of an angular metal searcher or director inserted into the tonsillar recess is extremely painful and unsatisfactory from the point of view of hitting off the abscess cavity and of subsequent drainage. Tonsillectomy has been recommended but not often practised. The pus having been found by a palatal incision, sinus forceps are inserted and opened and the abscess evacuated by pressure; this can be followed by injection of hydrogen peroxide. Should prompt incision be refused, heat externally and mouth washes may possibly hasten the bursting of the abscess, as subsidence rarely happens; spontaneous evacuation takes place either between the anterior pillar and the superior pole of the tonsil, through or in the region of the tonsillar recess, or through the palate, and very exceptionally behind the posterior pillar. When the last happens, the case has probably been complicated by a lateral pharyngeal abscess; the latter

condition may, in fact, have been the prominent feature throughout. After the evacuation of the palatal abscess the symptoms may only be partially relieved, and there may be an apparent relapse. In these circumstances search should be made for a *lateral pharyngeal abscess* behind the posterior pillar; this complication is rare, but, if found, should be opened from the pharynx by means of a pair of angular scissors or an angular bistoury; an external cervical operation is rarely necessary. Exceptionally a second abscess may form above the opposite tonsil at an interval of some days from the appearance of the first. General septic phlegmonous or oedematous inflammation of the pharynx, often extending to the larynx, a highly dangerous condition, may be mistaken for a quinsy; it is rarely, if ever, a complication of a true quinsy, and is more probably always a distinct disease *ab initio*, being characterized by a tendency to spreading oedema, rather than to the formation of a localised abscess. A quinsy is of course in the first instance a localised phlegmon, and it is a moot question whether incision is advisable before there is evident pus formation. After complete recovery the question of excision of the tonsils should be considered in cases of recurrent quinsy, as the cause of this is usually to be found in a septic condition of the crypts (chronic lacunar tonsillitis). As the glands in the neck are frequently inflamed in quinsy, the danger of chronic cervical adenitis as a sequela should be urged when the patient is inclined to refuse early palatal incision.

Enlarged Tonsils.—Chronic inflammatory enlargement of the tonsils is a condition so common and so well known that only a few words are necessary in reference to certain points which just now are of special interest in connection with school clinics.

The etiology is usually obscure. The hypertrophy may appear to date from an exanthematous attack. Children in healthy surroundings seem to enjoy no special exemption. The teeth may be good or bad. The concomitant adenoid growths leading to mouth breathing have been held to determine hypertrophy, but an unknown common cause is probably at work. The changes in the voice and in articulation, the snoring and noisy respiration, deafness, aprosexia, deformities of the face, jaws, teeth and chest, enlarged glands, etc., are symptoms noticed in common with "adenoid growths."

No good purpose is served by describing the various types of enlarged tonsils; the state of the crypts, whether septic or otherwise, is often more important than shape and even size.

Children with considerably enlarged tonsils

often enjoy good health, and if the tonsils are only moderately enlarged and cause none of the above symptoms there seems no urgent reason for surgical interference; should, however, signs and symptoms be present, and should there be a history of recurrent attacks of acute tonsillitis, or of peritonsillar abscess (quinsy), then excision is indicated, together with the removal of adenoids, if present.

The important question of latent tubercle bacilli in the tonsillar crypts has brought forth most contradictory answers. Whereas Levy and Chiari found that in 1085 patients actually suffering from laryngeal tuberculosis there was clinical evidence of tuberculosis in less than two per cent., on the other hand, Wood gives sixty-nine per cent. of tuberculosis cases examined as suffering from tonsillar tuberculosis. The discrepancy is probably to be explained by the want of distinction between clinical and latent tuberculosis of the tonsils. Still, considering that the tonsils are acknowledged avenues of entry of tubercle bacilli into the system, Wood's statistics are sufficiently disquieting.

Removal of Tonsils.—When from adequate reasons it is decided that the tonsils should be removed, it is axiomatic that the more completely this is carried out the better, if recurrence of symptoms is to be avoided. This does not necessarily mean that a severe dissecting operation is a *sine qua non*. Though the old-fashioned operation of tonsillotomy by means of a sharp guillotine frequently failed to remove sufficient to prevent recurrence of symptoms, and rarely removed more than nine-tenths of the tonsil, it does not follow that operation with the guillotine alone should be regarded as obsolete, and that all tonsillectomies in future should include partial dissection; for it is abundantly proved that with a *slightly blunt* guillotine alone a complete extra-capsular excision of the entire tonsil can be frequently, and even usually, accomplished by an expert operator. In *buried tonsils with septic crypts*, and in tonsils where the pillars and plica are adherent, complete enucleation by a dissecting operation, combined with the employment of the snare or blunt guillotine, usually essential.

The various methods of removal at our disposal may be summarized as follows—

1. With *sharp* guillotine plus *external* digital compression below the angle of the jaw, carried out by the anæsthetist or assistant. This method is often inefficient.

2. *Blunt* guillotine plus *external* compression.

3. The foregoing combined with the vulsellum.

4. Blunt guillotine plus *internal* digital compression at the anterior pillar of the fauces made by the operator; to this external compression can be added.

5. Blunt guillotine plus internal compression, plus *vulsellum*.

6. *Snare* plus compression plus vulsellum.

7. *Dissection*, i. e. instrumental separation of superior pole of tonsil and of adherent pillars, aided by traction with vulsellum, and followed by attempted complete enucleation with *finger*.

8. Dissection with the aid of dissector and vulsellum, as in the foregoing, followed by complete removal with a blunt guillotine; digital compression can be employed to supplement traction with the vulsellum.

9. The same as the foregoing, a snare being substituted for the guillotine.

When the tonsil, after any of the above operations, is still adherent at one spot and the instrument is "held," the finger is used as a separator and swept round the bed of the tonsil.

Of these operations, 2 and 4 are the favourite procedures, and by such simple means can the majority of enlarged tonsils be satisfactorily removed, provided a not too sharp guillotine of sufficiently small size be employed and the operator is reasonably expert, more especially in threading the tonsil into the instrument from the inferior pole. The shaft of the guillotine should be directed towards the tonsil from the angle of the mouth of the opposite side, and the ring of the instrument used as a raspatory to detach the gland from the posterior pillar and, with its capsule, from the tonsillar bed in a direction upwards and forwards, so as to bring it against the eminence on the lower jaw produced by the last molar tooth; the blade is then driven home. The only disadvantage in this method (Sluder's) is that the anterior pillar is usually slightly wounded, and Peters therefore prefers to make two cuts with the guillotine, the first a slight one to detach the tonsil from the anterior pillar; the cutting blade is then readjusted and the ring made to further displace the tonsil upwards and forwards before the second stroke, which removes the whole tonsil with its capsule, is carried out. Many experts, however, prefer to carry out tonsillectomy by means of a vulsellum and snare, and claim that there is less trauma and hæmorrhage.

For adherent and for buried tonsils a dissecting operation such as 8 or 9 should be resorted to in order to effect a complete excision of the tonsil along with its capsule. It must be remembered that there is often greater inflammatory reaction and increased liability to hæmorrhage after dissecting operations, and with the capsular barrier removed increased risk of infection of the adjacent lymphatics. There is much difference of opinion as to the employment of the knife or of a blunt dissector for detaching the pillars; the advantage of a

blunt instrument is that it is also available for freeing the superior pole of the tonsil containing the *crypta magna* (tonsillar recess).

10. Removal of the parenchyma, leaving the capsule intact, by *morcellement*, accomplished either by digital scarification or by punch forceps, is mentioned only to be condemned if carried out as a complete operation, though partial *morcellement* with Kretschmann's punch is justifiable for the removal of small portions of tonsillar tissue left behind after other operative methods, especially after attempted enucleation by finger, or by dissection, in which the tonsils turn out to be very friable.

The galvano-cautery, applied either in the form of the snare or multiple puncture, has been employed for dealing with cases of hæmophilia, pernicious anæmia and acute leukæmia; and the production of aseptic necrosis by the new method of diathermy has also been suggested. When, however, the history and symptoms point to either of these conditions, it is advisable to confirm by coagulation tests and by blood examinations, and to desist from all surgical measures.

among experts. Open chloroform anæsthesia on a table or couch is essential in the case of

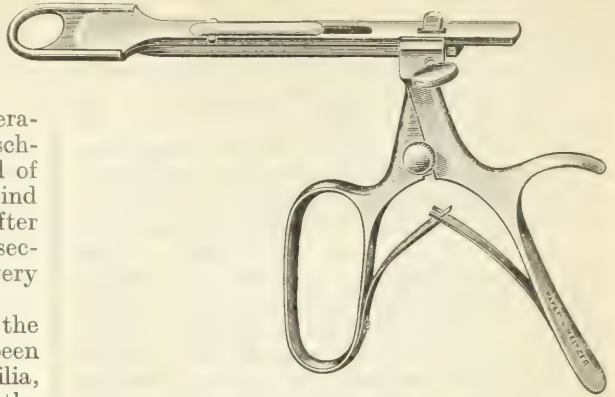


FIG. 4.—Ballinger's One-handed Guillotine with strengthened Mackenzie blade. This handle can also be used with Sluder's blades.

slow or only moderately experienced operators, when any operation which includes dissection is about to be carried out.

As regards tonsillectomes, the modifications of Mackenzie's guillotine still hold the field in this country, Hugh Jones's and Heath's being largely used. I sometimes employ a Mackenzie guillotine with a lifting fork attached for buried tonsils. Ballinger's tonsillectome is much used in America, and I can recommend it as a very efficient one-handed instrument, though rather too complicated for rapid cleansing in hospital practice.

Tonsillar Hæmorrhage.

Considerable bleeding immediately following tonsillec-

tomy with short anæsthesia, which does not cease spontaneously after a few deep breaths, usually does so after syringing with ice-cold water; if this fails hot water syringing should be tried. General parenchymatous bleeding is best dealt with in the first instance by pressure, a pad of cotton-wool or lint dipped in hydrogen peroxide or adrenalin solution or in a paste of equal parts of tannic and gallic acid being pressed with the end of a pair of long forceps against the bleeding, for ten or even twenty minutes. Watson Williams's special forceps, with one blade against

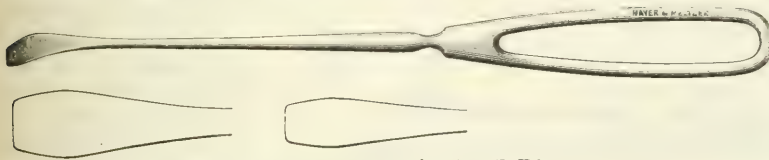


FIG. 1.—Dan Mackenzie's Tonsil Dissector.

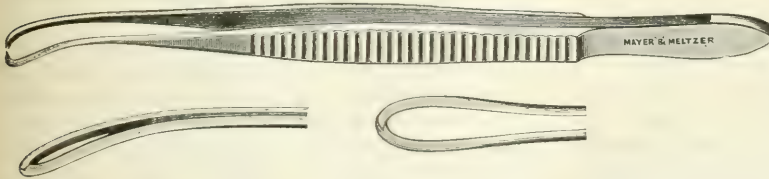


FIG. 2.—Hope's Tonsil Forceps, which can be used either as a tenaculum or as a dissector.

The position of the patient, whether sitting in a chair or lying in the extended position on a table, the choice of anæsthetic and the ques-

tion of long or short anæsthesia, are points on which it is impossible to dogmatize in view of the divergent opinions and practice obtaining

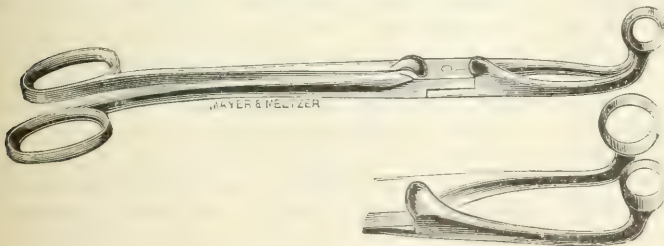


FIG. 3.—Kretschmann's Tonsil Punch.

the tonsil and the other outside near the angle of the jaw, is especially handy for this purpose. A spurting vessel can be clamped with a long pair

of artery forceps and ligatured later if necessary. A clamp forceps with broad blades for temporarily clamping the two pillars together vertically is so useful and efficacious that it ought always to be at hand. If on removal of these forceps after half an hour bleeding recommences, it will save further loss of time to sew up the two pillars over a roll of lint dipped in styptic. This can be accomplished either by a long curved needle, or more easily still by using Michel's hooks. The instruments for closing the hooks and removing them the next day are here illustrated. If each hook has a silk ligature attached to it, and the end secured outside the mouth, there will be no danger of trouble if the hook eats through. The writer has on two occasions brought about the immediate cessation of serious and long-continued bilateral tonsillar hæmorrhage by

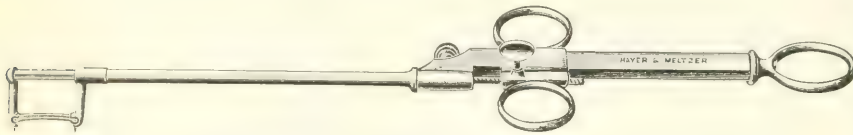


FIG. 5.—Instrument for suturing pillars of fauces with Michel's Hooks.



FIG. 6.—Forceps for opening and removing Michel's Hooks.

pressure on the carotid arteries with the patient lying on his back on the floor. As fainting occurred on each occasion the pressure may possibly have been exerted on the vagi as well, and it is impossible to escape the reflection that such pressure might not be altogether free from danger. The placing of a temporary ligature either on the external or on the common carotid has been resorted to on a few occasions, but can rarely be called for if instruments for dealing with the actual bleeding area are at hand. The value or otherwise of lactate of calcium, whether before operation or after bleeding has supervened, is a matter on which there is much difference of opinion. Subcutaneous or rectal saline injections may be necessary where much blood has already been lost.

Malignant Disease of the Tonsil.—A considerable and progressive enlargement of one tonsil in an adult should always raise the suspicion of *sarcoma*. A large embedded rhinolith can be excluded by exploration with a needle. The diagnosis is made with certainty by punching out a portion and submitting it to micro-

scopical examination. It is only in the later stages that the diagnosis is quite evident on account of surface ulceration and invasion of adjacent areas, including the glands of the neck accompanied sometimes by pain and impaired movements of the lower jaw and difficulty in swallowing. Lympho-sarcomas, and the round- and spindle-celled varieties, alone or mixed, and endotheliomas are the more usual forms met with. They may remain limited by the capsule for a considerable period and are more favourable for operative treatment than carcinomas. The tonsils are usually sooner or later involved in cervical *lymphadenoma*.

Carcinoma commences as a hard uneven swelling which subsequently ulcerates with an accompanying wart-like overgrowth. It rarely comes under medical observation until the glands are involved and there is some pain. The ulcer then has a hard base though fungating, and bleeds readily and tends rapidly to invade the pillars, base of tongue and other adjacent structures. The diagnosis, if there is any doubt in the early stage as to syphilitic or tubercular or lupoid ulceration, is settled by removing a small portion for microscopic examination. In early stages, when limited to the tonsil, excision has

been successfully performed from the mouth, with or without slitting the cheek. When, however, the glands at the angle of the jaw are enlarged and the pillars slightly attacked, nothing short of Vohsen's operation is likely to succeed. An incision is made from the mastoid tip to the hyoid and then carried upwards over the angle of the jaw; the lingual, facial and ascending pharyngeal arteries are ligatured, and the jaw divided in front of the masseter and the ascending ramus pulled strongly forwards out of the way; this gives good access to the tonsillar bed; enlarged glands may have to be dealt with by additional incisions. When the disease demands a much more extensive operation than this, the chances of successful radical removal are immensely reduced. Non-operative palliative measures include the use of the X-rays or the employment of screened radium salts, either applied to the surface for a period short of causing ulceration, or embedded in the tonsil so as to attempt to bring about aseptic necrosis. The glands should also be treated. Radium is a most

uncertain remedy, but apparent temporary disappearance of the growth has now been recorded in a number of cases, and in other instances there is marked reduction in the size of the growth and in the symptoms. Sarcomas appear to respond better than epitheliomas. Electrolysis is said to have been beneficial in a few cases of sarcoma of only moderate malignancy. When there is great narrowing of the fauces on account of the large size of the growth, much palliative success has been attained in producing aseptic necrosis of the bulk of the growth by the new method of diathermy, which produces a wound which heals well. This is in marked contrast to radium when used to the extent of cauterization, after which there is often no tendency to healing, and there may be increased pain. The other palliative measures, such as arsenic, anodynes, etc., are identical with those employed in superficial cancers in other parts of the body.

G. W. H.

INFLAMMATION OF THE LARYNX

Three varieties of laryngitis have been recognized and described analogous to inflammatory processes elsewhere—

1. The Acute.
2. The Subacute.
3. The Chronic.

Clinically these three conditions often merge imperceptibly one into the other in the order named, and certain symptoms and signs which are common to them all will be described in detail. Subacute laryngitis is a milder form of the acute variety, but it persists longer, and, if neglected, may lead to the chronic variety, which is a very persistent affection.

Acute Laryngitis.—This affection is so common that it is frequently looked upon by those who are subject to it as the natural result of "a cold which commences in the nose and spreads down the throat into the chest," and although in adults it gives rise, in the majority of cases, to symptoms of minor importance, yet in children and infants its onset may cause alarming symptoms, for the reason that the glottis in a child is so small that any swelling of the laryngeal mucous membrane impedes the airway and may temporarily occlude it; should this inflammatory condition and cedema extend to the mucous membrane below the cords, the danger to the child is greater still. It is known as "subglottic cedema," and calls for prompt treatment.

Pathology. The epiglottis and ventricular bands are red and swollen. The vocal cords, which normally are pearly white in colour, become pink, red or even a deep crimson, the amount of injection varying according to the

severity of the inflammation; in some cases hæmorrhages are observed on the upper surfaces of the cords. Mucus adheres to them, and on abduction it is drawn out into fine horizontal bands stretching from one cord to the other. This is typical of catarrhal laryngitis; associated with this is a myositis by extension from the inflamed mucous membrane to the internal tensors of the vocal cords, *i.e.* the thyro-arytenoidei. The cords on phonation fail to approximate in the way they should, and the voice is consequently either impaired or entirely lost.

Etiology. Among predisposing causes, the most common are liability to cold, infectious fevers, including influenza, syphilis, tuberculosis, pemphigus, herpes, impaction of foreign bodies, the result of injuries self-inflicted or otherwise, inhaling strong vapours, drinking corrosive liquids and boiling water, as children sometimes do. A very important cause of laryngitis, frequently overlooked, is nasal disease, either in the form of chronic hypertrophic rhinitis with mucopurulent discharge, or of suppuration in one of the nasal accessory sinuses; air passing through the nasal cavities becomes contaminated with organisms present in the discharges. The laryngeal mucous membrane becomes itself infected, and unless this nasal condition is recognized, treated and cured, laryngitis will persist and become chronic. Aural discharge, draining through the Eustachian tube is an occasional cause, and should be noted.

Symptoms. In acute laryngitis the voice is weak, hoarse, or may be lost entirely, but the aphonia is never so complete as in cases of "functional aphonia." There is soreness and stiffness in the throat owing to primary arrest of secretion, with a constant desire to cough and clear the throat. These sensations pass off so soon as the flow of mucus becomes re-established and the parts become again lubricated. If the ventricular bands are infiltrated as well dyspnoea may be present, and in children, as above noted, this may produce symptoms so grave that tracheotomy is required. Later the trachea becomes affected and inflammation extends to the bronchi, with resulting bronchial catarrh. In the majority of cases the acute symptoms last from three to seven days, then slowly disappear.

Physical Signs. With the aid of the laryngoscope the epiglottis is seen to be red and swollen. The ventricular bands and laryngeal mucosa share in the general inflammation, and if the cords are visible and not occluded by the infiltrated ventricular bands, they will be seen to be injected, red and sometimes hæmorrhagic. On phonation the cords do not meet, and the appearance is a typical one, the cords being

"bowed" and the glottis elliptical, as seen in functional paresis of the tensors of the cords, or the cords may meet in the anterior two-thirds, and fail to do so in the posterior third. This latter condition is due to paresis of the arytenoideus muscle; and occasionally, when both the thyro-arytenoidei and the arytenoideus are infiltrated and involved, the glottis has the appearance of a double ellipse, as the cords meet on phonation at one point alone, *i. e.* at the vocal processes. As a general rule it may be said that if the vocal cords are injected laryngitis must be present, and in point of fact the diagnosis of the case is usually obvious not only from the symptoms complained of but from the appearance of the interior of the larynx as above described.

Subacute Laryngitis is a milder form of the above condition. The symptoms and physical signs are not so marked; it is merely a matter of degree, but when established it may be persistent, and the condition gradually merges into the chronic variety.

Chronic Laryngitis.—In addition to this form of laryngitis being the results of a long-continued subacute attack, it may originate primarily as a chronic inflammatory process affecting the vocal cords alone, the commonest cause being improper or excessive use of the voice, as in the case of indifferent singers and speakers, clergymen, hawkers and other professional voice users. Officers in the services are particularly liable, from shouting out words of command; it is also secondary to nasal obstruction, which is a predisposing cause in almost every instance. When chronic laryngitis is once established, it is one of the most troublesome complaints to cure, for it is absolutely essential, to obtain this result, that complete rest to the voice should be secured. This is a difficult matter for some patients, as it implies cessation from their occupations for a long period, and consequently it is not unusual for chronic laryngitis to persist for years. A short time ago the writer saw a case of early commencing malignant disease of the larynx in a patient, a stockbroker, who had suffered from chronic laryngitis for ten years, and who would not or could not be induced to give his voice rest. It may be laid down as a general rule that all inflammatory diseases met with in the tongue and larynx should be dealt with energetically, and not allowed to become chronic. Unless this is impressed on the patients and the importance of this realized, results such as the above occur.

There is a form of chronic laryngitis met with in singers and those who subject their voice to constant strain termed **Pachydermia Laryngis**; briefly, a nodule forms on the cord which fits into a corresponding depression in

the opposite cord, or sometimes one cord is on a higher level than the other. The condition is important, as if the signs are not characteristic of the complaint, pachydermia may be mistaken for early malignant disease. **Chronic Hypertrophic Laryngitis**, as its name implies, is a condition where the interior of the larynx shows the result of a chronic inflammation with the deposition of tissue. In **Atrophic Laryngitis** crusts form on the cords, etc., and the condition is similar to atrophic rhinitis, and is, as a rule, associated with disease of one of the accessory sinuses.

Oedematous Laryngitis.—There is a serious form of acute laryngitis of sudden onset, associated with rapidly occurring oedema of the epiglottis and the mucous membranes of the larynx both above and below the cords. The epiglottis is often so swollen that it becomes curved on itself—so-called turban-shaped epiglottis. It can be easily seen on depressing the tongue with a spatula, and is palpable to the finger as a tumour at the base of the tongue. The symptoms to which this gives rise are obvious, and unless promptly dealt with asphyxia may result. The disease is more frequent in men than women, is caused by exposure to cold and is probably associated with septic influences.

The two severest cases seen by the writer were in medical men; one contracted the disease in the post-mortem room, the other through frequent dressings of a septic case. Cellulitis of the neck followed in each instance. This condition is indistinguishable from Ludwig's angina, which often terminates fatally. A more chronic form of oedematous laryngitis occurs in nephritis and oedema resulting from intrathoracic growth or from perichondritis, and in these cases it may be looked upon as a complication of pre-existing disease.

Perichondritis, or inflammation of the cartilaginous elements of the larynx, is seen in tuberculosis, malignant disease or syphilis, the latter being the most common; it is also met with in typhoid, and as a result of injuries such as fracture of the thyroid by direct violence and other injuries to the larynx. It occasionally follows operations on the larynx. The inflammation is deep seated and may be unilateral. The symptoms to which it gives rise are fever, dyspnoea, tenderness over the larynx, pain on deglutition and loss of voice. The arytenoids may be fixed, with resulting stridor, the cartilages may necrose and be shed, and the resulting ulceration may be so widespread and extreme that on cicatrization permanent stenosis of the air passages results with constant danger to life.

Membranous Laryngitis or Croup.—Children are liable to an acute form of laryngitis with

a deposition of false membrane from fibrinous exudation similar to that found in diphtheria. Whether diphtheria and croup are the same disease has always been a matter of controversy. There is really little doubt that the two are entirely separate diseases, for just as it is possible to have ulceration with false membrane extending from the tonsils to the palate which is not diphtheritic, so it is possible to have the same condition inside the larynx. In measles membranous laryngitis is not uncommon, and is often fatal. The disease is non-contagious, the diphtheria bacillus is never found, and it does not terminate in paralysis.

Treatment. In acute laryngitis when fever is present, the patient is better in bed or confined to a room kept to the uniform temperature of 64° F. The air should be moistened by means of a steam-kettle, a sharp purge administered and the patient forbidden to use the voice. A Rigollet's mustard-leaf (dipped in cold water, not hot) should be applied to the sternum, and a mustard foot bath given to the patient at night. The larynx itself can be treated locally in two ways, either by the use of inhalations or by means of direct applications in the form of sprays, laryngeal syringe or brush. It need hardly be pointed out that gargles in case of laryngitis are absolutely useless, for obvious reasons. So many different medicaments have been used and suggested as vapours that space will not allow them to be dealt with separately. If pain is present, and it usually is, the writer has found that a menthol vapour is best suited to the case, the usual formula being—

R Menthol gr. xxv
Spir. Vin Rectificat. ad ʒ i.

Ten to fifteen drops of this solution are added to half a pint of water at the temperature of 140° F. (boiling water must not be used), this is placed in a large cup or finger-bowl, which the patient holds in the lap while the steam is inhaled through the nose and mouth deeply into the chest for three minutes. The menthol vapour is so volatile that the inhalation should be used at once. The strength of the vapour can be regulated at will by the patient by either depressing or raising the bowl to weaken or strengthen the effects of the vapour. Another method is to place a piece of notepaper on the rim of the bowl, with a small perforation made in the centre with the finger or pencil. Vapour will then curl out of this like smoke through a chimney, and it can be dealt with by the patient at his convenience. This inhalation is too strong to enable the vapour to be inhaled by placing the mouth encircled by a towel or handkerchief on to the jug in the way usually adopted with other inhalations. Vapor benzoin

co. (ʒ i ad O i), vapor olei pini silvestris (ʒ i ad O i aquæ bullient.), which is a more stimulating inhalation and useful in the later stages, are the solutions probably most comforting to the patient. Regarding direct applications to the laryngeal mucosa, it may be said at once that applications of chloride of zinc solution forty grains to the ounce, applied after thoroughly cocainizing the larynx, will cut short an attack of acute laryngitis. The solution is a very strong one—must be used with care, and the case dealt with in quite an early stage to obtain the desired result; if this is not done, this treatment had better not be employed at all.

It is the practice of the writer to employ no direct applications to the larynx in the acute stage, with the exception of the one mentioned, and a solution of menthol in paroline (gr. vii. ad ʒ i) which is directed into the glottis (after cocainizing) by means of a metal laryngeal syringe; directly the solution enters the trachea coughing is set up, and the menthol and oil is thereby sprinkled in all directions over the respiratory tract, and great relief is derived; thirty minims of the solution is ample, and this may be repeated in four hours' time. To relieve the cough, which is harsh and troublesome, pulv. ipecac. co. gr. v to gr. x may be given with a tumbler of hot milk or a mixture containing codeina in conjunction with an acid, *e. g.*—

R Syr. Codeinæ ʒ ss
Acid Nit. dil. ℥ v
Syr. Pruni Virginiani ʒ ss
Aquam Chlorof. ad ʒ ss

every three hours.

Later, expectorants in the form of chloride of ammonium (gr. v), carbonate of ammonium (gr. iii), with ipecacuanha, paretoric, and potassium iodide (gr. iv), may be prescribed if necessary.

In the case of children where, as mentioned previously, dyspnoea may be an urgent symptom, nothing gives greater relief than an emetic, and here it may be stated that if an emetic is essential, the dose prescribed must be one which will promptly produce the desired effect. It is hardly possible to administer an overdose of an emetic such as vin. ipecacuanhæ, for it is at once rejected, and it is the practice of the writer, in dealing with children, to order ʒ ss of the vin. ipecac. (one tablespoonful), to be followed by ʒ ii of hot water. He has seen instances where ʒ ss of vin. ipecac. has been given every half-hour for three hours, and the child has never vomited at all, indeed, has been much the worse for the treatment; and mustard and water had to be administered before the desired result was attained. A tent-bed is often desirable for children, but it is unnecessary in the case of adults.

The treatment of chronic laryngitis requires care and perseverance, and unless this is done energetically the condition may persist for years. If nasal obstruction is present, this must be rectified; should granular pharyngitis exist, the granules should be cauterized or touched with chromic acid, or better, trichloroacetic acid. Astringents to the vocal cords must be applied two or three times a week, the most efficacious solutions being chloride of zinc, commencing with gr. x ad \bar{z} i and slowly increasing to gr. xx or gr. xxx ad \bar{z} i; lactic acid twenty to forty per cent., nitrate of silver gr. v ad \bar{z} i, or the patient may himself use a laryngeal spray of chloride of zinc or lactic acid, and inhale the spray from a suitable aerizer three times a day.

As has been mentioned before, no treatment for chronic laryngitis is really of any avail if the patient continues using the voice; silence is absolutely necessary, and unless this is thoroughly impressed on the patient by the physician, little importance being attached to the casual mention of it, the result is that the patient fails to improve. If the patient must speak he can do so in a whisper. The importance of this was first impressed upon the writer by Sir Felix Semon, and he has never seen reason to depart from this view. In the cases of singers, clergymen, etc., a complete rest from their vocation is imperative.

In cedematous laryngitis the patient should be in bed, a steam-kettle should moisten the air; ice can be sucked and compresses applied to the neck; intubation or tracheotomy may be necessary; or the cedematous epiglottis and arytenoids may be punctured or scarified in order to deplete the tissues and relieve tension. Spraying the larynx with adrenalin and cocaine may give temporary relief; but the reaction produced after adrenalin chloride has been injected or sprayed on to mucous membranes is always considerable.

In perichondritis, unless the case be tubercular, iodide of potassium and mercury should be promptly administered; if pus forms it must be evacuated. In cases of syphilitic origin the writer has seen cases much benefited by injections of "606" (salvarsan). The immediate danger in perichondritis is that the glottis may be occluded; stridor and dyspnoea are invariably present and the arytenoid joints may become locked, with resulting immobility of the cords. Tracheotomy is often beneficial in that it allows the infiltrated parts rest; the benefit of this may accrue in forty-eight hours, and the tube may then be removed. Syphilitic perichondritis invariably terminates in some stenosis of the larynx, and this may be extreme when ulceration has occurred with resulting cicatrices.

In dealing with a case of croup which, as has

been pointed out above, is clinically often indistinguishable from diphtheria, it is better to run no risk and give an injection of diphtheria antitoxin at once. This has often been the means of saving a child's life. It must be remembered that both in croup and diphtheria an examination of the larynx may be made at a time when no membrane is yet present, or it may have been coughed up and not had time to re-form. By the time a report has been received of the bacteriology of the organisms found, many hours will have been lost, if a diagnosis of membranous laryngitis has been made in error. The practice should be to take a culture and give the antitoxin until the diagnosis of diphtheria has been excluded. Intubation, which seems to have fallen into comparative disuse in this country, is still much practised in these cases in America and on the Continent, and provided that suitable help is at hand to replace the tube in case it be coughed up, it is safer for the child than to open the trachea. If membrane has formed in the trachea producing urgent dyspnoea, a low tracheotomy should be performed.

An emetic at the onset, stimulants, ammonia and bark, are called for, and later a mixture such as—

R Ammon. Carb. gr. i
Tinct. Cinchonæ Co. ℥ xv
Tinct. Nucis Vom. ℥ i
Syr. Tolutan \bar{z} ss
Aquam Cinnamoni ad \bar{z} ii

may be administered to the child every three hours.
H. J. D.

GRANULOMATA OF THE LARYNX

Syphilis.—Congenital Syphilis shows itself in the larynx in the first few months of life in the form of the milder secondary manifestations, and remains quiescent from the end of the first year until the time of the second dentition or of puberty, when lesions of the tertiary type are apt to appear. Rarely, however, severe forms occur in infancy and may produce stenosis; dysphagia is uncommon in young children.

Acquired Syphilis in the larynx cannot be definitely classified into secondary and tertiary forms, although, as a general rule, the more superficial lesions occur early, while deep ulceration and definite gummata are late manifestations. The earlier lesions cause but slight symptoms and probably often pass unobserved. *Erythema* is a frequent early manifestation, and may be distinguished from simple catarrh by its dusky colour and patchy distribution. *Condylomata* occur as flat grey patches surrounded by a marked zone of hyperæmia, which is highly suggestive; these early lesions generally show signs of having spread from the

fauces, and therefore frequently attack the lingual surface of the epiglottis, but they may be seen on any part of the larynx. *Diffuse infiltration* causes a dusky red tumefaction, which may break down with the formation of superficial ulcers; any part of the larynx may be affected, but, on the whole, syphilis, in contradistinction to tuberculosis, attacks the anterior parts, the epiglottis, especially its lingual aspect, and the anterior half of the glottis. *Gumma* is somewhat rare, attacks the lateral wall, epiglottis or arytenoid region, and is usually associated with diffuse infiltration; it forms a single, asymmetrical, solid, round red mass, which tends to break down rapidly. The *superficial ulcer* has a smooth, flat base and a sharply-cut margin surrounded by a well-marked zone of hyperæmia. The *deep ulcer* results from disintegration of a gumma and has a thick, solid base, covered by greyish-yellow necrotic tissue, and a sharply-defined edge. *Sprouting granulations* and *papillary outgrowths* may also be seen, and *perichondritis*, with subsequent *necrosis* of cartilage, is an occasional complication of severe cases. There is a tendency to the formation of dense *cicatrices*, of which the most characteristic results are deformity of the epiglottis and stenosis in the region of the glottis, especially at the anterior commissure.

Of *symptoms*, *hoarseness* is the most common, and the typical raucous voice is highly characteristic. *Dyspnœa* results from gummatous infiltration, from fixation of the cords, and, most often, from the contraction of *cicatrices*. *Dysphagia* is less marked than in similar lesions due to cancer or tuberculosis, but at times a gumma at the upper aperture causes extreme pain on deglutition.

The *diagnosis* is aided by certain general characters; the firm, dusky appearance, the predilection for the anterior half of the larynx, the raucous voice, the signs of syphilis or scars elsewhere, particularly on the fauces, the tendency to scarring and, in early lesions, the indolent swelling of the cervical glands.

Tuberculous infiltration, on the contrary, is in general pale and semi-translucent and affects principally the posterior regions of the larynx; at the upper aperture it is smooth, regular and symmetrical, while syphilitic lesions are nodular and irregular. Tuberculous ulcers are superficial and ill-defined, with pale, granulating base and no hyperæmic margin. The voice of tuberculous laryngitis is weak and effortless, with a marked tendency to aphonia.

Epithelioma does not appear or break down so quickly as a gumma, and an epitheliomatous ulcer has thick, everted edges and a bossy and nodular base; secondary involvement of the cervical glands may also be present. In doubt-

ful cases iodide of potassium should be given in large doses, but it must be remembered that the symptoms of cancer are often temporarily improved by this drug.

The *treatment* is that of syphilis elsewhere; in the tertiary forms both mercury and iodides should be administered. Severe cases call for the promptest treatment, for if a large gumma break down, or if perichondritis ensue, a dangerous and intractable stenosis will result. The author has had good results in such cases from the intramuscular injection of a soluble salt of mercury, of which the following is efficient and relatively painless: mercuric benzoate 1, sodium benzoate 2½, sodium chloride ½, water to 100 parts, in doses of 30 to 50 minims every other day; intravenous injection of salvarsan is now, however, to be preferred. Beyond careful attention to oral hygiene, local treatment is rarely necessary. Cicatricial stenosis calls for tracheotomy and subsequent dilatation when all signs of active disease have disappeared.

Tuberculosis.—In the larynx tuberculosis is nearly always the result of infection conveyed from the sputum through the laryngeal mucosa. There are a few proved cases on record of primary laryngeal disease, and a few more where infection has occurred from some such lesion as otitis media, but the vast majority of cases are secondary to pulmonary phthisis. The infection most often takes place near the vocal process, and thence slowly invades the rest of the larynx; the cartilage is very near the surface at this point and is frequently involved, a deep triangular ulcer on the inner face of the arytenoid is in consequence a common lesion. The affection invades the cords from behind forwards, so that the posterior parts are the more frequently and severely affected; the disease takes the form of a granular infiltration or of ulceration, the latter often extending in a linear form along the free margin of the cord, exposing its fibres and producing an appearance of cleavage. Sprouting granulations are common in the posterior commissure, and are soft in appearance, irregular and asymmetrical. The upper aperture is rarely invaded until the lumen has been extensively affected; the arytenoids are first attacked, and the infiltration extends thence along the aryteno-epiglottic folds to the epiglottis. As the arytenoid sub-mucous tissue is plentiful, the infiltration usually attains massive proportions without causing ulceration, and thus produces the typical symmetrical flask-shaped swellings of pale colour and semi-translucent appearance. The epiglottis is converted into a round sausage-shaped swelling, but ulceration occurs sooner here and begins on the laryngeal aspect. There is a chronic form of laryngeal tuberculosis, associated with very chronic pulmonary disease,

which the writer describes as "lupoid," in which the epiglottis is attacked first and is slowly eaten away by a nodular infiltration and ulceration, and in which pain, usually so severe in epiglottic tuberculosis, is conspicuous by its absence. With the exception of this form, infiltration of the upper aperture is of more serious import than disease of the laryngeal lumen, for the actual amount of tuberculous tissue is far greater and, by reason of its situation, it causes the dysphagia which so rapidly reduces the patient's strength.

Symptoms.—*Hoarseness* occurs early and is of a characteristic kind, the voice being weak and effortless, with a marked tendency to aphonia. *Difficulty in swallowing* is of three kinds: from pain, obstruction and entrance of food into the larynx. The last occurs in advanced disease, when the upper aperture is rigid from infiltration; true obstruction is rare, but painful deglutition is only too common, and in arytenoid disease is often most marked when swallowing fluids. Obstructive *dyspnoea*, though rare, occurs occasionally from excessive infiltration at the upper aperture.

Diagnosis.—Signs of pulmonary disease are important, but tuberculous laryngitis must not be diagnosed in every phthisical patient who is hoarse. The writer has seen a number of syphilitic lesions in the larynxes of consumptive patients, and such persons are peculiarly liable to simple laryngeal catarrh and to functional aphonia. Characteristic of tuberculous disease are the soft, translucent appearance of the infiltration, the pale, ill-defined margins of the ulceration, the predilection for the posterior half of the larynx, and the weak aphonic voice. The appearance of any granular infiltration or ulceration, or the unilateral affection of one cord, will serve to distinguish the disease from simple catarrh. It is not strictly true that pallor is characteristic, for though many lesions, especially on the arytenoids, are pale, others are deeply congested, and pallor of the fauces and unaffected parts of the larynx depends entirely on the degree of general anæmia.

Treatment.—Above all it must be remembered that tuberculous laryngitis is but a complication of pulmonary phthisis. Open-air treatment is of the greatest value in the treatment of the throat lesion, but dusty and windy climates are unsuitable, and cases with advanced laryngeal disease should not be sent to the high-level resorts of Switzerland. Complete silence over a period of months is often very helpful, but is a depressing measure which should not be insisted on in hopeless cases.

Local treatment is both active and palliative; the former must only be undertaken when there is a good hope of producing arrest or marked improvement, or with the definite object of

relieving dysphagia. Active measures consist in the rubbing-in of pigments, such as lactic acid,¹ for superficial lesions, the galvano-cautery for localised disease, the curette for sprouting granulations and interarytenoid ulceration, and the punch-forceps to remove massive infiltration at the upper aperture. It is in deciding on the advisability of such treatment that the greatest difficulty and need of experience is encountered, and before instituting such measures the progress of the patient, his temperature and weight over a period of several weeks, should be observed; it need only be said here that, in suitable cases, great improvement can be obtained and complete local healing is not uncommon. Of palliative measures steam-inhalations containing Friar's balsam and oily solutions of menthol in a nebulizer are helpful. When dysphagia is present a bland and unirritating diet is essential; soft solids are better borne than fluids. The latter can often be gulped when they cannot be sipped, and a good method is for the patient to lie prone and suck his drink through a straw from a vessel held below the level of his head; when fluid enters the larynx, he should lie on his back with the head extended and take the fluid through a rubber tube or from an infant's bottle. Of local anodynes, cocaine and morphia are of little use, and should at least be reserved to the last; the latter may then be necessary as a hypodermic injection. Orthoform and anæsthesin are the most valuable local anodynes, and may be used separately or together; they are non-toxic insoluble powders and are given as an insufflation a quarter of an hour before food; the patient can readily learn to draw the powder into his larynx through a glass tube. When dysphagia is extreme, the greatest and most speedy relief is afforded by removal of a small portion of the infiltrated arytenoid with punch-forceps, or by excision of the epiglottis if this be the source of the pain. This small operation can be very rapidly performed under cocaine, produces instant relief, reduces the swelling and, in the writer's experience, never aggravates the disease. The injection of eighty per cent. alcohol into the superior laryngeal nerve at the side of the thyro-hyoid space has lately been employed with good, though not permanent, relief of the pain.

Lupus.—Lupus of the larynx, usually associated with lupus of the nares and fauces, is a not uncommon accompaniment of the cutaneous disease. It attacks the epiglottis first and spreads thence into the laryngeal lumen. It appears in the form of a firm brownish-red or pink nodular infiltration and a slow serpiginous ulceration which, on healing, leaves a dense

¹ The writer prefers the following mixture, recommended by Lake: Lactic acid 50, phenol 10, formalin 7, water to 100 parts.

scar-tissue liable, in severe cases, to produce stenosis. It doubtless often passes unobserved, as *symptoms* are remarkably absent; there is no pain, hoarseness is only present when the neighbourhood of the cords is affected, and dyspnoea only as the result of severe cicatricial contraction.

The disease tends to improve under general constitutional *treatment*, an open-air régime, cod-liver oil and, especially, arsenic in full doses. Local measures may well be withheld while improvement is continuing under these measures. The galvano-cautery is of great value in the treatment of any localised patches which remain, and frictions with lactic acid, as above, are to be recommended for the treatment of more extensive disease. H. B.

TUMOURS OF THE LARYNX

Innocent Tumours.—The common innocent tumour of the larynx is inflammatory in nature and the result of irritation. It grows on the centre of the true vocal cord, that is, at the junction of the anterior and middle thirds of the glottis, for the posterior third of the glottis is formed by the arytenoid cartilages. The smallest growth found in this situation is the so-called "singer's nodule," which is formed by a heaping-up of the epithelium and subepithelial tissues, and may be classified either among tumours or as a form of pachydermia laryngis. There is no doubt that the other innocent neoplasms occurring at the centre of the vocal cord are, in the majority of cases, merely further developments of this simple inflammatory nodule. If the growth be chiefly in the subepithelial tissue, a *fibroma* results, and may by degeneration become a *cyst* or a *myxoma*, while a *papilloma* is caused by an increase of the epithelial cells with but a scanty growth of connective tissue. All benign laryngeal tumours, however, are not caused in this way, for some occur in early infancy and some on parts of the larynx not apparently subject to irritation. The etiology of these is obscure; some, especially those found at the anterior commissure, may be formed in developmental remnants.

Singer's Nodules occur on the cords of those whose occupation involves prolonged use of the voice. In spite of their name, they are seldom found in well-trained singers, for they are due to faulty production, rather than to over-use of the voice, and are especially common in female school-teachers. The ordinary causes of laryngitis are additional factors, especially nasal obstruction, which interferes with correct voice-production, while the chalk from the blackboard is a predisposing cause in teachers. The laryngoscope shows a tiny swelling, either

pink in colour or standing out white against the reddened vocal cord, for some degree of laryngitis is usually present; on the opposite cord there may be a similar nodule, or merely an area of injection. The growth occurs on the middle of the cord because this is the site of the maximum vibration, and therefore of the greatest irritation, should swelling of the cords bring them into contact during phonation. Similar nodules, symmetrically placed on each cord, are, as a rarity, found in young children; they are probably developmental in origin, and tend to disappear as the child grows older.

Multiple papillomata, rare in adults, are an important affection of childhood; they grow on any part of the larynx, may fill the lumen with a cauliflower-like mass of growth, extend to the subglottic region, and even invade the trachea. These growths usually come under observation between the ages of twelve months and five years, and tend to recur persistently after removal; this tendency, however, varies much in different cases, diminishes as the child grows older, and usually disappears at puberty.

Angeliomata occur, as a rarity, in the form of a flat nævous patch or a raised purple tumour on the vocal cords or on any part of the larynx.

Cysts are also uncommon in the larynx; the larger ones usually occupy the edge or lingual surface of the epiglottis; as already mentioned, the small growths on the centre of a vocal cord are sometimes found to be cystic.

Symptoms.—The only common effect of these benign laryngeal neoplasms is a disturbance of the voice ranging from slight huskiness to complete aphonia, according to the size and position of the growth; a tumour situated well away from the glottis need cause no symptom whatever. Dyspnoea ensues if the growths are so large as to obstruct the air-way, but is often remarkably slight if the growth of the tumour has been slow; it is a frequent and serious symptom of multiple papillomata of children, and is then subject to exacerbations due to spasm of the cords. Angeliomata are apt to bleed, and may, indeed, be the source of serious hæmorrhage.

The **diagnosis** is usually easy on inspection, but it should be remembered that a small growth near the anterior commissure is easily overlooked. Inspection of the larynx is difficult in young children, but is nearly always possible if the child be rolled in a blanket and firmly held in the nurse's lap while the tongue is controlled by Escat's epiglottis-tractor. The little globule of mucus which often appears at the centre of the cord during phonation in cases of laryngitis may be mistaken for a nodule, but it disappears after coughing. The outgrowths of tuberculous or syphilitic laryngitis are nearly always accompanied by infiltration of other parts of

the larynx and signs of the disease elsewhere; but the rare tuberculoma may exactly imitate a simple tumour of the cord, and can only be distinguished by the microscope, which should therefore always be employed to examine these growths after their removal. The diagnosis from malignant tumours is discussed under that heading.

Treatment.—Tumours situated away from the glottis and causing no symptoms may well be left untouched. Angeliomata also should be left alone; if hæmorrhage occur the bleeding point should be touched with the cautery; wide removal by thyrotomy is indicated by severe and repeated hæmorrhage. Cysts on the upper aperture are treated by making a large hole in the wall with punch-forceps or cautery, for simple incision is of no avail.

Singer's nodules and tiny tumours on the vocal cords will often disappear after the removal of every source of irritation. Absolute silence is the first essential, and may have to be maintained for several months. With a view to preventing recurrence, careful attention should be paid to correct production of the voice and to the treatment of any nasal obstruction or discharge. Dust is harmful, and black-board chalk must be avoided by the substitution of a damp sponge for the usual dry duster.

Larger growths and those which fail to disappear under this treatment call for removal. The smallest sessile singer's nodules are best treated with the galvano-cautery; it must be applied very lightly, with a fine point, lest too much be done and a depression result. Other tumours are removed with forceps, which should have sharp cup-shaped ends to work cleanly without tearing. Two methods are now in use: the indirect, by which the forceps are guided by the laryngoscopic mirror, and the direct, by which a direct view is obtained through a straight, electrically-illuminated tube passed into the larynx. The former is still the best method for ordinary cases, as it involves less discomfort to the patient and is equally safe in expert hands; the latter is useful in difficult cases, for subglottic growths, in very nervous patients for whom general anaesthesia is required, and is invaluable for the removal of multiple papillomata in children. The direct method has revolutionized the treatment of these difficult cases, for the growths can now be removed from the youngest child under general anaesthesia in the recumbent position and with the minimum of danger. Thyrotomy is unjustifiable in these cases, but when dyspnoea is severe a preliminary tracheotomy is advisable and often urgently required. The internal administration of calcined magnesia (MgO) has been followed by the gradual disappearance of these multiple papillomata, and is worthy of

trial; a suitable dose for a child of six years is twenty-five grains three times a day.

The **after-treatment** of growths on the vocal cord is conducted on the lines described under the non-operative treatment of small nodules. Absolute silence should be maintained for two or three weeks, or for longer if thickening or congestion persist. Improper voice-production, nasal obstruction and any other possible sources of irritation must be excluded. Any small recurrence may be treated with the galvano-cautery or by daily application of a chemical caustic, of which perhaps the best is a solution of salicylic acid in ninety per cent. alcohol, increasing the strength gradually from one to six or eight per cent.

Malignant Tumours.—Malignant disease affects the larynx as a primary growth or by extension from neighbouring parts; metastatic growths do not occur. Spheroidal-cell carcinoma and sarcoma are both extremely rare; epithelioma is the only common form of malignant neoplasm in this organ. Laryngeal cancer is usually classified, according to its situation, into *intrinsic* and *extrinsic*. Intrinsic cancers are those which occur within the cavity of the larynx, on the vocal cords, ventricular bands, ventricles, posterior commissure and subglottic region; the extrinsic tumours attack parts of the upper aperture, such as the epiglottis and the outer surface of the laryngeal walls; a frequent site is on the back of the cricoid plate. The intrinsic growths are the less unfavourable, for they grow more slowly, invade the lymphatic glands comparatively late, and are more easily removed; this is especially true of epithelioma of the vocal cord.

Symptoms.—The *only* early symptom is hoarseness. This cannot be too frequently repeated, for failure to realize this fact has too often meant fatal delay in inspection of the larynx and diagnosis. The impairment of the voice is very great in proportion to the size of the tumour; this is due to the involvement of the deeper structures by the growth and is of importance in diagnosis. Pain is a late symptom and occurs spontaneously, but is worse on swallowing or speaking. Other symptoms are obstruction to swallowing, obstructive dyspnoea, salivation, fœtor and general cachexia.

Diagnosis.—From the first a malignant tumour grows into and involves the deeper structures, and this gives it its distinctive characters. Thus a malignant growth is not completely pedunculated, it is always somewhat fixed, there is often an area of tumefaction beyond the obvious limits of the tumour, and there is, even at the earliest stage, a sluggish, delayed movement of the cord which is highly characteristic. An innocent tumour, on the other hand, is pedunculated and freely movable

on phonation or on manipulation with a probe. The situation of a tumour on the posterior half of the glottis is suggestive of malignancy. A form of tuberculous infiltration sometimes occurs in elderly men, limited to one cord, which very closely resembles an early epithelioma, more especially when examination of the chest only reveals bronchitis. Syphilis also sometimes closely imitates malignant disease, and in all doubtful cases a careful examination should be made for signs of tuberculosis and syphilis. With reference to the removal of a portion for microscopical examination, two cautions are necessary; it should only be done when the patient has consented to radical treatment, for the traumatism may cause increased rapidity of growth, and too much reliance must not be placed on a negative report, for the apex of an epitheliomatous outgrowth may closely resemble an innocent papilloma.

Treatment.—Internal operations are incomplete and unjustifiable in the treatment of malignant disease of the larynx. Early intrinsic growths are removed by thyrotomy, and the results as regards recurrence are relatively good. For the removal of more extensive tumours, excision of one half of the larynx or complete laryngectomy is necessary. The latter is the safer operation, for the trachea can be stitched to the skin of the neck and the pulmonary tract thus shut off from the wound. The indications for the treatment of inoperable cases are to keep the parts clean and to combat dysphagia. For the former, frequent spraying with antiseptic solutions, of which two to five per cent. resorcin in water is very useful. For the latter, orthoform and anæsthesin are the most valuable anodynes in our possession; they are given by insufflation and may be used separately or together, or combined with an antiseptic dusting powder such as iodol or amyloform. Cocaine has too fleeting an action to be of great use and should be kept to the late stage; morphine may be used as an insufflation in doses of one-quarter to one-half grain diluted with bismuth, and in the later stages should be given hypodermically half-an-hour before meals. In certain cases curetting of an ulcer will relieve pain and lessen fœtor. Dyspnoea is an indication for tracheotomy, and extension to the pharynx sometimes renders gastrostomy advisable.

H. B.

NEUROSES OF THE LARYNX

Laryngeal Paralysis

The larynx is an organ having two more or less antagonistic functions, phonation and respiration, the former being served by the

adductor and the latter by the abductor muscles. Of the two, phonation is the more recently acquired and, being directly controlled by the will, has a well-marked cortical centre on each side of the brain, stimulation of either of these causing adduction of both vocal cords. On the other hand, the respiratory function is older, more vital and less under conscious control, and can be maintained in dogs after ablation of both cerebral hemispheres. In accordance with this, functional disturbances always produce paralysis of the adductors, while organic lesions first paralyse the abductor muscles. No unilateral lesion above the bulb can paralyse the cords, for they are controlled from both cerebral hemispheres, and as a matter of clinical experience the larynx is not paralysed in cases of hemiplegia. Finally, a paralysis of the adductor muscles, leaving the abductors intact, being a functional disturbance and not the result of organic disease, should be clearly distinguished from organic paralysis due to pathological lesions of the nerve-tract.

Organic Paralysis.—The only muscle supplied by the superior laryngeal nerve is the crico-thyroideus, the function of which is to assist in making the corresponding cord tense during phonation; if it fails the cord becomes slack and wavy, but isolated paralysis of this muscle is excessively rare, though it may result from surgical injury, cut throat, pressure of a tumour, or from post-diphtheritic neuritis. In such cases it is associated with anæsthesia of the corresponding half of the larynx.

The common form of organic paralysis affects the other muscles, which are all supplied by the recurrent laryngeal nerve. One pair of muscles, the crico-arytenoidei postici, act as abductors of the vocal cords; the crico-arytenoidei laterales and the arytenoideus are adductors, while the thyro-arytenoidei are tensors of the cords during phonation.

In the healthy larynx the edges of the cords on phonation are straight, parallel and almost in contact; on deep inspiration they are widely abducted. During quiet breathing there is little movement, and the width of the glottis, about 13·5 mm. in the adult man, is maintained by a tonic action of the abductors, for the "cadaveric position" assumed after death or complete paralysis is much narrower and only averages 5 mm. In any gradually progressive lesion of the nerve-path the muscles become paralysed in a certain definite order, the enunciation of which is known as "Semon's law." The abductor fails first and may be for an indefinite time the only muscle affected; then the thyro-arytenoideus becomes paralysed and finally the crico-arytenoideus lateralis.

When **Abductor Paralysis** has occurred the affected cord lies in the middle line. During

phonation the sound cord is adducted to meet it and the larynx appears normal; but on inspiration the paralysed arytenoid remains motionless, while the sound one is drawn outwards and backwards behind the level of its fellow, so that the paralysed cord appears the shorter.

There is no alteration of the voice; as the

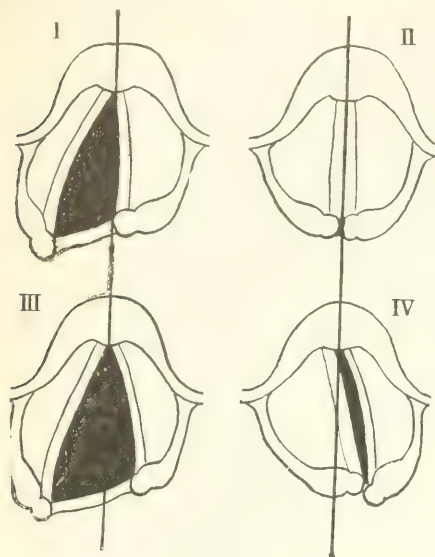


FIG. 1.

- I. Left abductor paralysis: inspiration.
- II. Left abductor paralysis: phonation.
- III. Left total recurrent paralysis: inspiration.
- IV. Left total recurrent paralysis: phonation.

Paralyses of the recurrent laryngeal nerve. (From the *Lancet*, June 3, 1905.)

maximum available aperture is reduced by half, there will be some dyspnoea on exertion, but there is no obstruction to quiet breathing except in children. Unilateral abductor paralysis, therefore, causes no obvious symptoms and can be detected *only by inspection*.

When the thyro-arytenoideus muscle fails the edge of the cord is no longer straight on phonation, and the cord itself appears rounder and narrower. The voice now becomes husky and may possess a peculiar "diphonic" character in which two distinct tones can be detected.

Finally, when total **Recurrent Paralysis** has occurred, the cord assumes the "cadaveric" position somewhere between the middle line and the normal position of rest. On phonation the sound arytenoid crosses the middle line and pushes the paralysed cartilage aside; this helps to distinguish true paralysis from fixation, with the reservation that the paralysed cartilage sometimes becomes fixed when the affection is of very long standing. The paralysed arytenoid sometimes drops forwards, exposing its broad

posterior surface to view and producing a peculiar appearance which may be mistaken for a tumefaction.

In cases of **Bilateral Abductor Paralysis** dyspnoea is a marked symptom; it is inspiratory, accompanied by stridor, and subject to severe paroxysmal exacerbations, which may occur at any time, even during sleep. For this reason a precautionary tracheotomy should be performed and a fenestrated tube inserted, provided with a plug which can be quickly removed when dyspnoea becomes urgent, and which should always be taken out before sleep. The voice is quite good, but breathless. If the case progresses to a complete recurrent paralysis, the severe dyspnoea passes off, but aphonia results and both cords lie motionless in the cadaveric position.

Etiology. A knowledge of the causation of these paralyses is important, for paralysis of a vocal cord is a valuable diagnostic physical sign in general medicine. The lesion may be situated (1) in the medulla, (2) at the base of the skull, (3) in the vagus, or (4) in the recurrent laryngeal nerve. In cases of paralysis from intracranial disease neighbouring nuclei or nerves are liable to be involved; thus paralysis of the same side of the palate, or persistent frequency of the pulse, points to involvement of other vagal neurons, and the rare association of paralysis of the cord, palate, sterno-mastoid and trapezius is due to a lesion of the bulbar and spinal-accessory roots.

Of *central* causes, tabes dorsalis is the most frequent, and is so common that it should be thought of first in cases of uncertain origin; other laryngeal neuroses also occur in tabes, spasm or the so-called "laryngeal crisis," anæsthesia and paræsthesia. The paralysis may be unilateral or bilateral, and may occur at a very early stage of the disease. Paralysis also occurs in general paralysis, syphilitic nuclear disease, gummata at the base of the brain and pachymeningitis; in these latter the oculo-motor muscles are often involved. In bulbar paralysis laryngeal palsy is the rule, but generally occurs late.

Peripheral causes include neuritis, especially from diphtheria, less often from other infective fevers, and from lead, arsenic and alcohol. One may mention here the "myopathic" palsies, where the posticus muscle has been injured by an œsophageal bougie or foreign body, or involved in a cancerous or other infiltration. Peripheral paralyses are, however, usually due to compression, most frequently of the recurrent laryngeal nerve; the commonest causes are (1) aneurysm, (2) enlarged glands and (3) cancer of the œsophagus. Rarer causes are mediastinal growths, pulmonary tubercle at the apex of the right lung, a rapidly growing goitre which need

not be malignant, cancer of the lung, pleurisy and massive pericardial effusion. The left cord is naturally by far the most frequently affected; bilateral palsies are most often due to nuclear disease, when the cause is peripheral it is usually oesophageal cancer or goitre.

The *prognosis* depends on the cause and is usually serious, but not necessarily, for paralysis may be due to some such trivial lesion as a fibrosed bronchial gland.

Functional Paralysis.—Paralysis of the phonatory function, that is of the adductor muscles, is a common manifestation of hysteria; in such cases the paralysis is often very complete, the onset and recovery sudden, and there may even be inability to whisper; often the cough is not aphonic. It should, however, be clearly borne in mind that the majority of cases are not hysterical; anything which adds to the effort of phonation, such as laryngeal catarrh or constitutional debility, predisposes to this affection, which is characteristic rather of "loss of tone" than of hysteria. An anæmic woman loses her voice with every trivial catarrh, whilst a navvy can still phonate although suffering from far more serious laryngeal disease; and the weak aphonic

crico-arytenoidei laterales and the arytenoideus, may be affected separately or all together; the arytenoideus may escape, or the thyro-arytenoidei alone be paralysed; the arytenoideus is seldom affected alone.

Treatment. Attention must be paid to the general health, and to the nervous system in hysterical cases; laryngitis must be appropriately treated, together with any concomitant pharyngitis, and especially nasal obstruction. Particular attention must be given to correct voice production and to the action of the respiratory muscles, as many of these patients try to phonate with the chest emptied of air; a few good lessons in production of the voice are of lasting value. Any local stimulation of the larynx will usually restore the voice for a time; but such measures alone have generally but a temporary effect, and the larynx soon becomes tolerant of and irresponsive to them. Of local applications chloride of zinc, twenty grains to the ounce, the faradic current externally across the larynx, or with one electrode applied internally to the cords, form a series of increasing potency. Suggestion should be made use of, the patient being assured that the application will restore the voice, and being made to count aloud on a full inspiration immediately after the application.

Spasmodic Affections

Glottic Spasm is most often the result of:

(1) local irritation, by foreign bodies, instrumentation, neoplasms or inflammatory conditions; (2) irritation of the recurrent laryngeal nerves by any of the causes which produce paralysis, especially by aneurysm; (3) central nervous disease, especially tabes dorsalis, and (4) hysteria, or neuroses associated with sexual disturbances. Children are particularly liable to spasm as the result of any local inflammation (*laryngitis stridula*). In the acute form the attack begins with a series of short stridulous inspirations, which may be followed by complete closure of the glottis and all the signs of asphyxia, and often ends with a loud crowing inspiration. There is also a more chronic form, with inspiratory stridor continual except during sleep or brought on by any exertion or the drinking of cold fluids.

Treatment. The exciting cause must be found and treated, when possible; all sources of irritation must be avoided. The attacks may be aborted or mitigated by the inhalation of amyl nitrite or chloroform, and the hysterical cases by strong smelling-salts or the free use of cold water to the head and face. In the persistent and chronic forms, bromides and chloral are useful; ipecacuanha to the point of nausea will usually allay the spasm, and is particularly valuable in children.

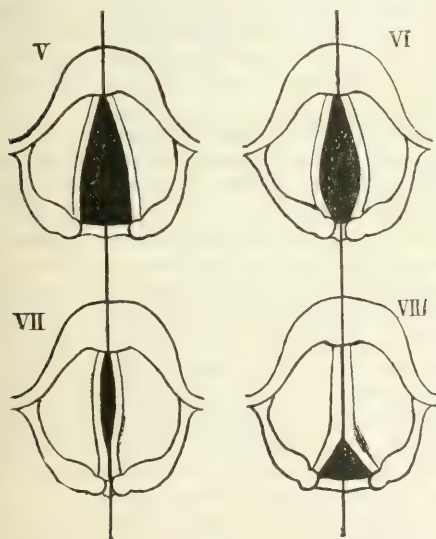


FIG. 2.

V. Paresis of all the adductors.

VI. Arytenoideus unaffected.

VII. Paresis of the thyro-arytenoideus.

VIII. Paralysis of the arytenoideus only.

All during attempted phonation. Functional paralyses. (From the *Lancet*, June 3, 1905.)

speech of a consumptive patient is in marked contrast to the raucous voice of the syphilitic.

The paralysis is always bilateral and is rarely complete, usually amounting only to an imperfect apposition of the cords. The three sets of adductor muscles, the thyro-arytenoidei, the

Laryngismus Stridulus is a spasmodic affection occurring in ill-nourished and usually rickety children, between the ages of six months and two years. The predisposing cause is an increased excitability of the nervous system, and the exciting cause of the reflex comes from the pharynx, especially from the presence of adenoid vegetations, or from the alimentary tract. The attack, which is similar to the glottic spasm already described, usually occurs at night, the child waking in a struggle for breath. Marked attacks last from thirty seconds to two minutes and are accompanied by cyanosis and convulsions, but slight attacks, called "passion-fits" or "holding the breath" by nurses, are not uncommon.

Treatment consists in attention to the general health and diet, and particularly in the removal of adenoids; change of air, especially to a higher level, is beneficial. The attack itself is treated by cold water to the face, stimulation of the nasal mucosa or conjunctiva or, best, by hooking the epiglottis forward with the finger.

Nervous Cough, or the "barking cough of puberty" is a neurosis, allied to a "tic convulsif," which affects adolescents; the characteristic cough is loud, single, persistent, without expectoration and ceases during sleep and when the attention is distracted. A very similar cough is due to reflex irritation, which may have its source in the ear, the nose or any part of the respiratory tract, the intestinal tract or even in the bladder.

Dysphonia Spastica, or **Phonic Spasm**, is an occupation neurosis allied to writer's cramp. On attempting to speak the cords come into contact, no air passes through the glottis and no sound is emitted. The adduction usually ceases on desisting from the attempt, but sometimes an attack of glottic spasm ensues.

Ictus Laryngis, or **Laryngeal Vertigo**, is a rare affection; it begins with a cough followed by glottic spasm and loss of consciousness, which is regained in a few seconds without confusion or stupor. The unconsciousness is probably due to forcible expiration against the resistance of the closed glottis.

Sensory Neuroses

Anæsthesia may affect the entire larynx or one half or region of it. Of peripheral causes the most common is the neuritis of diphtheria; it may be due to injury of the superior laryngeal nerve, to tabes dorsalis, general paralysis, bulbar paralysis, disseminated sclerosis, and gummata and tumours at the base of the brain, and is often associated with paralysis of the muscles. The diagnosis is readily made with a probe, but slight and partial cases are doubtless often overlooked. As a result of the loss

of sensation food tends to enter the larynx and is liable to produce pneumonia. The principal point of treatment is careful feeding; food must be swallowed slowly and, in unilateral cases, while reclining on the sound side. Cases of complete anæsthesia must be fed through a tube, and, as this may readily enter the glottis, the patient should always be instructed to phonate before the food is introduced.

Hyperæsthesia and **Paræsthesia**, consisting in a feeling of a lump, constriction, tickling or pricking, are not uncommon in neurotic persons. Perverted sensations also occur in tabes, hyperæsthesia is common in gouty subjects, and painful sensations referred to the larynx are a frequent early manifestation of pulmonary tuberculosis; flatulent dyspepsia is often associated with paræsthesia of the throat. The fear of cancer is frequently present, and the patient should be reassured; general tonic treatment and change is indicated, but it is not advisable to direct attention to the throat by local measures, while above all things the use of cocaine must be avoided. H. B.

LARYNGEAL STENOSIS

Laryngeal obstruction may be (1) congenital or (2) acute in onset, due to acute primary disease or injury, or (3) it may come on gradually as the result of chronic morbid processes.

1. **Congenital Webs and Adhesions** of the vocal cords occur in their anterior half or third and are very exceptional. Obstruction with stridor due to laxity of the walls of the laryngeal vestibule with indrawing during inspiration, though uncommon, is, according to Lees, less rare as a congenital malady than is generally admitted. Congenital papillomata have been recorded. More or less persistent stridor in infants is usually due to one or other of these conditions, and the diagnosis can be made with certainty under chloroform by means of a direct-vision endoscope, which enables one to differentiate between genuine laryngeal obstruction and thymic pressure on the trachea.

2. **Acute Laryngeal Stenosis** may be of the *intermittent* type, as exemplified by the nocturnal laryngismus of infants [with subglottic swelling and hypersecretion] and the occasional laryngeal spasm (laryngeal vertigo) of adults. In most instances, however, acute laryngeal stenosis is of sudden onset associated with tumefaction rather than spasm, and is so marked and *continuous* as to call urgently for surgical relief. The commonest form of oedematous obstruction of the larynx is that due to diphtheria. It is true that false membrane is also present, but the accompanying oedema, both supraglottic and subglottic, is the essential

feature in the production of the obstruction, with its accompanying inspiratory stridor. Laryngeal cedema may also be due to acute malignant inflammation of the throat of an erysipelatous character or a complication of various specific fevers, *e. g.* typhoid, smallpox, scarlatina, etc. In addition to inflammatory tumefaction of the soft structures, acute perichondritis and chondritis of the cartilages, and inflammation with subsequent fixation of the crico-arytenoid joint, may be superadded. Marked cedema may exceptionally be present in an uncomplicated acute laryngitis, such as is induced by a severe chill.

Acute inflammatory obstruction is occasionally of traumatic origin, following intralaryngeal operations of various kinds performed *per vias naturales*; this rarely happens after skilfully performed operations in adults, but may be unpreventable in the young, and on this account the writer as a general rule employs temporary intubation after removing papillomata in children. It may also follow endoscopic procedures such as per-oral bronchoscopy, if prolonged. Traumatic stricture following intubation or a badly performed tracheotomy is usually a delayed complication. Finally scalds and impacted foreign bodies may give rise to sudden obstruction.

3. Chronic Laryngeal Stenosis.—In children the majority of cases of stenosis of gradual onset are due to trauma, *i. e.* they are subsequent either to a badly performed, too high tracheotomy which has included an unintentional laryngotomy, a long retained and ill-fitting cannula and want of cleanliness, to injudicious intubation, or to intralaryngeal operations. In adults most cases are due either to syphilis, lupus, new growths (benign and malignant) or to double abductor paralysis. In addition we may have to deal with obstruction due to trauma (adhesions and webs), acute and subacute tuberculosis, leprosy, scleroma, the sequelæ of perichondritis and the subglottic hyperplasia following the acute laryngitis of specific fevers.

The *symptoms* of laryngeal obstruction calling for surgical interference are always evident enough, for not only is there dyspnoea and embarrassed respiration, which can be seen, but the accompanying inspiratory stridor, when once heard, will scarcely be confused with the stridor of tracheal stenosis or with the expiratory stridor of either paroxysmal or bronchial asthma. Up and down excursions of the larynx, and the position of the head, which is thrown back, are typical of marked laryngeal obstruction. All these symptoms become aggravated on any exertion; especially in acute conditions in children, when the act of crying or active resistance to manipulations often produces marked cyanosis. There is

always more or less dysphonia, and frequently aphonia, depending on the nature and situation of the stenosis, whether mostly supraglottic, glottic or subglottic. In acute conditions there is often either a brassy or barking cough.

Although the symptoms of laryngeal stenosis are unequivocal, a *diagnosis* of the actual lesions producing them can only be made with certainty by either direct endoscopic inspection or by indirect laryngoscopy with the laryngeal mirror; the latter is usually all that is necessary.

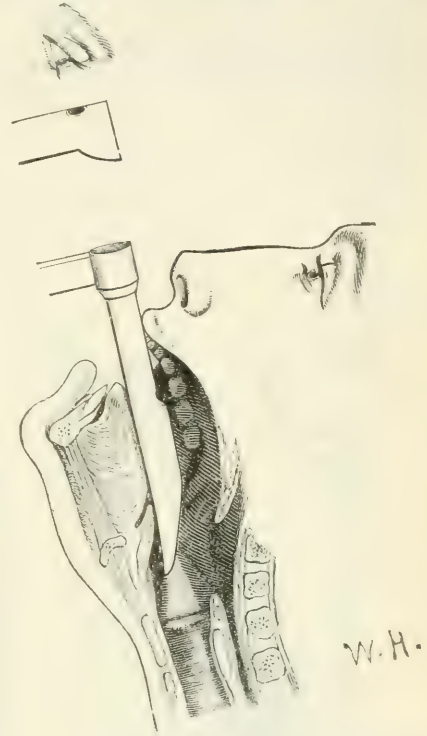


FIG. 1.—Brünings' Direct-vision Laryngeal Endoscope in the Vestibule of the Larynx. The proximal portion is tubular, and the distal portion gutter-shaped. This laryngoscope is more useful for diagnostic examinations than for per-endoscopic operative manipulations. (Diagram drawn by the author.)

But in children it may be impossible to make an adequate examination without a general anæsthetic, and in such circumstances an excellent view of the larynx can be obtained by direct-vision laryngoscopy, provided a large-sized endoscope is employed. The small tube spatulæ in Killian's and in Brünings' sets are very inferior to the writer's large, slotted, direct laryngoscope, and also to Jackson's and Mosher's instruments, even for infants. [The laryngeal appearances of the several diseases causing stenosis, here considered as a whole, will be found under the respective sections devoted to them.]

The *prognosis* in the more serious forms of laryngeal stenosis here discussed depends on the nature of the lesion, whether acute or chronic; most acute inflammations of course tend to spontaneous recovery, and the same applies here, provided the incidental dangers to life can be tided over by a temporary intubation or tracheostomy or other appropriate treatment. The prognosis in chronic cases is different; without operation death from asphyxia is often inevitable when the disease is progressive, unless temporary surgical relief is forthcoming, but even then there is rarely any tendency to spontaneous recovery of the laryngeal lesion after relief has been afforded by, for instance, tracheostomy, and the chance of subsequent

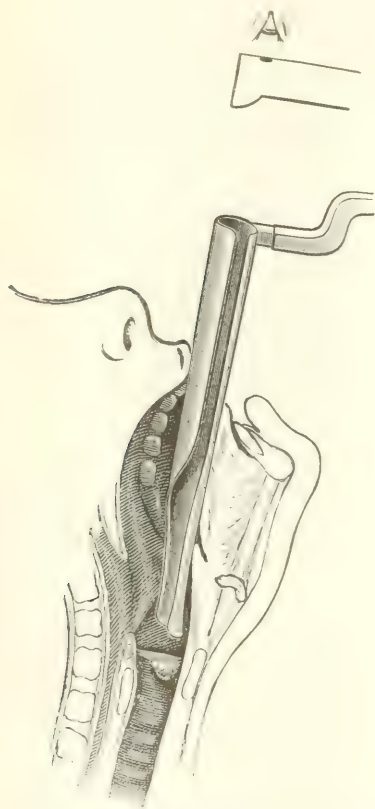


FIG. 2.—Hill's Slotted Endoscope for inspecting and operating in the Larynx and Deep Pharynx under direct vision. The full adult-size endoscope is here shown in situ in a child of ten with papilloma of the larynx. The same size can be used for infants under chloroform. The large lateral slot on the Kirstein principle not only facilitates per-endoscopic instrumentation, but enables binocular vision to be employed. The outline of Brünings' hand-lamp is omitted.

cure of a chronic hypertrophic stenosis even by local surgical measures is in some instances remote. On the other hand, in the case of webs

and adhesions, benign tumours and foreign bodies, the prognosis is usually favourable if efficiently dealt with.

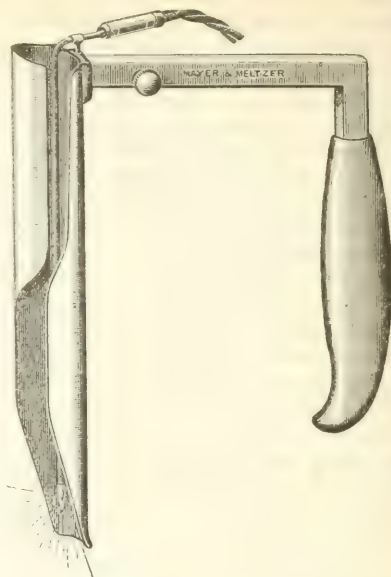


FIG. 3.—Hill's extra large Slotted Direct-vision Laryngoscope and Pharyngoscope with distal illumination, for operating on large tumours and foreign bodies ($\frac{1}{2}$ scale).

Treatment. The remedial measures at our disposal comprise—

1. The internal administration of drugs, either by the mouth or hypodermically.
2. Endolaryngeal topical applications and sprays and inhalations.
3. External hot and cold applications, plasters, etc., over the "pomum Adami."
4. Therapeutic inoculations of antitoxins, serums and vaccines.
5. Emergency laryngotomy, tracheotomy or intubation to relieve urgent dyspnoea.
6. Curative surgical measures performed either (a) *per vias naturales*, e.g. multiple puncture and removal of webs, foreign bodies and growths, or (b) through a cervical incision, e.g. tracheostomy combined with dilatation, laryngo-fissure, tracheo-laryngostomy, etc.

Internal medication is an essential part of treatment in syphilitic stenosis (mercury, iodides, and arsenates) in diphtheria (antitoxin and stimulants) and in laryngismus in infants (ipecacuanha), and serums and vaccines are occasionally useful in septic inflammations, but in most laryngeal stenoses medical are quite subsidiary to surgical measures. Salvarsan injections, however, have quite revolutionized the treatment of syphilitic stenosis and often work wonders in the course of a few days in all except those with very old, tight, thin cicatrices,

and even in these there is sometimes some improvement which renders subsequent dilation easier.

The sucking of ice and hot and cold applications are occasionally useful in acute inflammatory obstructions, but such measures are far less effective than spraying or painting the larynx with a solution containing cocaine and adrenalin. In definite cedema *multiple puncture* and scarification gives marked immediate relief which is often permanent, and is in this respect much more satisfactory than applications of cocaine and adrenalin in conjunction with hypodermic injections of pilocarpin. Inhalations of sedatives and of oxygen are sometimes useful as adjuncts to surgical measures.

In the treatment of laryngeal obstruction with acute respiratory embarrassment, the immediate question to be decided is usually whether *tracheotomy* or *intubation* should be resorted to; in most instances the windpipe will be opened for choice from the fact that few practitioners have intubation instruments at hand and fewer still can employ them with confidence, precision and despatch. In adults tracheotomy should in most cases be the operation of choice, more especially in chronic cases with or without acute exacerbation, but in children, *e. g.* with diphtheria and other acute conditions, the case is rather different when the practitioner is equally skilled in both methods. The advantages of intubation over tracheotomy are thus summed up by Semon and Watson Williams (*Albutt's System of Medicine*)—

(1) Its simplicity, celerity and painlessness and the ready consent given by parents to a non-cutting operation. (2) The considerably higher percentage of recoveries in children under five compared with tracheotomy. (3) The comfort of the patient, as, when in place, the tube cannot be felt and there is no further tedious technique as after tracheotomy. (4) Respiration is conducted through the natural passages. (5) A general anæsthetic is not usually necessary, so that there is not the same delay as in tracheotomy, where such must occur, even if local infiltration anæsthesia is employed.

The disadvantages urged are the occasional coughing up of the tube when too small a one has been selected, and the fact that a skilled person may not be at hand to reinsert it in time; there are also occasional troubles at first in swallowing liquids in the case of very young children. These can usually be obviated by inducing the patient to suck up out of an ordinary feeding bottle whilst lying flat and face downwards on the nurse's lap. If an intubation tube is long retained in acute tumefactive laryngitis it is liable to give rise in children to ulceration and subglottic hypertrophic stenosis, which may lead to serious and obstinate obstruc-

tion. This can usually be obviated by removing the tube at the earliest possible moment, and reinserting it for a few hours at night if necessary. Temporarily tracheotomy has the advantage in acute cases that it relieves respiratory obstruction and at the same time gives rest to the inflamed larynx. At the present day intubation is rendered much easier than formerly, as the lower ends of the tubes are now bevelled, thus rendering insertion through the tumefied

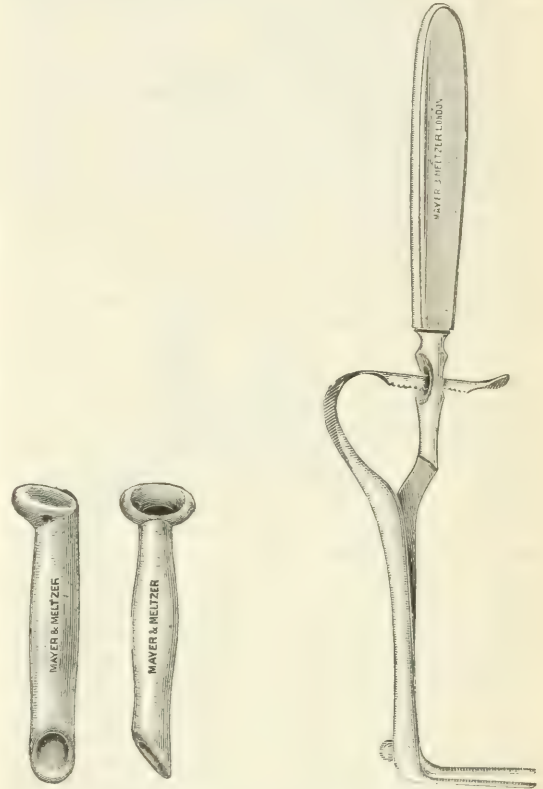


FIG. 4.—Side and end views of Thorner's Intubation Tubes, with forceps for insertion and extraction.

larynx a matter of little difficulty, and the same instrument can be used for insertion and extraction. E. Mayer employs a hollow inserter, so that breathing is not interfered with when the operator is inexperienced and slow. Intubation in children is really quite an easy operation, and the amount of actual practice necessary to acquire adequate proficiency is, as a matter of fact, quite slight. Experimentation in the post-mortem room on the bodies of children of various ages will enable the student to judge of the dimension of tube advisable according to the size of the child, and will also serve to familiarize him with the position of the epiglottis (which has to be hooked forward with the left index finger) and with the direction

of the laryngo-tracheal axis, which the tube must follow. The time is probably not far distant when all students will learn to intubate the larynx in the same way that, as a matter of course, they acquire expertness in passing a catheter into the urinary bladder. Intubation is by no means limited to the relief of acute laryngeal stenoses in children, but is also available in many chronic cases; it is likewise usefully employed in some temporary acute stenoses in adults, though in the latter tracheostomy is usually the method of choice, both in acute and chronic cases.

Intubation in chronic stenosis is, however, by no means the simple procedure described above for dealing with acute laryngeal obstructions in children. In old-standing cases the stenosis is often due to cicatricial adhesions and contractions, with such narrowing of the glottic or subglottic regions that dilation has first to be effected by graduated bougieing with or without cutting operations performed through a direct laryngoscope. In a child of seven years under the writer who was obliged to wear a tracheostomy tube for stenosis following a badly performed tracheotomy, really a tracheo-laryngotomy, for diphtheria, it was only with difficulty under general anæsthesia that a bougie one millimetre in diameter could in the first instance be passed through the contracted glottis. It was dilated up at one sitting so as to admit a bougie six millimetres in diameter, and an intubation tube of corresponding size inserted. Later a much larger one could be worn comfortably. The gradual treatment of hypertrophic cicatricial stenosis in children by the long wearing of an intubation apparatus has been very successful in the hands of Rogers and Delavan in America. The writer's want of success in children on account of the speedy recurrence of the stenosis is doubtless to be explained by the fact that the apparatus was never employed continuously by him for more than six months, whereas Rogers carries out the treatment for six years in some instances, and a fibrous stricture requires, according to Delavan and Thomson, at least two years of continuous dilatation to the utmost limit of the normal lumen of the respiratory tract before it can be considered likely to be permanently overcome. In this country St. Clair Thomson and Lack can claim successes in the traumatic hyperplastic stenosis of children by the method of prolonged intubation. An intubation tube of hard rubber has in one instance been allowed to remain in situ for four years continuously in a child's larynx without being once removed for cleansing purposes. A change of tube is, however, usually desirable every few months to determine if a larger size is indicated and feasible.

When the tube tends to be easily ejected on

account of the tracheal narrowing, Rogers uses a special apparatus with a pin fixed into the tube at right angles, and passing through a fistula in the neck, which serves to keep it immovably in position. The same object can be attained by an endless silk thread passing through two holes in the head or other part of the tube, and brought out through the tissues of the neck by means of a curved needle passed by the direct method either through the thyro-hyoid or through the crico-thyroid membrane. The strands of thread can be firmly secured by a clamp where it emerges through the skin of the neck; a couple of inches can be pulled through in one direction every day so as to ensure cleanliness and prevent the thread rotting. When "moored" tubes are used they can be made with much thinner walls than the ordinary unmoored hard rubber tube, where weight is a necessary factor for keeping it in position, so that there is a distinct gain in the increased lumen of the respiratory channel; on the other hand, the forced expiratory blast in attempts at coughing is less efficacious in getting rid of tenacious mucus, should such be present.

Since the introduction of O'Dwyer's tubes for continuous retention the method of Schroetter of inserting a hollow L-shaped vulcanite or metal tube into the larynx for ten minutes every other day, for two or three weeks or even longer, in order to effect gradual dilatation, has fallen almost into disuse.

Intra-laryngeal surgical measures (other than intubation) comprise—

1. Removal of foreign bodies.
2. Puncture and scarification, already alluded to in connection with acute cedema either of septic or traumatic origin.
3. Incisions for dealing with adhesions and webs, followed by temporary intubation to prevent re-adhesion during healing.
4. Excisions of hyperplasia and new growths.

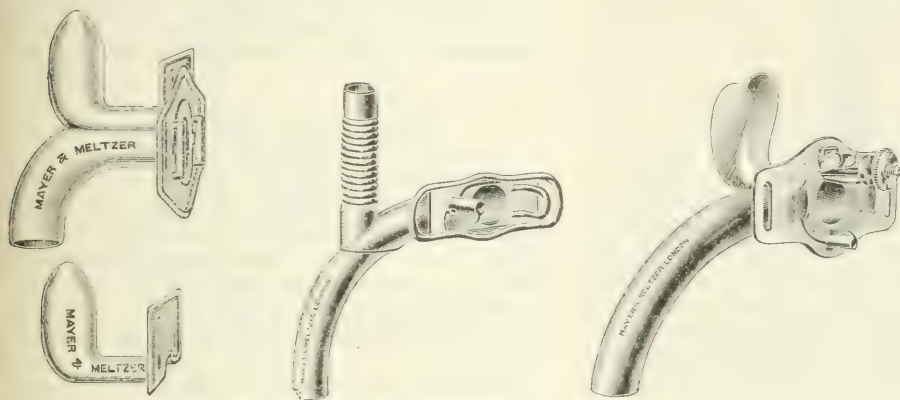
These several procedures are best performed through a large-bore direct-vision laryngoscopic tube (Fig. 3).

5. Section and exsection of the vocal cords in bad double abductor paralyses, followed by temporary intubation, has occasionally been practised, but has hitherto proved a failure.

Emergency Laryngotomy through the crico-thyroid membrane enables one easily and rapidly to relieve dangerous asphyxia due to spasm or to the impaction of a foreign body, or, indeed, to any acute obstruction in the larynx; when, however, a cannula has to be retained, for even a few days, tracheotomy is the better operation, as a laryngotomy cannula is apt to lead to granulation and subsequent stenosis, on account of the relative immobility of the larynx compared with that of the ringed trachea.

Tracheotomy is the operation of choice in an emergency, and the more or less permanent retention of the tube (*tracheostomy*) is the usual treatment adopted by those who are unskilled in laryngeal surgery. In cases of great obstruction and when other methods fail it can always be relied on and should often be the method of choice. Moreover a fair voice is often available in this method, which is not so whilst an intubation apparatus is in situ. A moderately high tracheotomy free of the first two or three rings is usually performed, but where the stenosis extends far down the trachea and in malignant and in tubercular obstructions in the larynx a low tracheotomy is often preferable.

Tracheostomy combined with dilatation from below is an improvement on the wearing of an ordinary tracheostomy tube in that a cure of the stenosis is aimed at as well. The special



Lack's.

Shimmelbusch's.

FIG. 5.
Störk's Cannulae with Dilating-stenosis Plugs.

dilating tracheostomy tubes of Störk, Shimmelbusch and Lack all have this feature in common, that a dilating apparatus extends from the angle of the cannula upwards through the strictured lumen of the trachea and larynx. It is more especially valuable in stenosis in the subglottic portion of the larynx and adjacent part of the trachea, where the maximum narrowing is within the cricoid ring. The treatment in long-standing cases has to be continued for months rather than weeks. The management of the apparatus is more technical than that entailed in all but the early stages of the method of tracheo-laryngostomy, in which a straight winged rubber tube is employed (described below); but it possesses the advantage that the ostium in the air passages is much smaller, as the larynx itself is not fissured, and it is free from the high immediate and remote mortality connected with tracheo-laryngostomy; it has, however, a more restricted field of application than the latter.

Laryngo-fissure consists in dividing the

thyroid cartilage where the two alæ meet in front, together with the thyro-hyoid and crico-thyroid membrane in the middle line; if the obstruction extends low down the cricoid may also require division; the sides of the fissure are then retracted laterally and foreign bodies seized, adhesions divided and webs, granulation and new growths removed by punch forceps and scissors. In some cases, especially in dealing with webs and adhesions, the fissure should keep open for two or three weeks till epidermization has taken place, in order to avoid re-adhesion. The author uses a special celluloid intralaryngeal splint, in order to prevent adhesions, on the same principle as Semon's nasal splint. In marked stenosis the patient has to wear a tube in the trachea until after the fissure has healed. Granulations may subsequently have to be removed by the direct laryngeal method, and even when the tracheotomy can be dispensed with an intubation tube may have to be worn for a considerable period in cicatricial stenosis. Skin grafting in fissure - laryngostomy has been practised by Chiari.

For old-standing cases with marked cicatricial formation when extending down within

the cricoid, and especially where the trachea is also stenosed, the only external method holding out hope of a radical cure is that of *tracheo-laryngostomy*, in which the laryngo-fissure is prolonged down into the trachea as far as may be necessary; the obstructing tissues are removed as described above, and the skin is sewn to the edges of the mucosa on each side; the ostium and the lumen of the larynx and trachea is then kept open by a red rubber drainage tube of as large a size as can be comfortably inserted, the lips of the fissure being kept apart by two lateral flat rubber wings attached to the drainage tube laterally in its middle third, the width of the wings being nearly that of the depth of the fissure. This winged tube devised by Hope not only helps to keep the fissure open and prevent contraction at its upper and lower ends, but also serves to keep the tube from slipping too far up into the pharynx or too far down the trachea. The apparatus can be removed and reinserted daily for purposes of cleanliness by any nurse and even by a lay person after a little practice.

The patient is able to breathe through the mouth, as in per-oral intubation, and the soft rubber tube is more comfortable than a hard per-oral

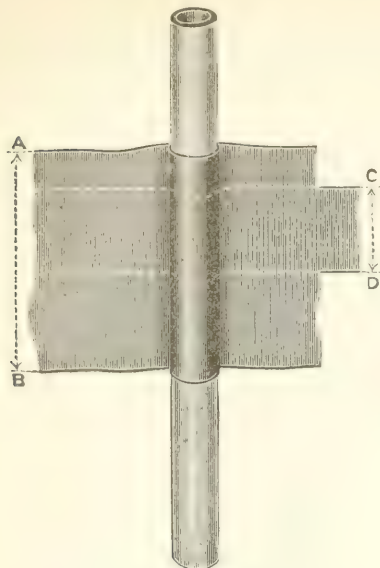


FIG. 6.—Winged Intubation Apparatus designed by Hope for dealing with cases of severe cicatricial stenosis of the larynx and trachea in the author's clinic. It consists of a red rubber drainage tube, with fixed thin sheet rubber wings or bands, which can be fastened round the neck. AB shows the width of the wings for use immediately after operation, when the fissure is often an inch and a half in length. As the fissure shortens with time the wings are gradually cut down, so that they may eventually measure only half an inch in width as at CD.

intubation apparatus and is less likely to cause ulceration and perichondritis by pressure on particular spots. A larger tube can be sub-

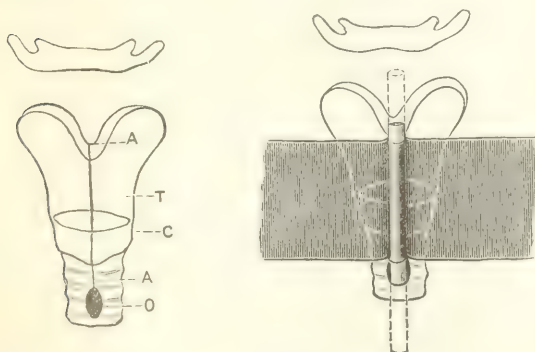


FIG. 7.—In the left-hand diagram, AO = the extent of the tracheo-laryngo fissure. The winged tube, in its relation to the fissure and to the stenosed lumen of the larynx and trachea, is shown in the right-hand diagram.

stituted from time to time as reduction of the stenosis takes place. Tracheo-laryngostomy

in practice, however, is not so satisfactory a procedure as the above description might imply. The wound has to be very carefully attended to in the early stages in order that skin may remain attached to the mucosa and favour epidermization; granulations have to be dealt with and contraction prevented. Moreover there is a mortality, immediate and remote, connected with the operation which has been placed as high as sixteen per cent.; with increased experience this should be reduced to a minimum. On the other hand, the tube can often be removed and the ostium closed by a plastic operation in from four to six months, which compares favourably with the very prolonged method of per-oral intubation. In a bad traumatic case of the author's, however, twelve months have elapsed since the first tracheo-laryngostomy was performed; an enlargement of the contracting fissure was necessary nine months later, and the probability of an ultimate successful issue has only recently been apparent.

G. W. H.

INJURIES OF THE LARYNX

Injuries of the larynx arise from wounds, crushes or compression of the neck, from swallowing scalding or corrosive fluids or inhaling their vapours, from foreign bodies traversing or becoming impacted in the larynx or ulcerating into it, and from operative measures carried out through or upon it and the adjacent parts.

Wounds of the larynx are not infrequently the result of suicidal injuries of the throat and are incised, lacerated or punctured according to the nature of the instrument used and the force employed in inflicting them.

(a) In the *thyro-hyoid space* the epiglottis and superior laryngeal nerves are exposed to injury. The cartilage, if severed, may be displaced and obstruct the breathing and blood may enter the larynx and trachea. Division of the nerves results in sensory paralysis and food is likely to enter the larynx. The bleeding having been stopped and the wound cleansed, the divided cartilage, nerves and soft parts should be drawn together with buried sutures and the skin wound dealt with according to general surgical principles.

The chief complications likely to arise are inability to swallow, entrance of food into the larynx and obstruction to breathing. Feeding may have to be carried out through a tube placed in the œsophagus and tracheotomy performed to relieve dyspnoea. The condition of the mouth, teeth and nose require careful attention if sepsis is to be prevented.

(b) The *thyroid cartilage* may be cut into and the larynx opened above or below the glottis

(level of true cords) or the cords themselves may be injured. In most cases it is advisable to perform tracheotomy at once in order to put the parts at rest and prevent the onset of surgical emphysema. The wound should then be dealt with, commencing with the mucous membrane, which should, if possible, be completely closed with buried sutures, the cut cartilage drawn together with silver wire, the soft parts approximated and the skin wound treated as before. Accurate adjustment of the divided tissues is essential if stenosis or interference with the voice is to be avoided, and where this is impossible steps must be taken during the after-treatment to avoid or minimize these dangers.

(c) In wounds involving the *crico-thyroid membrane* bleeding from veins or the crico-thyroid artery may prove troublesome; when this has been stopped the lateral parts of the wound should be closed, and the central part together with the opening in the membrane left to heal by granulation, as apart from the difficulty in suturing the wounded membrane surgical emphysema is very likely to follow attempts at complete closure. The recurrent laryngeal nerves are well protected from injury by the inferior cornua of the thyroid cartilage, and only in the event of these being cut through are they likely to suffer.

Fracture of Bone and Cartilages.—The *hyoid bone* is not infrequently fractured by violent compression of the throat as in throttling or strangling, occasionally by blows, and it is also said to have occurred from muscular action. The symptoms are pain, difficulty in swallowing, blood-stained expectoration, hoarseness and a feeling of suffocation. There is bruising of soft parts, swelling or deformity of the neck, and on palpation undue mobility and crepitus. A skiagram should confirm the diagnosis.

Occasionally the great cornua are connected with the body of the bone by a synovial joint, and in such cases injury to the soft parts would present symptoms similar to those of fracture; a skiagram, however, would disclose the true condition.

Treatment. Displacement may be rectified by manipulation between a finger in the pharynx and the other hand on the neck. A poroplastic splint should be moulded and applied to the neck. If the mucous membrane has been penetrated precautions must be taken to prevent sepsis occurring, and the mouth and pharynx should be well rinsed out after each feed. Owing to the pain, swallowing is interfered with, and thick, ropy mucus collects in the pharynx, giving rise to cough and ineffectual attempts to clear the throat. Position, frequent irrigation of the mouth and astringent anodyne lozenges will control these symptoms.

The *laryngeal cartilages* commence to ossify in the twentieth year, the thyroid and cricoid first and the arytenoids later. Fracture is therefore more common from the twentieth year onwards, and the thyroid cartilage is the one most frequently affected. A severe crush may involve all the cartilages, but the arytenoids are rarely fractured and never alone.

The *symptoms* vary according to the severity of the injury and the amount of displacement of the fractured parts. In extreme cases death may occur from suffocation within a few minutes, but in less severe ones pain, dyspnoea, dysphagia, cough, blood-stained expectoration, hoarseness or aphonia with bruising of soft parts, swelling and deformity may be present. Manipulation or attempts at swallowing may elicit crepitus, and laryngoscopic examination show injury to the mucous membrane and distortion of the canal, or dislocation as well as fracture. When the mucous membrane has been perforated surgical emphysema may also be present.

Treatment. If dyspnoea is urgent tracheotomy should be performed at once. Where there is displacement of fragments, dislocation or distortion of the lumen, an attempt should be made to pass a laryngeal spatula or bronchoscope tube and effect replacement by moulding the parts on it with pressure from without. Failing this the trachea should be opened and the fractured cartilages dealt with by open operation. Sepsis and the accumulation of mucus and particles of food in the pharynx must be prevented if possible, and the entrance of food into the larynx or inability to swallow got over by passage of an oesophageal tube.

Burns and scalds caused by swallowing hot or corrosive fluids affect principally the superior aperture of the larynx. Shock of varying degree and dyspnoea due to the rapid swelling which occurs in the lax mucous membrane of this part are the earliest symptoms, followed by pain, restlessness and mental distress in proportion to the intensity and extent of the injury. If any part of the mucous membrane has been destroyed, sloughing and ulceration occur and during the process of healing adhesions may form or contraction may produce stenosis of the aperture.

Treatment. Shock and the relief of dyspnoea require immediate attention. The latter may be effected in the case of a superficial burn or scald by scarifying the swollen mucous membrane, but if of greater degree tracheotomy should be performed in order to prevent the entrance of septic matter into the lung when inflammation and sloughing occur. The pain, restlessness and mental distress can be relieved by the administration of sedatives internally and the application of cold or heat externally. Spraying with cocaine and adrenalin will often

relieve the pain and allow the patient to take food without having recourse to the œsophageal tube. When ulceration occurs local applications should be made to promote healing and contraction prevented by the passage of instruments.

Foreign Bodies in the Larynx. Any foreign body which is small enough to pass through the superior aperture may under certain conditions find its way into the larynx. The following are some of the commonest. Particles of food, sweetmeats, bones, teeth, dentures, beads, buttons, small coins, parts of toys, needles, pins, nails, pieces of grass, straw, nutshell, pipe-stem, tissues removed during operation, parts of surgical instruments and blood clot.

The conditions which favour their entry are—

1. A sudden forced inhalation such as precedes a cough, sneeze, yawn, sigh, cry or gasp. 2. A partial or complete loss of cerebral control, as during sleep, narcosis, intoxication, epileptic or other fit, insanity, etc. 3. A gross change in the structure of the larynx and pharynx or nerve lesions, the result of injury or disease.

A bolus of food or large foreign body may become impacted above the superior aperture and completely block the air-way, or a small foreign body may have passed through the larynx and be coughed back into it.

The *diagnosis* rests partly on the history and symptoms, but chiefly on the result of examination.

The history should be carefully gone into, as a fit of coughing or choking in a child is often attributed to a foreign body, particularly if something with which it has been playing has disappeared. Even if these symptoms subside, every effort should be made to find the missing article and orders given to examine any vomit and the motions in case it may be passed in them.

In the case of foreign bodies opaque to the X-rays, a skiagram or examination under the screen may disclose their presence.

An abrasion of the larynx or adjacent part of pharynx, the result of swallowing a fish bone or other hard substance, will produce symptoms which suggest to the patient that a foreign body is present.

The *symptoms* vary with the size, nature and position of the foreign body and the length of time it has been in the larynx. If it is large enough to block the air-way, and it becomes impacted, symptoms of asphyxiation arise, or a smaller body in contact with the cords producing

spasm may have a similar effect. Pointed or sharp bodies give rise to pain and pricking sensations, cough, dyspnoea, dysphagia, secretion of mucus and possibly some bleeding. A smooth body may only excite attacks of paroxysmal cough and excessive secretion of mucus, and exceptionally there are no immediate symptoms at all.

Sooner or later, however, inflammatory phenomena supervenes, with much swelling and injection of the mucous membrane, secretion of large quantities of mucus or muco-pus, and in some cases ulceration and bleeding.

Treatment. The mouth and pharynx should be rapidly explored with the finger, and if the foreign body can be felt an attempt should be made to dislodge and remove it. Urgent dyspnoea or the onset of spasm will require immediate relief by laryngotomy or tracheotomy. The latter operation is also indicated when a child with a foreign body in its larynx has to be left beyond the reach of prompt surgical aid. If in the absence of serious symptoms it is decided to wait until special instruments and skilled assistance can be obtained, the patient should be put to bed in the semi-prone position and with the head low so that if the foreign body alters its position it may gravitate towards the front of the larynx and away from rather than towards the cords. A dose of opium or morphia combined with atropine should be given to relieve distress and check the excessive secretion of mucus. Preparations should be made for performing tracheotomy so that in the event of its becoming necessary there shall be as little delay as possible.

The removal of a foreign body from the larynx will be a comparatively simple matter to those skilled in the use of direct vision instruments if it is undertaken early enough and before the parts have been damaged in attempts to remove it by other means, but when inflammation and œdema are present it becomes much more difficult and may be impossible. If this method is not available an attempt may be made at removal with laryngeal forceps passed, in the case of adults under indirect vision and after the application of cocaine to the throat and larynx, or in children by sense of touch and under general anæsthesia. Failing these methods after a preliminary tracheotomy, the larynx should be opened and the foreign body removed through it. Other forms of treatment, such as the administration of emetics, inversion of the patient and shaking or slapping on the back are not to be recommended.

W. A.

IV.—DISEASES OF THE SKIN

CONGENITAL AFFECTIONS OF THE SKIN

THE congenital affections of the skin may affect the whole surface, as in ichthyosis, or involve a limited area, as in the common mole. To the congenital affections of limited area the term "Naevus" is often applied; it is no longer confined to purely vascular affections of congenital origin.

Ichthyosis and Xerodermia.—(*Definition*: A congenital hypertrophy of the horny layers of the skin, characterized by dryness, roughness and scaling.) Ichthyosis is a family disease, and may be traceable through several generations. The exact process which produces the increase in the horny layers of the epidermis is unknown.

Clinical Features. As a rule the child is born with an apparently normal skin, but a few weeks to a few months after birth the surface is noticed to be dry and rough. These characteristics increase in severity from the fifth to the fifteenth year and the condition then remains stationary.

Xerodermia is the name given to the mildest degree of ichthyosis. The surface is rough and slightly scaly, and the natural furrows are more distinct than in the normal skin. On the limbs there is usually some prominence of the hair-follicles (*keratosis pilaris*). In the more developed cases of ichthyosis the surface is covered with dirty brown scales. The face is dry and scaly and cracks radiate from the angles of the mouth and palpebral fissures. The whole of the surface may be involved, but it is not uncommon to find the epidermis in the flexures smooth and supple. The scalp is covered with fine scales.

In severe cases the scales are of a dark brown colour, of various sizes, diamond or polygonal in shape, resembling the scales of a fish. In some instances the hair is very scanty.

The ichthyotic skin is always dry, and there is no sensible perspiration except in the flexures.

Erythrodermatous Xerodermia.—Occasionally one meets with a xerodermia which is universal, affecting the flexures as much as the rest of the skin, and differing from the common type in the fact that the whole surface is red. It is doubtful whether this condition should not be considered in relation with the exfoliative conditions grouped as "erythrodermia."

Complications of Xerodermia and Ichthyosis.—These abnormally dry skins are peculiarly susceptible to cold and damp, and they are prone to recurrent attacks of eczema in the winter.

The dry rough skin is very difficult to keep clean, especially in children, as particles of dust, etc., adhere to the scales.

The atrophic condition of the sweat apparatus renders it difficult to treat renal disease in such patients by means of diaphoretics.

Diagnosis. The fact that the cutaneous condition has been present from early infancy, and its almost universal distribution, suffice to differentiate ichthyosis from eczema. Ichthyosis hystrix (p. 1226) is a local condition, the rough skin being in bands or streaks.

Prognosis. Ichthyosis and xerodermia are incurable; they usually get worse between the ages of five and fifteen, and tend to improve later, but the condition never clears up entirely.

Treatment. Temporary improvement often follows the administration of thyroid extract, but in a condition which lasts a lifetime, and is of itself of no danger, it hardly seems justifiable to use it. The daily application of equal parts of glycerine and water after the bath will suffice to keep a xerodermatous or moderately ichthyotic skin comparatively smooth and supple, but in the more severe cases greasy applications are better. I have found daily anointing the surface with equal parts of lanolin and olive oil of service. Care must be taken to prevent chapping of the face and hands after washing, careful drying, especially in the cold weather, being of importance. Should the ichthyotic surface become eczematous Lassar's paste or an ointment of zinc oxide with ten grains of salicylic acid to the ounce will be found useful.

Ichthyosis Gravis (Harlequin Fœtus).—It is customary to consider in relation with ichthyosis a rare condition called Ichthyosis gravis or Harlequin fœtus. This is an affection of the new-born, and is sometimes seen in the stillborn. The skin is tough and like parchment, and is furrowed by deep cracks dividing the surface into large plates. The eyelids and the lips are stiff, the infant is unable to suck, and usually succumbs in a few days. The cause of the affection is unknown.

Xerodermia Pigmentosa (Kaposi's Disease).—A very rare congenital anomaly which occurs in families, but which does not appear to be hereditary. It is characterized by freckling, atrophy, telangiectases and the formation of warty growths which tend to become malignant. The affection begins in the first year of life with the formation of freckles on the face and on the backs of the hands, and on the legs if these are exposed to sunlight. The freckles

gradually increase in number year by year and then telangiectases are noticed. Later small brownish warty tumours, rarely larger than a split pea, develop. Many of these warts fall off, leaving atrophic scars. Others, unfortunately, tend to grow very rapidly, forming large malignant tumours. It is rare for the patient to survive puberty.

Congenital Traumatic Pemphigus.—A rare anomaly of the skin in which slight traumatism causes the formation of blisters. It is a family disease and has been known to occur in several generations. In some cases there is no evidence of heredity. It has been suggested that the underlying cause is a hyper-excitability of the vasomotor system. The disease is usually first noticed when the child begins to crawl about, and sometimes earlier. Blisters form on the parts exposed to pressure, the knees, backs of the feet, fingers, etc. The least friction appears to be sufficient to cause the development of the blebs, which appear with remarkable rapidity. Most of the bullæ contain serous fluid, but blood blisters are not uncommon. The blebs vary in size from a pea to a walnut, they dry up rapidly and often leave atrophic patches. As the patient gets older the blebs form in other parts on the least pressure or friction, and these may involve such areas as to prevent the sufferer from doing any work. In some of the less severe cases I have seen improvement about puberty, but this is rare. In none of my cases has there been eosinophilia, a point of distinction between this affection and herpetic dermatitis.

Sclerema Neonatorum (Hidebound Disease).—This rare disease is characterized by a remarkable toughening of the skin and subcutaneous tissues, associated with subnormal temperature and evidence of low vitality.

Clinical Features. The infant may be born with sclerema, or the condition may develop soon after birth. The induration begins in the lower limbs and steadily spreads until it is universal. The skin is of a dull yellow colour, quite smooth and feels as hard as hide. It is fixed to the subjacent structures and immobile. There is no pitting on pressure. The infant is quite rigid and unable to suck. The temperature is subnormal, it may fall as low as 90° F. or even 80° F. The child is drowsy and there is often diarrhoea. In this type the condition is hopeless. Very rarely the sclerema is partial, and then the patches feel like plates of leather in the skin. Recovery is possible in the partial cases.

Edema Neonatorum.—This condition is even rarer than sclerema. The disease begins by swelling of the lower limbs which gradually spreads to the trunk. The skin is dull red or bluish and mottled, it feels doughy and pits

on pressure at first. In later stages the tension is so great that pitting cannot be produced.

Moles.—Moles are of several kinds. They are conveniently divided into hard and soft moles. In the former are included warty nævi, ichthyosis hystrix and in the latter the pigmented moles and similar lesions devoid of pigment.

Ichthyosis Hystrix, Linear Nævus, Nævus Unius Lateris.—(*Definition:* Congenital streaks or bands composed of warty elevations covered with scales.)

Clinical Features. Linear nævi may be noticed at birth, but they often escape observation for several years. They may be insignificant lesions an inch or so in length, or bands extending the whole length of a limb or around one half of the trunk. As a rule they are unilateral, but rarely bilateral lesions occur. Each band or streak is made up of a number of closely set small warty excrescences covered with scales. They are of the same colour as the surrounding skin or brown or black.

Epithelioma may occasionally develop in late adult life upon such nævi.

Treatment. As a rule they may be left alone, but if treatment is desired on account of their position, excision or destruction with the cautery should be practised. Radium, if procurable, will remove them. I have also used the carbonic acid snow with advantage. The mere application of caustics like salicylic acid is of no use.

Tylosis, Keratoderma Palmaris et Plantaris.—An hereditary and family nævoid condition characterized by thickening of the epidermis of the palms and soles.

Etiology. The anomaly may occur in successive generations of a family, and affect several members of the same generation.

Clinical Features. The palms and soles on both sides are covered with thick, horny, yellowish plates. The margin is sharply defined and the normal fissures are well-marked. In some instances the skin is brown or nearly black. In such cases the surface broken up by the exaggerated fissures resembles a mosaic or the bark of a tree.

Tylosis is first noticed in early childhood and persists throughout life. The movements of the parts are impeded and the fissures are often very painful. The patient may thus be prevented from working.

Treatment. The surface may be softened by plasters of salicylic acid. X-rays have also been used, but I have seen grave atrophy with telangiectases where the rays have been pushed to destroy the horny plates.

Nævus Pigmentosus.—This, the common pigmented mole, is a circumscribed flat or elevated pigmented spot on the skin of congenital origin. It is often hairy.

Pathology. The pigmented mole is composed of masses or rows of cuboidal cells in the corium. These are believed to be of epiblastic origin, and it is assumed that in the process of development they have been included in the mesoblast. In addition to the cellular masses there is excess of pigment and commonly hypertrophy of the hair follicles.

Clinical Features. Pigmented moles may be present at birth and may occur anywhere. They may be multiple or single. The lesion is a well-defined spot or patch of brown or brownish-black skin usually covered with hair. It may be no larger than a pin's head, or may involve large areas of the trunk or of a limb or cover a large part of the face. The surface may be smooth or warty, and the hair may be fine and downy or stiff and strong.

Prognosis. It should not be forgotten that after middle life pigmented moles may start to grow and develop into melanotic carcinoma, with rapid metastases.

Treatment. Small pigmented moles may be treated by radium or by solid carbon dioxide. The latter is often satisfactory. The pencil of the carbonic snow is pressed firmly on the mole for thirty to forty seconds. The reaction, which produces blistering, is rather severe. The blisters should be evacuated with a sterile needle and the surface dressed with boric acid ointment. Small hairy moles often do well if the hairs are removed by electrolysis. Large areas are best treated by a surgeon skilled in grafting. The mole is removed at one or more sittings and the areas denuded are grafted.

Any rapidly growing pigmented mole in an adult should be excised without delay with a fair margin of healthy skin.

Nævus Vascularis.—Vascular nævi are congenital local or diffuse hyperplasias of the cutaneous and subcutaneous vessels. They are the commonest congenital anomalies of the skin. According to the parts involved they are classified as (1) cutaneous, (2) subcutaneous, and (3) mixed nævi. In the mixed nævus the skin and the subcutaneous tissue are both affected. Exactly similar nævoid conditions are found in the mucous membranes and at the muco-cutaneous junctions.

Etiology. It has been suggested that as nævi are much commoner on the head and neck than elsewhere, injury at birth may be the cause, but there is no actual evidence to support this. Nævi are found twice as frequently in the female as in the male.

Pathology. Pathologically nævi are divided into three classes.

1. **Simple Angioma (Port-wine Mark).**—A simple hyperplasia of the capillaries. The capillaries are dilated but there are no lateral communications.

2. **Cavernous Nævus (Strawberry Mark).**—A hypertrophy and dilatation of the capillaries of the skin or of the subcutaneous tissue or of both. There are cavernous spaces forming lateral communications between the vessels.

3. **Nævus Araneus (Spider Nævus).**—This consists of a central dilatation of vessels with radiating dilated capillaries extending from it. Though often appearing in childhood or even later, this form is usually included among the vascular nævi.

Angioma Simplex (Port-wine Mark).—The port-wine mark is usually of considerable size, affecting perhaps the greater part of one side of the face or neck or a tract along a limb. It is usually unilateral. It is a well-defined red or purplish area, usually smooth, but occasionally presenting small erectile excrescences upon the smooth surface. In the neighbourhood of a large port-wine mark there are often small satellite lesions of similar character. The colour disappears upon pressure and changes with the temperature; effort, etc., may also increase the depth of colour. In some cases the adjacent mucous membranes are affected as well as the skin.

A pale pink area of the same nature as the port-wine stain is not uncommon on the forehead and at the nape of the neck, but this often disappears spontaneously.

Course. The simple angioma as a rule is permanent. It may increase in area, but commonly simply grows with the growth of the child. Those on the forehead and nape often disappear spontaneously.

Treatment. Port-wine marks are notoriously difficult to treat. The best results in my experience have been obtained by the application of liquid air. The liquid air (temperature -182° C.) is supplied in litre bottles similar in structure to the thermos flask. A small quantity is poured out on to a shallow dish and is applied to the surface upon pledgets of wool or lint held in a sponge-holder. The application is made with some pressure, and is rather painful. In a child it is better to make the application under an anæsthetic if the face is the part affected. As an immediate result of the treatment the skin becomes white and looks as if it had been touched with an escharotic. In a few hours blistering occurs. The fluid is evacuated and the blebs are dressed with boric acid ointment. It may be necessary to apply the liquid air several times. The result depends upon the depth of the nævoid condition; if the affection is deep, many applications may be made without producing more than a diminution of its colour. The treatment is expensive, as one litre of the liquid air costs fifteen shillings.

The treatment of these nævi by solid carbon

dioxide does not in my experience give such good results. The largest carbon dioxide pencil that can be conveniently used is a square inch in surface, and in a large nævus it is difficult to get a smooth result. Radium treatment of port-wine marks is very tedious and, consequently, expensive. The best results are obtained by the application of radium of strength 10,000 units, and the constant repetition of the applications takes several months to treat a large area. If stronger preparations of radium are used there is a likelihood of telangiectases occurring in the scar.

Multiple puncture with the galvanic cautery has often been used, but the results are not very satisfactory.

Cutaneous Nævus (Strawberry Mark).—The cutaneous nævus is usually smaller than the port-wine mark. It varies in size from a pin's head to an inch or more in diameter. It is of a bright red colour, and slightly raised above the level of the surrounding skin. The surface is usually smooth, occasionally lobulated. Under the pressure of the finger the colour disappears and the swelling diminishes. Crying, coughing or any effort tends to cause erectile swelling. Cutaneous nævi may occur anywhere. They are commoner on the head and face than elsewhere, and they are often multiple.

Subcutaneous Nævus.—This is a congenital flat swelling of the same colour as the surrounding skin. Compression causes it to diminish in size. It, like the cutaneous nævus, may have erectile properties.

Mixed Nævus.—The mixed nævus is commoner than the subcutaneous. It consists of a localized soft swelling which can be diminished by compression. Its surface is red, like that of the cutaneous nævus, but the redness rarely covers the whole swelling. Large mixed nævi are sometimes seen at the muco-cutaneous junctions.

Course of the Cavernous Nævi. Occasionally these nævi disappear spontaneously, more often they simply grow with the growth of the child, but in some instances they increase with great rapidity.

Complications. Injury or friction may cause the nævus to become inflamed and ulcerate, especially when it is situated in the groin, about the genitals or in a cavity. Such ulceration may involve the whole or part of the nævus, and usually leads to spontaneous cure with scarring.

Treatment. Nævi require treatment when they are increasing rapidly and where their presence is a disfigurement.

Small cutaneous, subcutaneous or mixed nævi may be *excised*. The operation is rarely attended with difficulty, as the nævus is usually encapsuled. Even in the diffuse form bleeding

is rarely considerable. Should there be trouble from hæmorrhage, it can be controlled by hare-lip pins passed on each side and the parts compressed by rubber tubing wound round them.

Carbonic acid snow is a convenient agent for treating the purely cutaneous nævi. There are many devices for making the carbonic acid pencil. I find that the collection of the snow in a wash-leather bag fastened to the nozzle of the gas-cylinder is as convenient as any. The snow is moulded in a brass or vulcanite tube fitted with a rammer. A solid pencil of the snow is thus obtained, and it can be cut with a penknife to the size required. The pencil is pressed firmly upon the nævus for thirty seconds and the immediate result is a white cavity with an indurated margin. In five minutes the colour returns to the nævus and it resumes its normal size. In a few hours the area is blistered, and the blister requires treatment by boric acid ointment until healed. The actual application is not very painful, but when thawing takes place there is considerable pain. In most cases it is only necessary to treat the nævus once.

Electrolysis is the best treatment for the subcutaneous and mixed nævi. Where the lesion is small it is advisable to use the unipolar method. This consists in introducing a needle attached to the negative pole into the substance of the nævus while the positive pole is placed on some indifferent position. A current of from five to eight milliampères is passed until the nævus becomes solid and doughy. The needle is then withdrawn, and the surface covered with gauze fastened with collodion. In larger nævi both poles are attached to needles which are introduced into the nævus. The needles should be made of irido-platinum and coated with an insulating varnish to within half an inch of their extremities. A current of ten to fifteen milliampères is passed until the nævus becomes solid. The needles may be removed from part to part until the whole is treated. Steel needles should not be used, as a deposit of iron may form at the positive pole. Where the nævus is on the face, and particularly if it is close to the eye, a general anæsthetic should be used. In very large nævi an apparatus devised by Lewis Jones, in which there are multiple needles alternately positive and negative, may be used with advantage. In the electrolysis of nævi care must be taken not to do too much at one sitting, and if there is proper insulation there is little risk of sloughing.

Radium may be used for these nævi, but long applications are required, and I am not convinced that the results are better than those obtained with carbonic acid or electrolysis. One advantage, however, is that the application is painless.

Large nævi about the muco-cutaneous junc-

tions may require a combination of excision, the cautery and electrolysis for their cure.

Nævus Araneus (Spider Nævus).—Spider nævi usually appear in childhood, often in the second decennium. They sometimes follow slight traumatism, stings, etc. They are common on the face and are usually multiple.

Each individual lesion consists of a round, slightly erectile red swelling rarely larger than a millet seed, and from this centre dilated capillaries stretch out like the rays of a star.

These little nævi can be removed by touching the central spot with the pointed cautery at a dull red heat, or by electrolysis, using the needle attached to the negative pole.

Lymphatic Nævus.—In rare cases congenital lymphangiomata occur. They may be associated with the common vascular nævi. They consist of minute transparent vesicles closely aggregated. They appear in infancy and are usually situated on the trunk and limbs. They cause no symptoms, and if removal is required this may be affected by excision or electrolysis.

Congenital Affection of the Glandular Elements

Adenoma Sebaceum.—A congenital overgrowth of the sebaceous glands. The type most commonly observed is that described by Dr. Pringle. It consists of a number of nodules of pink colour affecting the middle third of the face, and especially the naso-labial furrows. The tumours are present at birth and tend to increase till puberty. They are often associated with common nævi and pigmented moles and fibromata, especially a flat fibroma above the iliac crest on each side.

Adenoma sebaceum usually occurs in mentally deficient children, but not always. In some cases the tumours are not pink, but of a pale colour, or with a warty surface.

The adenomata may be removed by the knife or by electrolysis. J. H. S.

CONGENITAL SYPHILIS

Congenital or Hereditary Syphilis results from infection of the ovum or fetus by the *Spirochæta pallida* or *Treponema pallidum* of Shaudinn. The toxic effect of the organism is often manifested by an abortion or series of abortions or stillbirths, followed by a living syphilitic child with or without symptoms of syphilis, and finally by a healthy child, as the syphilitic toxin becomes exhausted by time or treatment. The high rate of mortality thus brought about accounts for the relative infrequency of the inherited as compared with the acquired disease. Probably, also, many cases with only marasmic or visceral symptoms escape recognition. Transmission of the disease is usually said to occur

through the mother alone, or the father alone, or through both parents, but direct spermatoc infection of a healthy ovum by a syphilitic father has been much disputed. The possibility of infection of the mother by her syphilitic fetus (syphilis by conception) also turns upon the validity of direct paternal transmission. Whether this be accepted or not, it seems probable that, in the majority of cases at least, the immunity of the mother from infection by her syphilitic suckling (Colles' law), and of the child from infection by its syphilitic mother (Profeta's law), is due to actual syphilis, and the fact that the Wassermann reaction has been shown to be positive in the apparently healthy mother and child is in favour of this view. The symptoms of inherited syphilis may be conveniently divided into "early" and "late," but it is important to remember that no arbitrary line can be drawn between them, and it is not uncommon to find post-mortem evidence of the so-called late manifestations in syphilitic fetuses or stillborn children.

A syphilitic child may be born alive or dead, prematurely or at full term, and with or without symptoms of the disease. In many cases it is apparently healthy at birth, but it may present various deformities or soon waste and die of anæmia and inanition.

Fatal jaundice or hæmorrhage may occur within the first few days, and the so-called syphilitic pemphigus is another symptom which may be present at birth or a few days after birth. This eruption, which indicates a severe infection but not necessarily a fatal prognosis, affects chiefly the palms and soles, and less often the face and trunk. It consists of large, scattered, usually flaccid bullæ, containing purulent or blood-stained fluid, with a brownish-red base and areola. Its distribution, occurrence a few days after birth, and the association with it of other evidence of syphilis will serve to distinguish this eruption from pemphigus neonatorum, a bullous impetigo of streptococcic origin, which occurs at a later period than the syphilide and often in epidemics.

If the child escapes these natal or post-natal phenomena it will in all probability remain free from symptoms until the third or fourth week. Between this time and the eighth week, more rarely after the twelfth week, it is liable to develop a series of local and general symptoms, the former of which correspond to a certain extent to those of the second stage of acquired syphilis. These symptoms may be conveniently classed as local and general.

Local Symptoms—

Lesions of Mucous Membranes.—In the majority of cases the first manifestation to appear is "snuffles." When the rhinitis is

severe the nostrils are blocked and sucking is interfered with, so that the child may be starved for want of nourishment. Snuffles are sometimes accompanied by a characteristic hoarseness of the cry due to laryngitis.

Lesions of Skin.—Excoriations, fissures, or mucous patches about the mouth, nostrils, anus or other parts of the body may occur at the same time as the snuffles. The cutaneous eruptions proper come on a little later. They are polymorphic and may be macular, papular or papulo-squamous, rarely vesicular or pustular, and, as already described, bullous. The type most often met with consists of flat brownish-red discs coalescing to form large irregular glazed desquamating areas on the buttocks, lower abdomen and genito-crural regions; the face, especially around the nose and mouth, the palms and soles and the limbs may also be affected, and sometimes the eruption invades the trunk or the whole of the body. Condylomata and gummata are rare at this stage, but the echthymatous or furuncular syphilide may occur in the first three months, and I have seen a child covered with large gummata a few weeks after birth.

Lesions of Hair, Teeth and Nails.—The growth of hair may be increased, and is then sometimes known as the syphilitic wig, or there may be alopecia affecting the scalp or the eyebrows. It is probable that some of the cases of congenital baldness are due to inherited syphilis. The temporary teeth are apt to undergo early caries, and typical Hutchinsonian teeth have been occasionally seen in the temporary set.

Syphilitic Onychia begins with the other early manifestations, but may outlast them. I have seen it as an apparently single phenomenon. Inflammation and suppuration of the matrix lead to rapid exfoliation of the nail, or the process may be more chronic, the nails becoming arched, narrowed and claw or fan-shaped.

Lesions of Eye.—Ocular manifestations are not usually seen until later, but iritis and choroiditis and, rarely, optic neuritis may occur during the first three or four months.

Lesions of Bones and Cartilages.—Pseudo-paralysis, usually affecting the arms and caused by acute epiphysitis, may be one of the first symptoms to attract attention. Dactylitis, affecting the proximal rather than the distal phalanges, and the hands rather than the feet, is sometimes observed during the first year. Periostitis and the formation of nodes have also been noticed in infants under six months (Carpenter). Craniotabes may occur during the early months of hereditary syphilis as well as in rickets, but some authorities maintain that when it does so it is due to rickets occurring in association with syphilis. The same objection has been raised with regard to Parrot's nodes,

a term applied to a localised thickening of the bones surrounding the anterior fontanelle, causing the hot-cross-bun or natiform skull. These changes come on during the first two years of life, but may persist for several years.

Lesions of Internal Organs.—Enlargements of the spleen and liver can often be made out, and, taken with other symptoms, are useful diagnostic indications. Changes in the lungs, kidneys, thymus, pancreas and heart may be found in the dead fœtus or stillborn child, and the spirochæta pallida has been found in the affected tissues.

Orchitis, usually bilateral and causing swelling and hardness of the testicles, is common during the first four months up to three years, and it is sometimes complicated by hydrocele (Carpenter).

General Symptoms.—These may be present at birth, but more often develop with the local symptoms. They vary according to the severity of the syphilitic toxæmia. The child may be born shrivelled and undersized and die of marasmus; usually, however, it is well nourished at birth but soon begins to waste and lose weight, and before long assumes a yellowish-brown colour and a wrinkled and wizened aspect usually compared to that of a little old man.

Late Manifestations.—The late phenomena of congenital syphilis may also be divided into local and general symptoms. They occur about the time of puberty, or at any time from the second to the twenty-fifth year, but no arbitrary age limit can be fixed.

The most characteristic local symptoms affect the teeth, eyes and ears, a combination often known as Hutchinson's triad.

The *dental* changes chiefly affect the upper incisors of the permanent set, which are dwarfed and peg-like and have a shallow crescentic notch at the cutting edge and rounded angles.

In association with notched teeth, certain *ocular* changes, of which the most important is interstitial keratitis, are found. Both eyes are affected, usually one before the other, the condition varying from a slight haziness to complete "ground-glass" opacity of the cornea, and is accompanied by a network of fine blood-vessels in the sclerotic, forming the so-called "salmon patch." The condition clears up under treatment and in course of time often completely disappears.

Traces of old choroiditis and iritis may also be found. Changes in the tympanum and middle ear cause rapid and often permanent deafness. The *bony* changes seen at this period are chronic osteitis and periostitis of the skull and long bones. When the crest of the tibia is affected, the condition known as "sabre-blade tibia" is produced. Syphilitic synovitis and osteo-

arthritis with chronic effusion and osteophytic outgrowths are not very uncommon.

Cutaneous and Mucous Membrane Lesions are rare in the later stages of congenital syphilis, and bear no comparison in point of frequency and variety to the tertiary syphilodermata of acquired syphilis.

Small isolated cutaneous or subcutaneous gummata, sometimes known as syphilitic furuncles, are most common during the first year, but are occasionally met with up to the twentieth year. They begin as raw-ham or copper-coloured nodules about the size of a pea, which break down to form punched-out or sinuous ulcers.

Condylomata may crop up two or three years after the early cutaneous eruptions have ceased, to appear especially in untreated or insufficiently treated cases.

The most characteristic of the late cutaneous manifestations is deep ulceration, especially of the nose and palate, causing perforation of the latter and rapid and extensive destruction of the soft and bony tissues.

The saddle-shaped nose and radiating scars about the mouth or anus afford important evidence of past disease.

Certain changes in the *visceral organs*, mostly of a gummatous nature, have been found in the liver, spleen, kidneys and in the nervous and cardio-vascular systems. Of these, enlargement of the liver and spleen are the most important from a diagnostic standpoint.

Adenitis has occasionally been observed as a late manifestation, and orchitis may occur as late as the twelfth year.

Nervous Phenomena may occur either as early or late manifestations, and include mental degeneration, congenital idiocy, general paralysis, hydrocephalus, chronic meningitis, tabes dorsalis, cerebral and meningeal gummata, cerebral and spinal spastic palsies and neuritis of cranial nerves.

Late General Symptoms.—These are not so striking as those of infancy, but varying degrees of retarded mental and physical development, to complete infantilism with delay or absence of sexual characteristics, are recognized results of congenital syphilis. The child is usually weakly and anemic as well as stunted in growth, and easily falls a prey to tuberculous or other disease. Some cases, however, lose nearly all traces of the inherited taint.

Diagnosis. The diagnosis cannot be made on any one symptom alone, although the presence of chronic snuffles, a dusky polymorphic eruption about the buttocks, face, palms and soles, pseudo-paralysis or enlargement of the testicle in an infant under three months, are individually strongly suggestive of congenital syphilis. As a rule, there will be

other local or general indications to found the diagnosis upon. Diaper rashes, scabies and urticaria papulosa are all apt to be mistaken for syphilis and may occur concurrently, but the absence of limitation to the diaper area, and of burrows and wheals, will help to distinguish these conditions. As already mentioned, the bony changes of rickets cannot always be differentiated from those of syphilis. In later years, one or more of the symptoms of Hutchinson's triad will lead to a closer examination and often disclose syphilitic changes elsewhere, and a positive Wassermann test will put the matter beyond doubt.

Treatment. Treatment of a syphilitic mother is often successful in procuring the birth of a healthy child, and should be begun as early as possible during pregnancy. The father should also be treated if his Wassermann reaction is positive. The child should be suckled by its mother, as it will then have a much better chance of surviving than when fed artificially.

The majority of syphilitic infants improve rapidly on mercury given by the mouth, and this is usually the most convenient method of administration. Grey powder may be given in doses of a quarter to one grain three or four times daily with sugar, bicarbonate of soda or aromatic chalk mixture. The addition of Dover's powder (grains one-eighth to a half, according to age) is useful if there is diarrhoea. Other preparations used are the subchloride, perchloride and proto-iodide. Inunction is sometimes preferable, a piece of blue ointment, the size of a pea, being placed on the binder or rubbed into different parts of the body every day. Mercurial treatment should not be stopped as soon as the symptoms disappear, as unfortunately often happens, but should be continued systematically for at least a year, with occasional intermissions if necessary. When later symptoms occur, iodide of potassium may be combined with the mercury. Fissures and excoriations may be dusted with equal parts of boric acid or calomel and zinc oxide and starch or a weak mercurial ointment applied inside the nostrils to remove the crusts.

In urgent cases, such as those with iritis, when rapid and intense action of the drug is required, fumigation, intramuscular injection or mercurial baths are used, or two of these methods may be combined. Salvarsan (dioxidyamido-arsenobenzol), which has to some extent replaced mercury for this purpose, may be administered intravenously to the mother or intramuscularly to the child. Ehrlich advises that both should be injected, the doses for the mother being 0.3 to 0.4 grm., and 0.008 to 0.01 grm. per kilo of body weight for the child. Good results have been reported in infants, but there is a danger of the child succumbing to the toxins liberated

by the dead spirochaetes. When salvarsan is given to the mother, it is supposed that the endotoxins set free lead to the formation of antitoxins which are imbibed by the child, as arsenic is not excreted in the milk.

E. D.

DERMATITIS FROM LOCAL IRRITATION

Mechanical Irritation.—1. Blows, contusions and pinches cause—

(a) *Erythema*, redness which disappears on pressure, attended with slight swelling and perhaps itching. This erythema is transitory and only follows slight injury.

(b) *Wheals*, raised flat swellings, at first red, but owing to oedema the centre rapidly becomes pale. Such lesions follow a sharp blow, as with a cane or whip. Wheals, again, are transitory.

(c) *Ecchymoses*, effusions of blood into the skin and subcutaneous tissue, as in the common bruise. The blood is gradually absorbed, the bruise passing through various colour changes. Subungual ecchymoses are common in pinches of the nail, and may lead to loss of part or the whole of the nail-plate.

2. Prolonged pressure leads to a more chronic erythema, *Erythema paratrimma*, the first stage of the bed-sore, and in certain conditions this passes on to sloughing and ulceration.

3. Friction may produce erythema and blisters or bullæ, as in the use of unaccustomed tools, or in rowing.

Prolonged intermittent friction or pressure leads to the formation of the *callosity* seen on the workman's hand, or to *corns* from the pressure of ill-fitting boots (p. 1233).

The friction of two opposed surfaces of skin causes *chafing* or *intertrigo*.

4. Scratching causes *excoriations* and *abrasions*, denudations of the surface. These are usually linear, but they may be punctate. Where such lesions occur it is obviously necessary to seek for some underlying cause, such as scabies or pediculi or some general condition causing itching.

Napkin Eruptions in Infants.—It will be convenient here to consider the eruptions which occur in the area covered by the napkin in young infants.

1. **Napkin Erythema.**—This eruption is common. It is caused by the irritation of urine and fæces. It is, therefore, most frequently met with in the children of the careless, but in some well-tended babies it may develop in consequence of frequent micturition caused by a long prepuce, or an irritant diarrhoea.

The eruption is on the *convex* surfaces in contact with the napkin, that is, on the buttocks and lower part of the back, on the backs

of the thighs and the calves and heels, which may come in contact with the soiled napkin. The flexures are unaffected.

The eruption is dark red, smooth and often shining. In neglected cases, probably from superadded infection, vesicles may form, and even papules and ulcers.

The parts must be kept scrupulously clean, the napkins must be frequently changed, washed and dried before being reapplied, and the area should be well dusted with a powder containing equal parts of zinc oxide and starch or talc. If there is ulceration boric acid ointment or a weak mercurial (hydrarg. ammoniat. grs. v to an ounce of zinc ointment) applied. Attention must also be given to the state of the bowels, and circumcision may be required.

2. **Infantile Intertrigo.**—This is a common eruption in neglected infants, but also occurs in fat babies.

It affects the groin and neck. In the groin the eruption is found in the flexure and on the adjacent parts of the thigh and scrotum. It is due to the friction of opposed surfaces, and further irritation is supplied by the contact with fæces and urine in the groin cases, and in the neck from the irritation of sour milk allowed to lodge in the neck folds.

The eruption is primarily an erythema, but the warmth and moisture of the part lead to the formation of vesicles which rupture early and leave a moist oozing surface. The eruption may extend beyond the actual flexures, but is always present in them. Coccal infection leads to ulceration.

The treatment is on the same lines as for napkin erythema.

Diagnosis. These eruptions on the napkin region are often thought to be syphilitic, but the syphilitic eruption is of a hammy colour, there are lesions on the palms and soles and about the mouth, and there are also snuffles and other evidence of spirochætal infection. A seborrhoeic eczema may lead to some difficulty in diagnosis, but the eruption is more widely distributed, there is greasy scaling, and often the presence of pityriasis capitis in the mother. The napkin erythema is distinguished from intertrigo by its presence on the convex surfaces, while intertrigo begins in the flexures.

Intertrigo in the Adult.—Intertrigo is met with in the obese adult of both sexes. It occurs in the groins, and in the gluteal cleft and under a pendulous mamma. It is also found in the interdigital clefts of the toes. It begins as an erythema with an ill-defined outline, it may become vesicular, and on the rupture of the vesicles an oozing surface develops. It must be remembered that many of the groin eruptions in both sexes are caused by the

Epidermophyton inguinale (*Eczema marginatum*, p. 1244). Here the eruption has a well-defined festooned outline, while the centre is buff coloured and scaly. Examination of scrapings by the microscope will show the fungus. Sabouraud and Whitfield have recently shown that many of the cases of intertrigo between the toes are due to the same fungus.

Callositas (Corns).—Definition: A localised hypertrophy of the horny layers of the epidermis of the hands and feet caused by friction.

Frequently recurring friction and pressure appear to be the essential factors. The callosity is a raised, flat, horny, yellow or greyish-yellow plaque. Suppuration is rare. As a rule callosities are on the hands and in positions constantly rubbed by tools.

If treatment is required the callosity may be soaked in hot water and pared away. A salicylic plaster or salicylic collodion will also remove the horny layers.

Corn.—A corn is a painful hypertrophy of the horny layer of the epidermis of the toes or sole caused by ill-fitting boots.

The hypertrophied epidermal cells form a conical mass, the apex of which impinges upon the papillary layer and thus causes pain. Corns are flat rounded elevations of the epidermis of the toes and soles. Where they exist between the toes they are white and soft from maceration (soft corns), but elsewhere they are hard and of yellow or greyish tint. Corns are often multiple. Both the hard and soft corn are painful on pressure, especially in cold and damp weather.

Treatment. The corn should be softened in hot water and then pared down with a sharp knife, the conical plug or "root" being also removed if possible. Salicylic collodion (one part in five) painted on nightly, followed after four or five days by fomentation in hot water, often suffices to remove the hard corn. The soft corn may be pared down or treated with salicylic collodion.

Affections due to Cold

Chilblain (Erythema Pernio).—A chilblain is a localised erythema attended with exudation, occurring on the fingers, toes, ears and nose in certain predisposed persons in cold and damp weather. Children and adolescents are specially prone to the affection. The erythematous spots are of a dusky red colour, and itching is often severe. From neglect the chilblain may pass on to vesication and ulceration, the so-called "broken chilblain."

Treatment. The patient should take plenty of exercise and good food. Fats in some form are also beneficial. Thick boots and gloves should be worn and warm water should be used for washing. Calcium lactate sometimes acts

beneficially. It is given in doses of ten to fifteen grains thrice daily for six doses and then omitted for three or four days. Arsenic in small doses is said to be prophylactic. Locally the application of the tincture of iodine may be tried, but menthol (one drachm in an ounce of olive oil) is better to relieve the itching. In bad cases the electric hand or foot bath is often of service. Broken chilblains are treated by fomentations and ung. acid boric.

Frost-bite.—This is extremely rare in this climate. There are two varieties of lesion. In one, a bulla forms and when this ruptures an area of necrosis is found underneath. In the other form there is gangrene. The destruction caused may lead to great deformity if the nose or the ear be affected.

The immediate treatment consists in rubbing the affected part with snow.

Dermatitis Hiemalis (Dukring).—American physicians have drawn attention to a recurrent winter eruption which does not appear to be recognized in this country. The eruption occurs on the hands and rarely on the feet. It consists of round or horseshoe-shaped, red, raised plaques, which are at first covered with small vesicles very like herpes. On the rupture of the vesicle small weeping areas are left. Scaling is the final stage. Dermatitis hiemalis closely resembles lupus erythematosus in the later stages, but the lesions do not tend to spread peripherally.

Affections caused by Heat

Ephelis Ab Igne.—It is unnecessary here to describe burns and scalds, but there is a form of pigmentation due to heat which comes under the notice of the dermatologist. It is seen most commonly on the front and inner sides of the legs, and is usually caused by the habit of toasting the legs before the fire. It also occurs in cooks and stokers. It is characterized by brown macules scattered over the affected surface. The brownish discoloration causes a mottling which often has a reticular arrangement. In rare cases a similar mottling is seen apparently as the result of exposure to cold.

Affections caused by Light

Solar Erythema (Sunburn).—The sites affected in solar erythema are the forehead and the malar eminences and the nose. In rare instances the trunk or limbs, if exposed to strong sunlight, may be involved. The eruption does not occur in those who are tanned by prolonged exposure to the sun's rays, pigmentation being Nature's protection against the actinic rays of light. Fair people suffer most. The area affected is bright red, swollen and hot, and tenderness and smarting are often troublesome

features. The eruption fades in a few hours to several days, and is usually followed by free desquamation, and finally by pigmentation (bronzing).

The treatment of solar erythema consists in the application of soothing lotions or ointments, the calamine liniment or a zinc cream being suitable preparations. As a prophylactic, susceptible persons may wear red or brown veils, or powders or ointments containing pigment may be applied.

Ephelis, Freckle, Lentigo.—Freckles are yellowish or brown or blackish spots of pigment produced by exposure to the actinic rays of light.

Treatment. Perchloride of mercury (three grains to the ounce) in glycerine or spirit is applied two or three times a day until the parts become red, when a little zinc ointment is applied. Red or brown veils may be worn by those specially liable to freckles.

Summer Eruptions.—In this group there are several rare conditions which demand consideration. The least severe form is known as **Hutchinson's Summer Prurigo**. In this affection there is an eruption of papules and vesicles on the face, neck and upper extremities. Each lesion consists of a pale red papule, in the centre of which there is a tiny vesicle. The eruption itches at night, and the tops of the lesions may be scratched off, and small blood crusts form.

The eruption occurs in children and usually ceases at or about puberty. It is a recurrent summer affection, and the patient is usually free in the winter. There are, however, some almost identical cases which recur on exposure to cold and wind.

Arsenic in gradually increasing doses was recommended by Hutchinson. Ichthyol internally has also been advocated. Soothing lotions, such as a lead lotion with a little liquor carbonis detergens, are usually sufficient to allay the irritation. The unguentum metallorum may also be used.

Hydroa Æstivalis, Hydroa Vacciniformis (Bazin), is a rare recurrent summer eruption occurring in children, usually beginning in the second or third year of life. The exposed parts are affected, and the eruption is often preceded by a sensation of heat, and there may be general symptoms, the child obviously being out of sorts. The eruption begins with the formation of red spots, on which vesicles develop. The vesicles coalesce to form flat bullæ, which dry up into crusts in three or four days. In some cases lesions closely resembling those of vaccinia form. On the separation of the scabs a scar is left. Each attack lasts two or three weeks, the eruption coming out in crops.

The attacks occur year by year in the summer, but as puberty approaches they become less severe and finally cease.

Protection of the affected parts is necessary in the subjects of this disease. Arsenic may be given, but to be beneficial it has to be pushed. The vesicles should be opened with a sterile needle and mild antiseptic ointments applied. Pastes containing ichthyol are of great service.

X-Ray Dermatitis and the Effects of the X-Rays on the Skin

Exposure of the skin to the X-rays may be followed by definite reactions varying with the intensity of the radiation and the length of the exposure. In all cases there is a latent period, which again varies with the intensity and duration of the radiation.

Stage 1. An exposure to the X-rays equivalent to the B tint on the pastille of Sabouraud is followed after fourteen to twenty-one days by epilation. The hair falls out, leaving the area bald, and after a period of about six weeks the hair grows again. This reaction is used in the treatment of tinea capitis.

Stage 2. A slightly longer exposure will cause erythema and an epilation which may be permanent. Such a reaction starts about the fourteenth day.

Stage 3. A heavier dose is followed after ten or twelve days by vesication.

Stage 4. A still heavier dose is followed by ulceration. The base of the ulcer is covered by a washleather-like slough which is very adherent.

Stage 5. The reaction after an enormous dose may occur in eight days and may terminate in gangrene.

It will be readily understood that there is no hard-and-fast line between these stages, and that they are only given for convenience. The skin may recover entirely after the second stage, but where there has been vesication, atrophy and telangiectases are certain to occur. In the fourth stage the ulcer may take many months to heal, and the scar is depressed, pigmented and telangiectatic. In the last stage the ulcer never heals. All forms of radio-dermatitis are exceedingly painful, and persistent pruritus often follows healing.

It is obvious that as there is a long period of latency, frequently repeated doses of the rays may produce one of the later stages of the dermatitis, and this often followed treatment when frequent repetitions of the exposures were made without any measurement of the dose.

Dermatitis of the Operator.—This unfortunate affection should never be seen under present circumstances, as in all properly-equipped outfits there is provision for the protection of the operator. In the pioneer workers it was first noticed that the nails became brittle, and later painful and tender chronic ulcers formed on the backs of the fingers and hands. The ulcers

were of irregular outline, covered with a yellowish slough and with a livid red margin. The whole finger or the hand sometimes became tumid and tender. Painful onychia was also a frequent feature, especially in the cold weather. In some cases the phalanges underwent partial absorption. Ultimately the fingers became terribly deformed, and movement was impeded by cicatricial tissue. In certain cases pigmented warts appeared, and unfortunately some of these went on to epithelioma, necessitating amputation. In a few cases death has resulted from cancerous metastases.

X-ray dermatitis is notoriously difficult to treat. In some cases fomentation of the acute lesions gives relief, in others the parts are so sensitive that heat cannot be borne. Soothing dressings of all kinds may have to be tried until one is found that the patient can tolerate.

Radium Dermatitis.—Exposure of the skin to radium produces somewhat similar effects to those seen after the use of the X-rays. The alpha rays are particularly irritant, and when prolonged exposures are necessary the radium is covered with aluminium or thin lead. In very long exposures lead of a half to two millimetres in thickness is used.

The radium scar is often telangiectatic, like that following an X-ray burn.

Professional and Trade Dermatitis

Soaps and Soda. Domestic servants, washerwomen and others who use strong soaps and soda in cleaning often require treatment. It must also be remembered that soaps intended for house-cleaning are used by the poor for their children's tender skins, with the result that an eczematous eruption occurs.

Water. Barmaids and restaurant employés require treatment for a similar affection from constant washing-up of glass and crockery. They most commonly suffer in the winter, and insufficient drying after washing is apparently the exciting cause.

Turpentine dermatitis is seen in painters and others.

Sugar dermatitis occurs in confectioners, grocers and work-girls engaged in packing sweets. The eruption is very irritable and pustulation is common.

Woods. Teak, rose-wood, satin-wood and cocus-wood used in the manufacture of flutes may cause an eczematous dermatitis.

Silicate used in packing round boilers and cold-storage apparatus causes a dermatitis.

Plaster, lime, etc., used in the building trade cause a chronic dermatitis with thickening of the epidermis and painful fissures.

Aniline dyes form another group of irritants, and we are frequently able to diagnose the nature of the irritant by the staining of the nails.

Aurantia, a dye used in staining the cheaper yellow boots, is a similar irritant.

Bichromates are used by French polishers and others, and here again the staining helps the diagnosis.

Photographic chemicals also produce dermatitis.

Hair Dyes. Certain chemicals used in dyeing the hair cause severe dermatitis and sometimes loss of the hair.

Arsenic causes an eczematous eruption and ulceration. Where the arsenic, as in some green pigments, is in fine powder, the eruption is not confined to the hands, but attacks the trunks and the thigh and external genitals. A common feature is perforation of the septum nasi. This is almost constant in some factories.

Tar, asphalt, paraffin and soot form another group producing a definite series of eruptions. The tar worker first suffers from a chronic eczematous eruption; then small warty growths form, and many of these fall off. Later large tumours, "tar-mollusca," occur, and though most of these growths also fall off, in the older workers they develop sometimes into true epithelioma.

Flax, jute and wool workers are liable to irritant dermatitis. Bacterial and fungous diseases are treated elsewhere.

Dermatitis caused by Plants.—Amateur and professional gardeners occasionally suffer from acute attacks of dermatitis from the handling of certain plants. The cause is often overlooked, especially if the practitioner is not aware that a patient makes gardening a hobby. Certain varieties of *Primula*, particularly the *P. obconica*, cause an erythematous and vesicular eruption which may be associated with general malaise, pyrexia, etc. The hands and face are most commonly affected, and the eruption may closely resemble erysipelas. The poison ivy (*Rhus toxicodendron*), dogwood (*Rhus venenata*), and the poison oak (*Rhus diversiloba*) may also cause a similar eruption. Certain bulbs, colchicum, scilla, and some of the *Euphorbiaceæ* and the *Daphne mezereum* may produce similar affections in certain subjects.

The parts should be protected by soothing creams and lotions. By some authors a solution of hyposulphite of soda (a drachm to the ounce) is recommended.

Feigned Eruptions (Dermatitis Artefacta).—The practitioner must always bear in mind, when face to face with an eruption of unusual character, that the condition may be produced by the patient with the object of enlisting sympathy or evading work. Such cases are most common in hysterical girls and women, but they also occur in malingering workmen, and in the services in those endeavouring to obtain their discharge.

The eruptions in question may be produced by simple friction with a moistened finger, by the application of irritant chemicals, and the like. The lesions produced vary very much; in some cases they are simple abrasions and excoriations, in others, inflammatory and even ulcerative conditions which may suggest virulent septic infection. As a rule the lesions do not conform to any known type of skin disease, they are always within reach of the fingers, and commonly present a rectangular outline, whereas most dermatoses have rounded or oval margins. In some cases the lesions are linear streaks, which at once suggest their origin to an observer who is mindful of the possibility of an eruption being artefact. In others the remarkable limitation of the eruption, and the normal character of the adjacent skin, may cause suspicion. In many instances, however, it is only a large experience that is able to lead to a decision.

I have several times pointed out that in the feigned eruptions of the hysterical there are other signs of the nervous condition, viz. anæsthesia of the palate, hemianæsthesia, stocking and glove anæsthesia and alterations in the visual fields. It is an important point that in many cases some slight accidental traumatism seems to suggest to the patient the production of these feigned eruptions.

In the malingerer there is greater difficulty. Again, some slight injury may suggest the self-infliction of abrasions, etc., or steps may be taken to keep up an already existing traumatic dermatitis. It is extraordinarily difficult to prove the nature of the trouble, and the patient often shows great ingenuity in concealing the method adopted to produce it.

The practitioner who has a suspicious case may adopt one of two methods. He may cover the affected parts with a fixed dressing, consisting of a simple ointment on lint, covered with a thick plaster of Paris case, or he may take steps to prevent the use of the hands by enclosing them in a similar case. In one of my patients an eruption of blisters on the fingers of one hand was covered by a plaster of Paris dressing, and as fresh blebs appeared at the top of the plaster, this was gradually increased until the blisters were, as it were, pushed upwards to the shoulder. By a ruse it was discovered that the patient used blistering fluid to produce the bullæ. Even when this was discovered it was indignantly denied, and that is the universal experience in such cases, the patient will never confess to the fraud. It is often very difficult to get the patient's friends to believe that the practitioner is taking the correct view of the case. Where the patient is hysterical, moral influences must be used. The patient should have plenty of occupation,

and should be impressed with the idea that recurrences of the eruption will necessitate the immediate application of bulky protective dressings. In the malingerer it will be often found that the incentive to keep up the lesions is supplied by a liberal compensation allowance. This should at the earliest possible opportunity be commuted for a fixed sum, a step usually followed by rapid amelioration. Where the fraud can be definitely proved it certainly seems that the aid of the law should be invoked, but employers rarely run the risk of the further expense in such matters. In the services, on the other hand, there are disciplinary measures which can be brought into play. J. H. S.

ERUPTIONS DUE TO ANIMAL PARASITES

The common parasites which give rise to eruptions on the human skin are the head and body louse, and the pubic or crab louse (*pediculus capitis*, *pediculus corporis* or *vestimentorum* and *pediculus pubis*); the bed bug (*cimex lectularius*); the harvest bug (*leptus autumnalis*); wood-ticks (*ixodes*); the bird-mite (*dermanyssus avium* et *gallinæ*); and the gnat and mosquito (*culex pipiens* and *culex anxifer*).

The *demodex* or *acarus folliculorum* is occasionally found in the sebaceous glands, but does not cause any symptoms in man. Larvæ of the gadfly or botfly may be deposited under the skin and give rise to furuncular or serpiginous swellings, and a few cases of "creeping eruption" supposed to be caused by the larva of a dipterous insect (larva *migrans*) of the genus *gastrophilus* have been described. There is also a minute *acarus* (*pediculoides ventricosus*) which causes grain itch, an urticarial eruption chiefly met with in those who handle straw mattresses. Various flies, bees, wasps, spiders, ants and caterpillars may also give rise to eruptions on the skin.

Tropical parasites causing eruptions include the jigger or sand-flea (*pulex penetrans*); the guinea-worm (*dracunculus medinensis*); and a filarial parasite causing craw-craw. The *cysticercus cellulosa* and *echinococcus hydatid* have been found in the skin in rare instances.

Pediculosis.—The *pediculus capitis* is two to three mm. in length, and one to one and a half mm. in breadth. It is elliptical in shape, flattened on the dorsal surface, and grey or slightly yellowish in colour with darker edges, and has six jointed legs, terminating in claws, attached to the anterior part of the body. The female, which is larger than the male, deposits ova or nits to the number of fifty or sixty along the shafts of the hairs, and these hatch out in about a week. The nits are whitish conical or pear-shaped bodies fastened to the hair by a

collar of glutinous material in such a way that they can be drawn along it without becoming detached. At the proximal end there is a lid or operculum through which the young escape.

Pediculosis of the scalp chiefly occurs in the heads of children, especially of girls with long hair, but women and even men may be affected. There may be no symptoms except the presence of the nits, which are yellowish and globular when maturing, glistening white and flat when dead or empty. The pediculi themselves are found on the scalp at the roots of the hairs, but when in small numbers they are not very easily seen, or they may have been removed by treatment, so that the nits remain as the only evidence of the disease. Often there is no itching even in severe cases, but as a rule there is sufficient irritation to give rise to scratching and the inoculation of pyogenetic organisms, followed by the impetiginous lesions and enlarged occipital glands which are commonly associated with the presence of pediculi. In neglected cases the hair may become matted and glued together into an adherent mass by exudation, pus and dirt, giving rise to a condition to which the name of "plica polonica" has been applied. In addition to pustular lesions of the scalp, face and trunk, there may be a fine vesico-papular or vesico-pustular eruption on the face or on the neck and shoulders in girls when the hair is worn long.

Diagnosis. The pediculus can scarcely be mistaken for anything else. Nits can be distinguished from scurf or scales by their shape, and by the fact that they are not easily detached and can be drawn along the hair shaft. The pustular eruption and heaped-up masses of white or greenish-brown crusts on the scalp, the enlarged occipital glands, and the presence of impetiginous lesions on the face or elsewhere make the diagnosis easy.

Eczema of the scalp is more diffuse. There is redness and the exudation is less purulent and not heaped up into thick isolated crusts. Small-spored ringworm is characterized by the presence of scaly patches and stumpy hairs; kerion is apt to be localised and the inflammation is deep-seated. In some large-spored cases the diagnosis from the impetiginous lesions accompanying pediculosis can only be made by the microscope. Pediculi and ringworm are not very commonly associated. Tertiary syphilitic lesions occur in adults and show ulceration beneath the scabs. Patches of psoriasis are dry and often circumscribed, the scales are heaped up and silvery, and lesions will be found on other parts of the body. Pustular folliculitis is rare and localised to the hair follicles.

Treatment. If possible the hair should be shaved off or cut short, but this is not essential.

The pediculi are easily killed by the continuous application of almost any antiseptic lotion or ointment. Paraffin or turpentine, or equal parts of these and soft soap or olive oil, are useful domestic remedies. Carbolic lotion (1 in 60), perchloride of mercury (1 in 1,000), or oil of sassafras are all efficacious. Oil of sassafras has the advantage of not being toxic, and, being oily, it helps to soften and remove the scabs as well as kill the pediculi. The hair is saturated with the oil or lotion, which should be left on all night under a bathing-cap or other impervious dressing. It may be necessary to repeat the process several times. The hair is then thoroughly washed with soft soap and ammoniated mercury ointment applied. The nits may be combed out with a small-toothed comb. Vinegar or acetic acid is sometimes prescribed, but it is not easy to dissolve the nits or their attachments in this way.

As pediculi and the accompanying impetiginous lesions are easily conveyed to others, affected children should be kept from school and their hats or caps and brushes sterilized or destroyed.

The Pediculus Corporis or Vestimentorum is similar to, but larger than, the *pediculus capitis*. It is chiefly found in people of uncleanly habits. Children are said to be rarely affected, and this is generally true in hospital practice, but the disease is fairly common in Poor Law and Council Schools.

The pediculus does not live on the skin, but in the seams of the clothing worn next the skin. The characteristic lesion is a minute hæmorrhagic spot caused by the blood sucked up by the pediculus. The intense itching produced by the parasite leads to scratching and the formation of small blood-crusts where the finger-nails have encountered inflamed and prominent follicles or wheals. Infection with impetiginous lesions follows.

The back of the neck and shoulders are the parts principally affected, but lesions may be found anywhere within reach of the finger-nails. In chronic cases, especially in vagrants, the affected skin becomes thickened, leathery and deeply pigmented as the result of continual scratching; a condition to which the term "vagabond's disease" is sometimes applied.

Diagnosis. The finding of the pediculus in the seams of the underclothing, especially under the neck-band of the shirt in men, is sufficient to establish the diagnosis; but when the patient has recently changed his underclothing and pediculi cannot be found, the presence of linear scratch marks on the back of the neck and shoulders, interspersed with hæmorrhagic spots, blood-crusts, and pus infections, form a clinical

picture sufficiently characteristic to prevent the condition being confused with other diseases.

The hæmorrhagic specks are distinguished from blood-crusts, which may occur in scabies or prurigo, by the fact that they are in the skin and cannot be removed by the fingers. The essential element of chronic urticaria is an evanescent wheal, and of prurigo a persistent papule. The absence of burrows and the special distribution of the lesions differentiate pediculosis from scabies. Addison's disease and other diseases causing pigmentation are not accompanied by thickening of the skin nor by itching and secondary lesions, as in pediculosis. Diabetic or renal pruritus may be excluded by examination of the urine. In cases of neurotic senile pruritus, antiparasitic treatment and prolonged observation may be required before a definite diagnosis can be made.

Treatment. Thorough cleansing of the skin with soap and water and efficient disinfection of the clothing, followed by the application of an antiparasitic ointment such as unguentum staphisagriæ or unguentum hydrarg. ammoniata, will exterminate the pediculi and relieve the itching and secondary symptoms due to scratching. Mercurial or sulphur baths are also useful, but the essential point is to remove the pediculi and ova from the clothing.

Pediculus Pubis.—The crab louse is the smallest of the three varieties of pediculi, it is shorter and broader than the head louse, measuring about one to two mm. each way. It has six jointed legs ending in claws, and also eight short feet at the sides of the abdomen. Like the body louse and head louse it is greyish in colour, or slightly yellow after feeding and engorgement with blood; under the microscope it looks dark brown. The female is nearly twice the size of the male. She lays fifteen to twenty eggs, which hatch out in about a week. The pediculus is found clinging to the hairs of the pubic region close to the skin; it may also be found on the hairs of the axillæ or on the eyelashes or beard. Sometimes it may be discovered on the hairs of the abdomen and thighs. The nits are smaller and rather darker in colour than those of the pediculus capitis and corporis, and are arranged in rows along the hairs in a similar manner. The disease is nearly always contracted during sexual intercourse, and is found in both well-to-do and hospital patients.

Symptoms. In the majority of cases there is severe itching and little spotty papules capped by a pustule or blood-crust are formed. A severe eczematous dermatitis, which may spread beyond the actual part affected, sometimes results from scratching or from the use of strong applications. Occasionally the

itching is trifling and no secondary lesions are present.

Another lesion produced by the pediculus pubis is a grey or bluish stain, the macula cærulea or "tâche bleuâtre." These stains are supposed to be due to a pigment injected by the pediculus, and were first observed in patients suffering from typhoid fever.

Diagnosis. Careful examination with a lens will disclose the presence of nits or pediculi on the hairs of the affected part. Eruptions from other causes are rare in the pubic region. In acute eczema, not due to irritants, other parts of the body are usually attacked; ring-worm has a well-defined edge and mycelium can be found in the scales; pus infection is more localised and often follicular, and primary pruritus is usually either part of a generalized attack or has its chief site in the genital organs.

Treatment. Shaving the part will at once remove the nits and pediculi, but as there are objections to this method it is better to apply a weak carbolic or lysol lotion, followed by ammoniated mercury or oleate of mercury ointment. Naphthol and balsam of Peru may also be used. Blue ointment is effectual but apt to cause dermatitis. When the pediculi have been killed a soothing application is required until the dermatitis and itching subside.

Scabies.—Scabies is caused by the *Acarus* or *Sarcoptes scabiei hominis*, a member of the spider family, which lives and breeds in the horny layer of the skin. The female is smaller than a pin's head but large enough to be visible to the naked eye. It has a rounded body and eight short legs, to the anterior pairs of which are attached four suckers, the posterior legs bearing five setæ or bristles. It burrows under the skin, in which it lives about two months and deposits about fifteen eggs. The male differs from the female in being much smaller and having suckers instead of bristles on the posterior pair of legs; it does not burrow under the skin but lives on the surface, its function being the impregnation of the female.

The disease chiefly occurs in young adults and children of both sexes. Close and prolonged contact is required for infection, which generally takes place at night when the acarus is active. Sleeping with infected persons is the commonest form of contagion, and the disease is often acquired during sexual intercourse. It is possible that scabies may be contracted from sleeping in lodging-house beds previously occupied by sufferers from the disease, but as a rule the acarus remains on the skin and not in the bedding or clothes.

An infected husband will in all probability communicate the disease to his wife, who may

in turn infect the child at her breast; older children are also liable to be attacked from nursing the child and to infect other members of the family with whom they sleep. In this way the disease soon spreads through the whole household.

Scabies also attacks the horse, dog and other animals, and may in rare instances be contracted from them.

Symptoms. The female acarus having been impregnated by the male, burrows head foremost, obliquely downwards, into the horny layer of the skin and, in so doing, forms a tunnel one-eighth to half an inch or more in length, visible on the surface as a sinuous or irregular greyish or black dotted line. This is known as the burrow or cuniculus and is pathognomonic of scabies.

At the extreme end of the burrow there is a minute elevation called the acarine eminence, in which the acarus can often be seen with the naked eye as a minute glistening body just beneath the skin. If a pin be inserted obliquely into the end of the burrow and its roof be torn up, the acarus will cling to the point of the pin and can be mounted and examined under the microscope. It is fairly easy to extract the acarus in a recent burrow uncomplicated by excoriation or pus infection, but care must be taken not to draw blood or rupture the vesicle, which is often present, for if this be done it will probably be lost in the fluid which escapes. When the acarus itself cannot be discovered, ova or faecal masses may be found.

The vesicle is usually situated just behind the acarus, and is possibly due to the action of a poison excreted by it on the cells of the rete when it reaches that layer, although the acarus itself remains in the horny layer above. Sometimes the burrow is lifted up by the vesicle and then forms part of its roof. The difference of opinion which exists as to the position of the vesicle is probably due to the fact that the acarus, having reached the deepest part of the horny layer, begins to burrow upwards again, leaving the vesicle at variable distances behind her.

The cuniculi are found on the sides of the fingers and interdigital spaces, the palms and palmar surfaces of the wrists, the elbows, anterior axillary folds, the areolæ in women, the umbilicus, the skin and glans of the penis, the buttocks, the malleolar regions and soles of the feet.

In addition to the burrows themselves, and the vesicles, pustules and excoriations with which they become complicated, certain secondary lesions are set up by scratching and pyogenic infection in their immediate neighbourhood and at some distance from them. These secondary lesions consist of scattered isolated papules, vesicles, pustules, small blood-crusts

and scratch marks. In addition to the parts already enumerated they affect the anterior surfaces of the forearms and elbows, the pectoral region, the region of the umbilicus and lower abdomen, and the anterior and inner aspects of the thighs. They are due to reflex irritation or to a poison excreted by the female acarus, or possibly, although there is no proof of this, to the peregrinations of the male over the skin. The face and scalp nearly always escape in adults, but in children at the breast a few lesions, chiefly of an impetiginous nature, may be found on these parts. In children, burrows are often found on the feet, especially on the soles, and there is a greater tendency to a widespread dermatitis or eczematization of the trunk and limbs.

Diagnosis. When the characteristic burrows can be found the diagnosis of scabies is easy and is confirmed by the finding of the acarus. In cleanly people, or in those whose work necessitates frequent immersion of the hands in water, it may be difficult to find the burrows, and in hospital patients, on the other hand, they are often so much scratched and infected as to defy recognition. As a rule the peculiar distribution on the anterior surface of the body and on the buttocks, the isolated character of the lesions, the intense itching at night, and a history of infection, will enable the diagnosis to be made. I have, however, seen cases in which itching was entirely absent. As syphilis and scabies are often contracted at the same time, care must be taken not to overlook the former, nor to mistake the induration occurring round a burrow for that of a chancre. Pediculosis vestimentorum especially affects the back and shoulders, and is characterized by the presence of hæmorrhagic spots. In urticaria there are no burrows and the elementary lesion is a wheal. Papular urticaria of children, which often closely simulates scabies, is characterized by the shotty papules in the centres of the wheals. In doubtful cases of varicella vesicles can often be seen in the mouth. Eczema tends to form a "sheet" eruption with a fissured surface and a serous discharge drying to form small flaky crusts, whereas in scabies the lesions are isolated, scattered and more pustular.

Treatment. The burrows must first be opened by thorough scrubbing in a bath with a brush and soft soap, particular attention being paid to the parts frequented by the acarus. In infants a milder soap and ointment should be used. An antiparasitic ointment, of which sulphur is the best, is then rubbed in and allowed to remain on the skin all night. This should be repeated for four or five nights in succession. A weak sulphur ointment, fifteen to twenty grains in an ounce of vaseline with a little prepared chalk, is usually efficacious. If the

ointment is too strong, or is used for too many nights in succession, a sulphur dermatitis will be set up, the itching of which may be mistaken for that of the disease; and it is advisable that a second course of sulphur treatment should be preceded by an interval of a few days, during which time soothing lotions or ointments may be applied. A useful plan is to begin with sulphur for three or four nights and follow with a two per cent. naphthol ointment, which may be used indefinitely without fear of setting up a dermatitis. It should be remembered that in all pruriginous affections itching may persist for some days after the cause is removed. Instead of sulphur, β -naphthol or balsam of Peru may be used on account of their less unpleasant smell. Sulphur baths are cleaner than ointment, but they should be preceded by scrubbing with soap, so as to open up the burrows and allow the sulphur to penetrate. Underclothing and bedding should be disinfected by fumigation or by boiling or steaming. In hospital practice the patient may be directed to wear the same underlinen day and night until it becomes saturated with the ointment, or garments steeped in petroleum may be worn next the skin.

The Common Flea is too well known to need description. It produces a minute hæmorrhage where it punctures the skin, and this is surrounded by a crimson hyperæmic areola marked off from the healthy epidermis by a narrow white line. The lesions occur especially where the folds of the underclothing, in which the ova are deposited, are in close contact with the body, such as the neck, wrists, ankles and waist.

When the hæmorrhagic puncta are numerous they simulate purpura, but the erythematous halo, distribution, itching and presence of flea-stains on the linen make the diagnosis clear.

Treatment. A few drops of chloroform may be used to kill the fleas on the body and an antipruritic lotion or ointment applied to allay the irritation. Camphor or pyrethrum powder may be worn in a bag next the skin.

The Bed Bug is a brown oval-shaped insect with a repulsive odour. It lives in crevices in wall-papers, woodwork, furniture, bedsteads, etc., or may remain in the underclothing or bed-linen.

It comes out at night and feeds on the human body, causing a hæmorrhagic puncture and large wheals. At times a general urticaria may be set up. As the bed-bug is not often found on the body during the day, the diagnosis from ordinary urticaria is not always easy.

Treatment. Any insect powder may be used, and the rooms and furniture infested by bugs should be fumigated with sulphur.

The Harvest Bug is a minute red spider-like oval acarus, one-third to one-half mm. in length, with six long hairy legs. It is met with in summer and autumn in harvest fields, grass, gooseberry and currant bushes, etc. It bores into the skin of the ankles and legs or other parts of the body, but not deeply, and can be picked out of the skin with a needle. It sets up an intense itching accompanied by urticarial or eczematous lesions.

Treatment consists in the application of weak sulphur, naphthol or mercurial ointments.

The Wood Tick is found in trees and bushes and is occasionally parasitic on man. It fastens itself on the skin and does not drop off until it is engorged with blood. A drop of any essential oil will make it relinquish its hold, and an evaporating lotion may then be used to allay the irritation set up.

The Bird Mite is a minute greyish-white parasite which infests fowls, but may reach the human skin and set up a certain amount of irritation and dermatitis.

Treatment is by antiparasitic and antipruritic lotion if required.

Gnats and Mosquitoes produce wheals accompanied by intense itching and sometimes followed by blistering and cellulitis when rubbed. Essential oils, such as oil of lavender or eucalyptus, tincture of pyrethrum or infusion of quassia, are useful as preventives, and the irritation may be relieved by ammonia and spirit, or lead lotion. Ichthyol may be painted on when the inflammation is severe.

The Jigger or Sand-Flea is prevalent among the coolies on the East Coast of Africa, and is also found in tropical America, in China and in India.

It resembles the common flea, but is smaller and has a longer proboscis. The female burrows into the skin and causes small painful tumours which may suppurate or ulcerate.

Treatment consists in killing the parasite with an essential oil and picking it out with a needle.

The Guinea-Worm is found in tropical countries and forms a cord-like swelling or a small circumscribed subcutaneous tumour or a bulla (Malcolm Morris), which finally bursts and liberates the worm and its contained embryos.

The worm may be extracted by slowly winding it round a quill or match, but as there is a danger of rupture and the escape of the embryos, it is better to kill it by douching the part frequently with water or by injecting into it a solution of perchloride of mercury.

The Cysticercus of Tænia Solium has been found in the subcutaneous tissues, where it forms pea- to walnut-sized tumours. Echinococcus hydatid gives rise to a soft semitranslucent fluctuating subcutaneous tumour, but, like

the distoma hepaticum, bilharzia hæmatobia and ankylostomum, is very rare in the human skin.

Craw-craw is a tropical disease supposed to be caused by a filarial parasite, but there is some confusion as to the etiology and symptomatology of the affection, and it is probable that the name has been applied to more than one disease.

It occurs on the West Coast of Africa, chiefly in negroes. Papular, vesicular, pustular and ulcerative lesions resembling those of scabies occur on the hands and forearms or scattered over the body, but no burrows are found. The disease is rebellious to treatment and relapses after apparent cure; hot baths and the application of salicylic spirit lotion, β -naphthol ointment and boric acid powder have been recommended. S. E. D.

SKIN DISEASES DUE TO VEGETABLE PARASITES

Under this heading are usually classed those diseases which are due to mould fungi, though of course all the bacteria are also of vegetable nature.

Perhaps the simplest way to deal with these diseases is to divide them up according to the part of the skin affected, since they present great differences both in their clinical appearance and in their appropriate treatment in different parts of the body. We have, then, to consider mycelial diseases of (1) *the hairy regions*, namely, the scalp and beard; (2) *the nails*; (3) *the glabrous skin*.

1. The Hairy Regions, the Scalp and Beard.

(a) **Ringworm**.—Many varieties of ringworm fungus attack the hairy scalp, infecting the hair shaft and the horny layer. Although there is a great number of species, these may generally be grouped under three main varieties, namely, the *Microsporon*, the *Trichophyton megalosporon endothrix*, and the *Trichophyton megalosporon ectothrix*, or ecto-endothrix, as it is now sometimes called.

Each of these types has its own clinical appearances and some of the species also show peculiarities which will be mentioned under the clinical description.

The main differences are, however, shown in the method of affection of the hair. The *Microsporon* covers the intrafollicular portion of the hair with a closely set mosaic of small round or polygonal spores and penetrates it, growing in the form of narrow oblong mycelial filaments. The cuticle of the hair is eroded and the hair shaft rendered brittle.

The *Endothrix*, although it spreads into the hair from the infected horny layer and root-sheath, and therefore must at one time be more

or less abundant on the outside of the hair, rapidly dies out everywhere but in the hair shaft itself, so that the hair, when drawn, shows no fungus on its outer surface. The inside of the hair is stuffed full of round or square elements arranged in chains, though this arrangement is often difficult to see in the heavily infected hair, and the cuticle is not eroded. The hair shaft is rendered intensely brittle, perhaps more so in this than in any other variety.

The *Ectothrix* is usually, if not invariably, associated with inflammatory symptoms, so that the hair when drawn is apt to show a swollen root-sheath. The root-sheath is full of long filaments made up of square elements wandering in every direction over the surface of the hair. This variety also attacks the hair shaft to a variable extent, but it does not erode the cuticle. The hair shaft is usually somewhat less brittle in this variety than it is in the others.

The *microsporon* is known in dogs and cats (*microsporon canis*); the *endothrix* is known in birds; the *ectothrix* is known in cats, horses and cattle, and is believed to be invariably of animal origin.

Ringworm of the scalp is practically confined to children below the age of sixteen years. It is true that it is occasionally found in the heads of adults who are attending children with the disease, and is occasionally, in the case of the *endothrix* fungus, known to persist from childhood into adult life, but this is very rare.

Clinical Types. The commonest type begins as a small scurfy patch which rapidly spreads over the scalp into a ring. The skin is sometimes faintly reddened, but not much inflamed. The hairs are attacked early and owing to their brittleness break off about a tenth of an inch above the level of the skin. Frequently almost every hair within the affected area is so broken, hence the name of *tinea tonsurans* given to the disease. After spreading to the size of a florin or five-shilling piece new patches occur round the old and the whole scalp becomes invaded. In old-established cases the ringed appearance becomes lost and the head shows a condition of widespread scurfiness with ill-nourished, irregularly growing hair. In the old cases a certain amount of immunity seems to be established, so that long hairs are found growing in the patches, but they are frequently deformed, rough and pointed, and on examination are found to be riddled with the fungus. The common fungus present is the *microsporon*, but the *endothrix* sometimes produces similar clinical appearances. If the disease spreads on to the body from the head in large rings the variety may be the *microsporon* of the dog.

A second type of invasion is by the involvement of small groups of a dozen or so hairs scattered all over the head. In some cases the

invasion of the hair is accompanied by a very heavy desquamation, so that the disease may even be mistaken for psoriasis. The search for stumps is often prolonged before one can be found, and examination of the scales reveals nothing, as there appears to be no fungus in it. Very careful examination, however, especially by turning over the scales with a pair of forceps, will reveal certain softened, distorted and broken hairs lying curled up beneath them. This type of invasion is almost always associated with an endothrix fungus. Sometimes instead of the heavy scaling the scalp is quite clean, and one only finds the groups of broken hairs, often so short that they only appear as black dots, hence the name sometimes given, "black-dot" or "bald" ringworm. At other times, again, each hair is the seat of an indolent pustule not extending deeply enough to loosen the hair in the follicle. Both these types are also associated with the endothrix fungus.

The third type is accompanied by well-marked inflammatory symptoms. These may either take the form of a centrifugally spreading pustular folliculitis with diffuse redness of the whole of the affected area but without much swelling of the skin, or there may be one or more large bluish-red, œdematous swellings standing up perhaps a quarter of an inch above the surrounding skin and offering a sense of fluctuation to the finger indistinguishable from that afforded by an abscess. Should, however, an inexperienced observer be led by this fluctuation to incise the swelling, he will be surprised to find that he only sees at the most a few separate beads of pus exuding from the cut follicles and a somewhat free discharge of serum. This last type is that which is in England usually designated *Kerion* and on the Continent *Trichophyton profundum*. In by far the greater majority of the cases of ringworm, in which the inflammatory symptoms are essential to the disease and not due to the application of irritants, the fungus present is the ectothrix, but in undoubted cases both of primary pustular ringworm and of kerion the microsporon and the endothrix have been found.

Diagnosis. Ultimately the diagnosis lies, of course, in the demonstration of the fungus microscopically, but if the eye is not trained to select the diseased hair for examination one may often miss a case. It is quite useless to pick out hairs haphazard and mount them or send them for examination. Practically one may say that all cases of patchy scurfiness of the scalp in children should be suspected of being ringworm until very careful examination has enabled one to decide that there is no invasion of the hair present. The most difficult are scurfy endothrix cases and cases of any description which have been nearly cured by previous treat-

ment, and nothing but the most careful search will avail.

(b) **Favus.**—Of favus there are two main varieties, neither very common in this country, namely, *Achorion Schoenleinii* and *Favus Quinceanum*. These two varieties differ more in their appearance in artificial culture on artificial media than in their clinical appearances. As regards the appearance of the hair, favus is at once distinguished from ringworm in that it does not render the hair particularly brittle. As a rule a favus hair can be pulled out by the roots and is apt to bring with it portions of a somewhat swollen root-sheath. Under the microscope one finds that the root-sheath is crowded with round, oval and cubical elements of the most diverse sizes and shapes. The hair is penetrated by waving mycelial elements, generally oblong in shape, but very variable both in length and thickness. In places the cuticle of the hair is split up, but in the main it is not eroded.

Clinically the disease manifests itself in one of two forms, but these two forms, although very distinct, are not, as far as I am aware, identified with the two forms of fungus respectively. The first form is what one may term the classical type of favus. In this the disease begins as a minute crust of a sulphur-yellow colour. This crust enlarges peripherally until it reaches perhaps a quarter of an inch or more in diameter. By this time the centre has sunk down so as to form a cup or "scutulum," and others form around it until the whole scalp may be riddled with the disease, though it is to be remembered that favus is a much less rapidly spreading disease than ringworm. After the disease has persisted for some time the pressure of the masses of fungus forming the little cups causes an essential atrophy of the skin and follicles, with some depressed scarring and permanent baldness. Usually, but by no means invariably, the well-developed disease is accompanied by a strong mouse-like odour. The second form consists of patches of very thick scurf of a greyish colour associated with a small amount of atrophic scarring. The patches of scurf vary in size but are often as large as threepenny pieces. In the last case of this type that I saw the child had just come over from India and had had the disease for two years. There were still only two or three patches, which had been diagnosed as psoriasis, and it was only by pulling hair out of these scurfy patches that one could diagnose the disease correctly. The fungus on cultivation proved to be of the ordinary type, *Achorion Schoenleinii*. One may lay it down as a good rule that all patches of thick scurf associated with atrophic baldness, especially in children, should be suspected of being favus. One must also re-

member that favus, unlike ringworm, has little or no tendency to die out on reaching adult life.

Diagnosis. The diagnosis of the typical variety of favus offers no difficulty to any one who has seen the disease before. The striking appearance of the scalp, dotted over with concave cups of a bright sulphur colour, the presence of atrophic scarring and the peculiar odour will reveal the nature of the disease at once. In the atypical form, where merely thick crusting is present, the diagnosis is only to be made by means of the microscope, and since there are no "stumps" in favus one must select a bunch of hairs growing from the centre of the crust, when the fungus will be easily found coursing up the hair shaft and ramifying in the root-sheath.

Ringworm of the Beard.—Although in very rare instances the microsporon has been described in the beard it may be said that practically all the cases are due either to an ectothrix or the violet endothrix. Clinically the disease falls into two types. In the first the fungus gives rise to severe inflammatory reaction from the beginning. There are one or more large swellings varying in size from that of a pea to a large gooseberry, of a dusky red colour, and not unlike gummata in appearance. Careful examination shows that the hair is broken and irregular over these patches, and sometimes a small amount of pus may be seen oozing from the follicles. The hair may be very difficult to extract, owing to its being broken off so short, but if one is successful it will be found that the shaft is stuffed with short mycelial elements which may also be seen ramifying on the root-sheath and in any pus that may have been mounted with the hair. This variety is due to an ectothrix fungus.

In the second variety the symptoms are much less inflammatory. Circular patches of various size are seen scattered over the chin, throat and cheeks. These patches are pink in colour but hardly at all swollen. There is a fine ring of scales at the edge of each and the free edge of the scale points towards the centre of the patch. The hair is broken off very short within the ring of scales, but if one can be extracted it will show a shaft packed with square or round mycelial elements and the root-sheath is found free from the fungus. The variety present is the violet endothrix.

Treatment. The treatment of ringworm and favus of the scalp and beard, being on similar lines, will be dealt with together.

For rapidity, certainty and painlessness the X-rays easily hold first place. It is not within the scope of this article to go into detail as to the technique, but it may be said that Adamson's method should always be applied in exten-

sive scalp cases, and may be adapted to the face in beard cases, with some modification. It should be always remembered that the rays do not kill the fungus, but merely remove the hair, so that the case becomes one of superficial infection with which one can deal easily. The whole area must, however, be kept under some antiparasitic remedy which will kill out the surface fungus and prevent that shed with the hairs from spreading the mischief. For this purpose Sabouraud advises a dilute alcoholic tincture of iodine, but I prefer greasy applications, and a weak white precipitate or salicylic acid ointment will do all that is desired.

Next in value after the X-ray treatment is undoubtedly that by croton oil, but as this must necessarily be handled by the expert, it is difficult to see how it can be necessary now, as, if the patient is able to command the croton oil treatment, he will be almost certain to be able equally to get the X-rays.

If neither of these methods can be used one is thrown back on the use of irritating antiseptics, which may in time cause the shedding of the diseased hair, for it is an axiom in the treatment of ringworm that it is out of the question to attempt to kill the parasite within the hair, and all diseased hair must be shed in order to bring about a cure.

Such methods are the daily application of equal parts of common salt and vaseline followed by frequent bathing with hot water, the daily inunction of twenty per cent. copper oleate ointment, the official ointment of nitrate of mercury, chrysarobin ointment—which must be used with great care on account of the risk of conjunctivitis—or, lastly, an ointment with which I have recently had some success containing a drachm of benzoic acid and half a drachm of salicylic acid to the ounce. All these ointments, however, frequently fail in their action, and I know of no method other than the X-rays and croton oil by which one may set a definite term to the length of treatment.

Finally comes the important question: When is a case to be regarded as cured? In the X-ray method the head is quite bald for a considerable period, and when the new hair is once seen to be beginning to grow satisfactorily the case may be signed up with confidence, but by all other methods it is necessary to stop the treatment for a month and watch carefully for the appearance of small scaly patches or stumps, and this needs a great deal of care and experience. No case of ringworm should ever be signed up as cured while there is still a scaly condition of the scalp.

2. Ringworm and Favus of the Nails.—Both of these diseases are somewhat rare, the latter extremely so. The symptoms of ringworm of

the nails are a thickening of the posterior fold, a marked hyperkeratosis of the nail bed, and a distorted, buff-coloured and friable condition of the nail plate. The fungus present is generally an endothrix. In favus bright yellow patches are present in and beneath the nail plate.

No differential diagnosis need be given from the clinical point of view, as careful microscopic examination is the only reliable method.

Treatment. The nails must be removed under either a local or general anæsthetic, taking every care to get away the last fragment of the friable plates, and the base should then be dressed with chrysarobin ointment, to which five per cent. of salicylic acid may be added. This application should be made daily under a rubber finger stall, packing the ointment beneath the posterior fold as far as one can get it. The dressing should be continued until the new nail is seen to be growing up, when if it is still diseased it must be again removed and the treatment repeated. It is an extremely resistant disease and I have found the X-rays useless even in high doses.

3. Ringworm of the Glabrous Skin.—Three main types may be described, namely, large red rings with a scaly margin and the scales pointing their loose edges inwards, generally due to an endothrix or a microsporon of cat origin; large areas of cushion-like inflammation and pustulation of the lanugo hair follicles (so-called agminate folliculitis), generally due to an ectothrix from the horse; and ringworm of the folds of the groin, toes and fingers, due to the epidermophyton inguinale. The first may be mistaken for other scaling diseases, such as some of the seborrheides, but the circles are more perfect in ringworm and the examination of a scale will easily decide the question. The second form may be mistaken for an œdematous eczema, but again the perfectly circular outline of the patch, combined with pustular inflammation of the follicles, should at once lead to microscopic examination. The third variety in its typical situation offers no great difficulty, but when affecting the hands and feet presents such unusual appearances that it is not commonly recognized. In the groin it produces a spreading red dermatitis with a perfectly definite margin, like a curtain on the inner side of each thigh.

The margin may be either scaly, with the free edges of the scales pointing inwards, or may be beset with fine pustules or vesicles, from which the fungus may be easily gathered. Itching is usually intense and in some patients inflammation is severe.

On the hands and feet the epidermophyton

may set up either an acute bullous eruption exactly resembling that of acute eczema, or an intertriginous eczema of the fingers and toes, the eruption leaving off at the heads of the metatarsals, or it may give rise to a widespread hyperkeratotic eczematoid eruption all over the palms and soles.

Treatment. The superficial types offer no particular difficulty. They may be treated with chrysarobin ointment, with salicylic acid three per cent. and benzoic acid five per cent. in an ointment, or with iodine pigment, and they usually disappear in a few days.

The agminate follicular type is more resistant, and either fomentation with perchloride of mercury (1 in 2000) may be used or chrysarobin. The epidermophyton infections are particularly obstinate. I find that chrysarobin ointment or the salicylic and benzoic acid ointment is the best application, but great care must be taken in the case of the hands and feet to get away as much as possible of the thick horny layer in order to let the drug reach the parasite. Some of these cases have persisted for years undiagnosed.

Two other fungus diseases need a few words of description, namely, *pityriasis versicolor* and *erythrasma*, both of which, especially the latter, give rise to so little discomfort that they are often only discovered accidentally.

Pityriasis versicolor occurs as small buff-coloured macules, chiefly situated on the chest and shoulders, but sometimes running down the arms on to the hands. On scratching the macules a scale is easily raised, and if this be examined under the microscope small short angular mycelial elements accompanied by bunches of spores will be seen. The fungus (microsporon furfur) is so plentiful that it is very readily found, yet, curiously enough, it is extremely difficult to cultivate outside the body and is only with difficulty inoculated from one patient to another.

Erythrasma occurs only in the groin and rarely in the axilla. It has the same distribution in the groin as the groin ringworm, forming curtain-like patches on the inner side of each thigh. The colour is, however, of an indolent reddish brown and scaling is not very marked until the eruption is scratched, when a fine powdery desquamation occurs. The parasite (microsporon minutissimum) can only be seen by staining and examining with a high power. It is extremely difficult to grow outside the body and is not very contagious. Either of these diseases can be easily cured by the persistent use of a weak (three per cent.) salicylic acid ointment.

A. W.

DISEASES DUE TO MICRO-ORGANISMS

A.—INFECTIONS DUE TO STAPHYLOCOCCI

UNDER this head are included carbuncles, boils and furunculosis, follicular impetigo and sycosis.

Carbuncles—For these *v.* the surgical portion of this work.

Boils and Furuncles are so well known to the medical and even to the lay public that a formal description is unnecessary. The chief distinction between the two is that boils are usually single, while furuncles are smaller and appear in crops. Both may conveniently be considered together. Although they occur often enough in subjects otherwise healthy, it is well established that certain conditions, for example, glycosuria and albuminuria, conduce towards their development, and they not infrequently are to be observed as a sequel to one of the exanthemata. They also occur as complications of any skin eruption which is attended by discharging surfaces or in which the skin is injured by vigorous scratching.

The treatment of these lesions is divided into two parts, local and general. The local treatment is by far the most important. If the boil be seen early, abortive measures may be tried. A favourite method is the injection of a drop of pure carbolic acid. This is painful. A less painful method is the use of Unna's mercury carbolic plaster mull. A varnish has been introduced, under the name Vernisol, of mercury and carbolic acid. This is sent out in a collapsible tube, whence it may be squeezed and spread over the surface with the finger. It soon dries to form a thin film. This is a very convenient way of applying these medicaments. Even if complete absorption is not obtained the area of suppuration is limited and rupture is accelerated. In no case, however, should a boil be allowed to burst spontaneously, but as soon as it is certain that pus is present it should be let out through an incision of suitable size, and the interior swabbed out with carbolic acid. The expression "suitable size" is used not without reason. There is seldom need for a cut more than a quarter of an inch long, and upon exposed parts such as the face, where cosmetic considerations are of importance, great care must be taken that the incision is not longer than absolutely necessary. The best after-treatment is to keep the wound covered with a dry gauze dressing, which is to be changed frequently, and each time the part should be washed with weak (1 in 4000) biniodide of mercury solution in order to diminish the risk of auto-infection. If the part affected be

hairy, *e.g.* the back of the neck, it should be shaved, for the discharge sticks to the hairs and, travelling downwards, infects fresh follicles. Above all things poultices and fomentations are to be avoided, for they afford splendid culture media for the organisms and increase the risk of auto-inoculation.

Internal Treatment. Under this head are comprised measures directed towards improving the general condition of the patient and increasing the resistance to infection. First and most important of all is attention to nutrition and the placing of the sufferer under proper sanitary conditions. Weakly children are often wonderfully benefited by cod-liver oil and malt. A time-honoured remedy is brewer's yeast, given in doses of a teaspoonful twice daily. Probably the best of all methods of increasing the patient's resistance is the administration of a vaccine. In fact, vaccine therapy met with its first and most striking successes in the treatment of boils and furuncles. Of late there has been a growing tendency to increase the dose given. At one time as small a quantity as half a million dead staphylococci were given, but now an initial dose of fifty million is usual, and it may be increased subsequently to as much as a thousand million. Stock vaccines may now easily be obtained, and it is well established that in dealing with staphylococcal infections good results may be obtained with these, but it is probably better to have the vaccine especially prepared from the patient's own organism.

Sycosis or follicular impetigo of the beard region is the most obstinate of all forms of septic eruptions of the skin. It results almost invariably from the introduction of infected material during shaving. Contrary to the popular idea, it is the brush and not the razor which is usually at fault. Very occasionally a case is seen, however, in a man who has never shaved at all. Once well established it may last for years. The microbes penetrate deeply down the hair follicles, where they are almost inaccessible to ordinary antiseptics. The main principle of treatment, therefore, is to produce epilation over the affected area. This is best done by means of the X-rays. To produce epilation of the face a full pastille dose of rays must be given, slightly more than would be sufficient to produce epilation on the scalp. Within a day or two of administration of the rays there is usually an aggravation of the inflammation, and of this the patient should be warned. Epilation should take place at the end of a fortnight. Both during the period of

waiting for epilation and after it has taken place the surface should frequently be bathed with weak antiseptic solution and dilute mercury ointment should be applied. Even if every care and precaution be observed, in some instances, nevertheless, relapses will be found to occur. In some cases, where secondary eczema is the most conspicuous feature and follicular pustules are scanty (such cases are usually of very long standing), it is expedient to give the X-rays in doses insufficient to cause epilation. The inflamed surface will react powerfully to the stimulation at first, but subsequently resolution occurs, with permanent improvement. When X-rays are not available epilation by means of forceps must be practised; this is tedious and painful, but with perseverance effective. Treatment of this condition by means of vaccines has been often tried of late and in a few examples successfully, but frequently it yields no satisfactory results. The same rules are to be observed in using vaccines for sycosis as in other staphylococcal infections.

H. D. D.

B.—INFECTIONS DUE TO STREPTOCOCCI

Erysipelas, *v. surgical section*.

Impetigo.—This exceedingly common eruption is produced by the streptococcus. The primary lesion is a tiny vesicle which forms beneath the skin. This bursts and the exuded serum dries into a yellow scab. The disease spreads both by direct extension of the original lesion and by auto-inoculation in fresh situations. Auto-inoculation is caused by rubbing with the fingers and arises from the dried discharge which sticks to the clothes. Extension is extraordinarily rapid, and an outbreak starting in a single spot may cover the whole face within a week.

Impetigo is far commoner in children than in adults, owing to the greater delicacy of young skins, whereby inoculation is more easily brought about. It is frequently associated with septic discharges from the mouth, nose or ears, and is a constant concomitant of all irritative conditions such as pediculosis, scabies or lichen urticatus. It is chiefly in connection with these that impetigo appears upon the trunk and limbs, otherwise it usually is seen upon the face and scalp. The diagnosis is almost always easy, the scabs, the rapid extension, the tiny outlying phlyctenules are the signs whereby it may be recognized. In infants it is sometimes difficult to distinguish it from eczema, but points to bear in mind are, that while eczema attacks the prominent parts of the face, such as the forehead, cheeks and chin, impetigo starts at the corners of the mouth or near the nostrils and ears. As a rule the real difficulty is to make

sure that impetigo is the sole condition with which one has to deal. It is of little avail to treat the impetigo which complicates scabies or pediculosis without attacking those affections themselves.

Treatment. Fortunately the treatment of uncomplicated impetigo is at once simple and effective. The only measures necessary are to bathe off the scabs at frequent intervals, and then to apply a *weak* antiseptic ointment. That recommended by the writer is ammoniated mercury gr. x made up with vaseline to the ounce. Another favourite formula is the so-called ung. metallorum, which consists of plumbi acetatis gr. x, zinci oxidi gr. xx, calomelanos gr. x, ung. hydrarg. nitrat. dil. ad 3i. When the trunk and limbs are affected it is advisable to order frequent changes of underclothing, which soon becomes soiled by the discharge. To infants' baths should be added a dessert spoonful of boracic acid crystals. Internal medicines have no effect upon impetigo, but weakly children should have their general health attended to on the usual lines. There are one or two varieties of impetigo which deserve special mention.

Pemphigus Neonatorum.—This is a form of impetigo which attacks infants within the first few days of life, and is characterized by the formation of bullæ rather than vesicles, hence the name. It is a serious condition; according to Sequeira, the death rate is no less than 30 per cent. Treatment is to be conducted upon the usual lines, but the babies should always be made in-patients if possible.

Chronic Impetigo.—In this category are to be included the scaly patches found about the upper lip and nose of infants suffering from nasal discharge and below the ears in cases of chronic otorrhœa; also the fissures which occur behind the ears and in the vestibule of the nose. Around these fissures there is often a certain amount of parakeratosis, the condition the French call "*perlèche*." In treating these it is often advantageous to add salicylic acid gr. v or x to the ounce of dilute mercury ointment. The fissures are extremely persistent, and may require to be ionized; good results are obtained with zinc ions. In adults the only form of impetigo which requires special mention is impetigo of the beard region. This is important, because if allowed to persist a condition of sycosis is sure to become engrafted thereon. In addition to the ordinary treatment it is important not to discontinue shaving. Before and after shaving the beard should be dabbed with a weak antiseptic solution in order to remove infective discharge lying adherent to the hair and skin, and thus to diminish the risk of auto-inoculation.

H. D. D.

C.—ACNE

Under this term are included three different skin eruptions, of which the only characters in common are that they occur on the face and that the sebaceous glands are affected. They are known respectively as *acne vulgaris*, *rosacea*, and *varioliformis*.

Acne vulgaris occurs with great frequency in either sex from the age of puberty onwards. The essential lesion is the "comedo" or "blackhead," which is present in every case, although it is often inconspicuous on account of the great development of pustules and furuncles. Such cases are described as *acne indurata*.

Acne rosacea is a disease of later life than *acne vulgaris*, and is often associated with some deeper-seated condition, such as indigestion or alcoholism. The primary lesion is a dilation of the capillaries of the face. The sebaceous glands are affected only secondarily, and when inflamed papules and pustules arise from their implication the general appearance is not unlike that of a bad case of *acne vulgaris*.

In *acne varioliformis*, which is comparatively rare, the eruption always starts near the margin of the scalp, and tends to spread backwards into the hair. The primary lesion is an inflamed papule. This undergoes slow necrosis, forming an ulcer which ultimately heals, leaving a pale depressed scar like that of a small-pox pustule; hence the name.

Treatment. In *acne vulgaris* it is most necessary to remember that the skin is invariably too rich in fat; we must therefore do all we can to remove the excess of this element, and for that purpose there is nothing like soap and water. The patient should be directed to steam the face over a basin of hot water for ten minutes every evening, and then to wash it vigorously with a flannel for at least five minutes. It is of secondary importance what soap is used, provided that it is applied with vigour, but it is advantageous to use one that contains ether, such as the following—

Sapo. Mollis \bar{z} ii
Etheris \bar{z} i
Sp. Vini Recti. \bar{z} i.
Ol. Ros. \mathbb{M} ii.

or, if this causes smarting, one that contains spirit only—

Sapo Mollis \bar{z} ii
Sp. Vini Recti. \bar{z} i
Tinct. Lavandulæ Co. q.s.

This forms quite an elegant preparation. It is sometimes more convenient to prescribe a solid soap. In that case we may select one of the formulæ suggested by Prof. Unna or Dr. Eichhoff. These are made by Messrs. Beiersdorf. One of these containing sulphur or sulphur with salicylic acid and resorcin should be chosen.

After the steaming and soaping process has been carried out the face should be treated with a lotion. Sulphur is the basis of all acne lotions and the following is the simplest formula—

Sulphuris Precip. \bar{z} ss
Sp. Camphoræ \bar{z} ss
Aquam Calcis ad \bar{z} i.

To this half a drachm of resorcin may often be added with advantage, especially if there are many small pustules.

Or it may be combined with salicylic acid, as in the following recipe—

Sulphuris Precip. \bar{z} iv
Acidi Salicylici \bar{z} ss
Sp. Vini Recti. \bar{z} ii
Aquam ad \bar{z} viii.

Another method of applying sulphur is in the form of a paint to be left on all night—

Sulphuris Precip. \bar{z} iii
Spir. Vini Recti. \bar{z} i ss
Glycerin \bar{z} i ss.

Or again, it may be made up into a cream according to Hebra's prescription—

Sulphuris Precip. }
Glycerini }
Sp. Vini Dil. } $\bar{a}\bar{a}$ \bar{z} iii.
Potass. Carb. }
Æther }

When the skin is thickened and indurated more drastic measures are necessary, and a paste may be applied in order to produce exfoliation. For example—

Resorcin \bar{z} i
Sulphur gr. xl
Vaseline ad \bar{z} i.

If this be put on at night and washed off in the morning for a few nights, the face will peel. When the skin recovers the acne will be found much benefited. After an interval, the process may be repeated. Pustules should be dealt with by opening them with a small scalpel and applying to their interior a drop of pure carbolic acid on the pointed end of a match. This is somewhat tedious, but has good results. Finally we have the X-rays, which exercise a great effect in damping down excessive activity of the sebaceous glands, and hence are beneficial in obstinate acne. Care, of course, must be taken that they are not used in excess. The dose must always be controlled by means of a Sabouraud pastille, while the eyebrows and scalp must be carefully protected. Half a full pastille dose at intervals of a fortnight should be sufficient for any single area, nor should more than three sittings be given without a rest of a still longer duration. Sometimes the use of X-rays in full doses leads to a trouble-

some pigmentation which persists for some months.

Of vaccines the present writer is unable to speak in terms of any great commendation. Anti-staphylococcal vaccination is sometimes useful, but we have not seen any cases which have failed to respond to the more ordinary methods of treatment improve much with vaccines. Many of the cases reported as successfully treated with vaccines have simultaneously been subjected to the older therapeutical methods, and who shall say to which the credit has been due?

As regards the internal treatment of acne vulgaris the only important points are to keep the bowels well open and to limit the ingestion of fats and pastry.

In acne rosacea, on the other hand, the internal treatment is of great importance. It is most essential that the underlying cause should be detected and treated. This may be gastric or intestinal, while pyorrhœa alveolaris or chronic pharyngitis, or even some pelvic disorder may be the real *fons et origo mali*. Whatever may be the appropriate treatment for the condition in question, the use of alcohol and of hot spicy foods must be forbidden. The internal administration of ichthyol in five-grain doses three times a day is often recommended. Locally much may be done to relieve the unpleasant sensations of burning and irritation. A cooling cream may be prescribed, *e. g.*—

Zinci Oxidi ̄ i	
Lanolini ̄ i	
Aquae Calcis	} āā ad ̄ i.
Ol. Olivæ	
(or Ol. Amygdalæ)	

It may be perfumed with oil of rose geranium.

Employing the above as a base, we may prescribe ichthyol ̄ ss in combination therewith. This is perhaps more effectual, but does not make such an elegant preparation.

If the patient has been or is still the subject of acne vulgaris in the past, it is better to eschew fatty preparations and to use a lotion.

For example—

Zinci Oxidi ̄ s	
Glycerini ̄ i	
Aquam Rosarum ad ̄ i	
or,	
Zinci Oxidi ̄ ii	
Calaminæ Prep. ̄ ii	
Ligni Plumbi Subacetat ̄ i	
Glycerini ̄ i	
Aquam Calcis ad ̄ i.	

The chief complications of rosacea are pustules and persistent papules.

If much inflammation and pustules are pre-

sent it is best treated with the simple sulphur lotion mentioned above.

Inflamed papules may be removed by the sulphur and resorcin paste if present in large numbers, but single ones may be conveniently dealt with by pressing them for about twenty seconds with a pencil of solid carbon dioxide. This substance can now easily be obtained in cylinders. On opening the cylinders the gaseous carbon dioxide escapes and may be caught in the solid form in a towel, and formed into a pencil of suitable size by means of a mould. Sets of moulds are sold by many instrument-makers; but elaborate and expensive apparatus is unnecessary. Acne varioliformis may always be treated successfully for the time being by means of sulphur lotion or a weak mercurial preparation. Again we refer to the formula given above for a dilute mercurial ointment, *e. g.*—

Ung. Hydrarg. Nit. gr xx
Paraffin Molle ad ̄ i.

Treatment must, however, be prolonged, as there is great tendency to relapse. H. D. D.

AFFECTIONS PROBABLY DUE TO LOCAL MICROBIC ORIGIN

This title being a wide one, must be dealt with on broad and elastic lines. To begin with it is necessary to state that there are many gaps to be filled up from the etiological point of view. In addition to the qualification "probable," another in the shape of the word "possible" will be convenient.

In the first place, there are some observers who favour a local microbic origin for Psoriasis. There is something to be said for this view. Generalization in psoriasis is frequently preceded by the appearance of one or two patches, which may remain localised and be present for varying intervals, some months in some cases, before fresh eruptive elements break out in other parts of the body. The assumption is that local infection of the skin occurs and after a period of incubation the hypothetical organism finds its way into the circulation. Other observers, though in favour of an organism, do not insist on the primary local origin of psoriasis. Others, again, reject the microbic nature of the disease and support a nervous etiology. There is no doubt that psoriasis requires a suitable soil to enable it to develop, and, further, experience of a large number of cases shows that a neuropathic element is often present. As to the organism, it may be pointed out that we have not yet discovered the organisms of the acute exanthemata, and it is only very recently that the spirochæte pallida has been demonstrated in syphilis. The microbe of psoriasis may be ultra-microscopical. At

any rate, although searched for, it has not been discovered. As to the primary local origin, the early patch or patches, it may be objected, may be produced from within. One point as to treatment, however, is that the early or primary patch or patches should be thoroughly dealt with and got rid of if possible.

There is another disease, *Pityriasis Rosea*, which starts with a primary or herald patch. Here, again, the question arises as to whether we are dealing with a local microbic origin or with a disease from within manifesting itself in the first instance in the shape of a preliminary lesion.

In the condition known as *Dermatitis Gangrænosa Infantum* a local origin has been adduced; the bacillus pyocyaneus, for instance, has been looked upon as the cause in some cases, at any rate. I have myself seen typical gangrenous lesions about the buttocks of a child, the patient developing paralysis of the palate, followed by inability to stand up, and paralysis of the diaphragm, death ensuing. The theory was that the gangrenous lesions were probably of diphtheritic origin, a point to bear in mind. The lesions of *dermatitis gangrænosa infantum* may arise as a complication of the eruption of varicella. Treatment in a general way consists in injecting one in thirty carbolic acid at several points just at the margin of the lesions—a cordon sanitaire—and dressing with sterilized gauze. This I have found efficient in several instances. But it is as well to search for an organism with a view to vaccine treatment, and if necessary to administer antitoxin, should the micro-organism of diphtheria be found.

In some forms of *Pemphigus*, such as *Pemphigus Acutus* and *Pemphigus Vegetans*, a local microbic origin must be sought for. There is a form of *Acute Pemphigus* which I have described as occurring in butchers and those handling animal products, and which I traced to a wound of the finger. The prognosis is very bad, most cases terminating fatally and rapidly. If a microbe can be isolated, vaccine treatment may be of service. As to *Pemphigus Vegetans*, this appears to develop as a result of a local infection. In one case running a splinter under the nail, and in another burning the finger end with sealing-wax, have been noted in the histories. There is every reason to believe the infection occurred as a result of such accidents, though the usual rule is for this disease to originate in the mucous membranes of the bucco-pharynx. In one case I obtained a pure culture of *B. pyocyaneus* from the contents of a bulla. In another case I have recently found a diplococcus, but I regret to say the vaccine treatment failed to save the patient. That should, however, be the line to take. I have

also suggested lumbar puncture as a mode of treatment, and, of course, an examination of the cerebro-spinal fluid obtained.

Botryomycosis, as well as fungating vaccination lesions, and hypertrophied scars, are all in my opinion due to infection by staphylococci.

In passing, I would mention *Hospital Gangrene* and *Noma*, which Vincent considers are the result of infection by the spirilla and the fusiform bacillus he has described.

In *Lichen Circumscriptus*, or *névrodermite chronique circonscrite* of French writers, an attempt has been made to prove a streptococcal origin. Of course, in all chronic cutaneous morbid conditions, secondary microbic infections of various kinds (including yeasts and so forth) must be remembered. The skin is so exposed to accidental infections, especially when there are exuding surfaces or the parts have been damaged, that it is not surprising many complications may arise. G. P.

GRANULOSIS RUBRA NASI

Definition. A disease characterized by persistent hyperidrosis, associated with erythema of the skin covering the tip and the cartilaginous portion of the nose. It is accompanied by the appearance of small vesicles or epidermic cysts and the occasional formation of small inflammatory papules.

Etiology. The disease is one of childhood; it may occur in early infancy. It tends to disappear about the age of puberty, though a case has been described as occurring in adult life associated with hydrocystoma. It affects both sexes, and there is a tendency for cases to occur in family groups.

The immediate cause of the affection is not clearly understood, but it has been noted that the patients who develop this disorder frequently suffer from a stagnatory peripheral circulation, with coldness and blueness of the extremities, and that members of the family may be affected by hyperidrosis and even hydrocystoma.

Morbid Anatomy. Microscopic examination of the skin shows a slight degree of dilatation of the vessels of the superficial plexus of the skin, with a small amount of cellular infiltration, consisting mostly of mononuclear cells, in the neighbourhood of the vessels and of the ducts of the sweat glands. There is a tendency to induration of the skin, the result of the formation of new fibrous tissue, predisposing to the development of small retention cysts of the sweat glands or ducts (hydrocystoma).

Symptoms. The most noticeable symptoms in the disease are the slight persistent redness of the tip and alæ of the nose, which in some cases may spread to the cheeks or even the forehead. In addition to the redness the point

of the nose is usually cold, and dotted with beads of sweat. In the course of the disease small inflammatory papules show themselves round the orifices of the sweat ducts, which, at first red, become brown and covered with a small crust. Small cysts may also be seen, covered by a few layers of the thick epidermis of the part, or there may be superficial vesicles. Discomfort from over-sweating, or a feeling of coldness and tenderness of the nose may be complained of, but little other local disturbance is noted by the patient. In many cases the localised hyperidrosis is all that can be seen; children so affected develop neither granules nor redness of the nose.

Treatment. Local cleanliness and gentleness in dealing with the slightly irritated skin is, as a rule, all that is necessary. The use of a dusting powder during the day containing small proportions of an astringent, such as tannic acid or tannoform, followed by a mild sulphur-resorcin salve at night, is recommended. Encouraged by the use of X-rays in hyperidrosis, very mild application of X-rays has also been made use of in the treatment of this disease, it is said with good results. The utmost precaution must be taken in using X-rays in such cases.

H. J. D.

TUBERCULOSIS OF THE SKIN

An ever-increasing number of diseases of the skin are ascribed to the action of the tubercle bacillus. In some of these diseases the demonstration of tuberculous causation has been rendered complete by the finding of tubercle bacilli in the tissues, or by the positive result of inoculation of the morbid tissue into susceptible animals, such as the guinea-pig. Both these tests may be regarded as final. In some diseases the assumption of their tuberculous nature rests on clinical grounds, or is rendered probable by their behaviour to one or other of several tests which cannot be regarded as of equal weight with the two fundamental findings cited, but which, nevertheless, are strongly suggestive of this causation. The tests which are chiefly used are as follows—

1. Reaction to the old tuberculin of Koch.

The late Sir McCall Anderson was a strenuous advocate of the use of old tuberculin, both for diagnosis and treatment. For diagnosis $\frac{1}{4}$ to 1 c.c. of 1 in 1000 solution is used; reaction to these doses, shown by rise of temperature, establishes a probability of tuberculosis. Before relying on negative results the dose should be repeated. (2) Von Pirquet's test. (3) Calmette's test. (4) Moro's test. These are all performed with dilutions of old tuberculin.

2. *Von Pirquet's Test.* The solution used is made up as follows—

Old Tuberculin 1

Five per cent. Phenol in Glycerine 1

Normal Saline Solution 2.

The skin is scarified (as in vaccination) through a deposit of two drops of this solution upon its surface. A small red papule will generally show itself in twenty-four to forty-eight hours. The inner side of the forearm is a convenient site for the test, which is especially valuable in young children.

3. *Calmette's Test.* The dried tuberculin is dissolved in distilled water (*not* glycerine) to make a .5 per cent. solution, of which two drops may be put on the conjunctiva. Severe conjunctivitis develops in tuberculous patients within twenty-four to forty-eight hours. This test is not free from risk to the eye, and has fallen into disuse in consequence of some accidents.

4. *Moro's Test.* An ointment made of—

Old Tuberculin 1

Lanoline Anhyd. 1

is rubbed into the skin of the upper arm with a glass spreader over an area of four square inches for half a minute. In positive cases small papules or pustules appear on the anointed surface within forty-eight hours. A control test with lanoline alone should be done on the other arm. Moro's ointment may also be used to identify doubtful tuberculous sites; for these become swollen and reddened when the ointment is rubbed into them.

Histological type of tuberculous lesions of the skin.

The so-called tuberculous nodule consists of an isolated mass of cells arranged in zones, usually with some giant cells in the centre, surrounded by epithelioid cells, which are in turn bounded by a zone of lymphocytes and plasma cells. Elastic and connective tissue are not found in the nodule, but surround it, and in a measure fence it in, as it were. Bacilli, when present, are generally found in the centre of the nodule or within the giant cells.

Clinical reasons for assuming cutaneous tuberculosis, e.g. the presence of other tuberculous symptoms, the existence of hereditary or family disease, and the duration, aspect and indolent course of the disease, are less reliable indications, but in combination with others strengthen the presumption of tuberculosis.

Darier proposed in 1896 a nomenclature which has been largely adopted—and sometimes erroneously interpreted—based on the convention that diseases which satisfied the first two tests, viz. the presence of bacilli and positive results of inoculation, should be called *tuberculoses*; and all other diseases in which there was an assumption, but not this definite proof, should be provisionally called *tubercu-*

lides and regarded as cases of attenuated tuberculosis. Unfortunately the similarity of the word tubercule to syphilide has suggested the use of the term for any tuberculous eruption of the skin, just as syphilide means any syphilitic eruption. This confusion should be avoided and the meaning restricted to that intended by its inventor.

I.—Tuberculoses

Clinical varieties of tuberculosis of the skin in which the demonstration of causation by tubercle is complete.

Lupus Vulgaris.—This is the commonest of all the diseases ascribed to tubercle. The early lesion typical of this variety, the so-called "lupus nodule" or tubercle, the "apple-jelly" nodule, may occasionally be visible to the naked eye, but is more often overlaid by the general inflammation and induration of the parts; even in such cases, however, the separate nodules may be rendered conspicuous by pressure on the surface with a flat glass slide, by which the superficial blood-vessels are emptied and the nodules appear as small, discrete, buff-coloured deposits. This is known as the diascopic test for lupus and is very useful. The tubercular infiltration, if present alone, is usually indolent and dry, but frequently there is a mixed infection, often by the streptococcus, in which case there may be rapid ulceration and loss of tissue. These conditions correspond to the old division of lupus into two varieties known as lupus non-exedens and lupus exedens; the secondary infection in the latter case should be ascertained, as treatment with an appropriate vaccine will often change the character completely. (See below, *Treatment*.)

Lupus is most frequently seen on the face and the extremities exposed to cold, the fingers, nose and ears; it may occur, however, on any part of the integument or mucous membranes but is very uncommon upon the scalp, the palms and the soles. The disease is usually derived from external inoculation and the lesions are few in number, though large areas may be ultimately involved in the slowly-increasing inflammation. Another type, called disseminated lupus, is seen very frequently after measles in children; it is a comparatively rare form, and must be assumed to be due to a general systemic infection spread by the blood-vessels. The foci in the skin may be very numerous and closely resemble some forms of tuberculides, but they show the typical lupus nodule and give the reaction of tuberculosis.

Tubercular Gummata.—These are hypodermic circumscribed nodules which usually suppurate indolently with little or no inflammation, causing so-called "cold abscesses." They occur chiefly in debilitated children, are few in

number and their nature can be proved by the evacuation of a creamy "laudable" pus on deep incision.

Verrucose Tuberculosis of the Skin.—Two varieties are included under this description:—(1) *The post-mortem wart*, which is a mixed infection as a rule, with tubercle predominating, is usually single, and situated on the hands, and (2) *multiple warty growths*, constituting a warty form of disseminated lupus, and probably derived from a systemic infection.

Tuberculous Ulcers are more commonly found on the mucous membrane, especially that of the tongue, than on the integument, but may also affect the skin, especially in phthisical and so-called scrofulous patients.

Lupus Erythematosus.—Lupus erythematosus is by many regarded as a tuberculous disease and classed with the tuberculides. The majority of modern writers (and I agree with their view) dispute altogether the tuberculous causation of lupus erythematosus. But there is a rare type of disease, known as lupus erythematosus which closely simulates lupus erythematosus, but is really a superficial but true lupus. Its differentiation from lupus erythematosus can only be made by the laboratory tests described above; in lupus erythematosus bacilli are never found, and inoculations from diseased tissue do not produce tuberculosis in guinea-pigs.

Treatment. In the great majority of cases tuberculosis of the skin results from local inoculation with tubercle bacilli, which are often localised to the site of invasion for indefinite periods, so that the opsonic index to tuberculin may be normal in cases of undoubted lupus. This local character of the infection justifies local remedies, and excision, warmly supported by Lang of Vienna, is an excellent treatment for the early circumscribed lesions of lupus, for tuberculous gummata and post-mortem warts. Since, however, the disease so frequently appears on the face, operation is usually resented by the patient, and where there are large areas of disease is inadvisable. In such cases where the infiltration is superficial, dry and uncomplicated by secondary infections, exfoliating methods, such as salicylic acid plasters, pure carbolic acid or pyrogallol acid, may be used.

Brooke's ointment is very useful—

Zinci Oxidi, Amyli aa ʒ ii
Vasel. Alb. ʒ ss
Ung. Hyd. Oleat. (5 %) ʒ i
Acid Salicyl. gr. xx
Ichthylol q.s.
Ol. Lavandulæ q.s.

In the limits of this paper I shall not discuss the much-advertised treatment by Finsen

light and X-rays, upon which volumes have been written. I have personally found much satisfaction from a combination of tuberculin and X-rays in some very intractable cases.

Carbon Dioxide Snow. I have used this method extensively in the last two years and am very satisfied with it, especially in superficial types. Pressure with the snow-stick should be deep, and prolonged for one-half to two minutes, according to age of patient, depth of infiltration and site of disease.

Ionization. I have used this method also with some success in superficial lesions, but have come to prefer the freezing method. But in some instances where there are small discrete nodules, either left by previous treatment or in early stages of the disease, I have found great benefit from needling the nodules with the naked zinc needle attached to the positive pole, and maintained in position until the space of destruction made by the needle corresponds to the size of the nodule.

Vaccines. In many cases, especially of the so-called ulcerative and discharging type of lupus vulgaris, the injection of appropriate vaccines will modify the eruption and often efface the secondary infection. The contaminating organism must be identified and the vaccine prepared from it used. The combination of tuberculin with this special vaccine has been in my experience very successful in some most formidable-looking cases which threatened rapid necrosis of tissue.

Tuberculin Injections—

1. **Old Tuberculin.** McCall Anderson published a series of remarkably good results with old tuberculin. The doses commenced with the diagnostic injection ($\frac{1}{4}$ c.c. of 1 in 1000) and were gradually increased, with precautions suggested by rise of temperature, through dilutions of 1 in 100, 1 in 10, to injections of pure tuberculin, the maximum dose employed by this writer being 1 c.c. of pure tuberculin. Care must be exercised with the earlier doses more especially, and rises of temperature should preclude repetition until after an interval of several days of complete apyrexia.

I have used old tuberculin personally and am satisfied of its benefit. Many writers, however, prefer the use of the new tuberculin (T.R. and T.B.E.) in doses of $\frac{1}{1000}$ mg. once in ten days (Sequeira), or once in four weeks (Norman Walker).

For internal medication and general treatment *vide infra*—*Tuberculides*.

II.—Tuberculides

The diseases included under this heading, the restricted meaning of which has been emphasized and should be borne in mind, are rare, but are now observed with increasing frequency

as attention is directed to them. They are a provisional group, members of which have from time to time been promoted to the rank of tuberculoses as definite proof of their tuberculous nature has been forthcoming. As has been stated, they are regarded as evidence of attenuated systemic infection and are usually disseminated in distribution, less chronic in duration than tuberculoses, and indeed tend to undergo spontaneous cure. The chief clinical varieties are—

Lichen Scrofulosorum.—This is a follicular eruption almost restricted to children, and consists of faint pink papules grouped in discrete patches, distributed chiefly on the abdomen and trunk. It may last a few weeks, and usually disappears spontaneously, without scarring. A very similar eruption not infrequently follows the injection of old tuberculin.

Acne Scrofulosorum.—The clinical resemblance to an inflamed acne vulgaris has suggested this name, which has become established in English medical literature. The essential lesion is a small bluish discrete papule with a tiny necrotic centre, distributed chiefly on the lower extremities and the buttocks, seldom above the latter level. It is much commoner in children, but may occur in adults. It may last for many months and tends to recur. Scarring as a rule follows its disappearance.

Sarcoids of Boeck.—By this is meant a disseminated papular eruption, occurring most commonly on the face, more often in adults than in children and in females than in males. The eruption is exceedingly chronic, lasting for years. This form is to be carefully distinguished from the succeeding.

Sarcoids of Darier-Roussy.—These are subcutaneous, indolent, non-ulcerating tumours, varying in size from a pea to a bean, distributed chiefly upon the trunk and occurring most often in adults and in females. They show tuberculosis histologically; very rarely tubercle bacilli have been found in sections, and the reaction to the inoculation tests in guinea-pigs is dubious and uncertain.

Erythema Induratum (Bazin's Disease).—This is a hypodermic tuberculide showing many analogies with the class just described. It occurs as infiltrations of a deep reddish-blue colour, closely resembling gummata and usually situated on the calf or lower part of the back of the leg; it is much commoner in women than in men, and in young women; it may also be seen in boys. Exceptionally the disease may have a wider distribution and occur on the upper extremities. The infiltrated areas may ulcerate, but more usually they persist indefinitely as nodular swellings. Inoculation of diseased tissue into guinea-pigs has given positive results from time to time,

but without sufficient certainty to warrant inclusion in the class of tuberculoses.

Treatment of Tuberculides. Since in this class of cases we have to do not with local inoculation, but with systemic infection, constitutional and not local treatment is called for and rests on the general principles that the strength of the patient must be maintained and improved by good and plentiful food, fresh air, warmth and rest. In the debilitated children of the poor, in whom these diseases are most often seen, admission to a seaside convalescent home will often work wonders. Cod-liver oil and thyroid extract are of extraordinary value in some cases; syrup of iodide and phosphate of iron and the hypophosphites are also useful. These methods are important adjuvants also in the treatment of extensive and chronic lupus vulgaris and scrofuloderma.

E. G. G. L.

ECZEMA

The confusion which exists at the present time in the group of diseases classified under this heading is such that it has been seriously proposed by competent dermatologists to abolish this name altogether and to break up the group. It is, in fact, true that the conception of eczema formed by the earlier writers of the English school, commencing with Willan and Bateman, is probably more accurate and, at any rate, more in accord with the latest opinions on this subject, than was the conception of eczema of a few years ago, confused as it had become by the inclusion of the form of dermatitis called by Unna seborrhœic eczema. I do not think we can better the definition expanded from Bateman given by Rayer in 1835:—"Eczema is an inflammation of the skin, non-contagious, often limited to a single region of the body, characterized at its beginning by very small vesicles, not prominent, usually closely juxtaposed or actually confluent, terminating in the absorption of the fluid they contain or in superficial excoriations accompanied by a serous discharge, to which succeed scaling, desquamation or renewed vesicular eruptions of the same type."

It is to the modern French school that we owe the rehabilitation both of the word and the conception which now nearly corresponds to the older view. Indeed, Sabouraud, writing in 1905, adopts Bateman's definition and finds nothing to add to it except that the disease is itching, polymorphic, diffuse or generalized, acute or chronic; he insists equally with Bateman on the vesicular character of the initial lesion. Most writers, however, recognize a stage of erythema previous to vesication; thus Darier sums up the clinical phases of an eczematous eruption as follows:—"Erythema,

vesiculation, weeping, scabbing, lichenification, desquamation." The latter two symptoms chiefly occur in the chronic stage. It will thus be seen that the whole class of seborrhœic eczema, so-called, is excluded, and advantageously excluded, from this category. On the other hand, I see no reason for refusing to include the large group of diseases in which symptoms indistinguishable clinically from eczema are produced by external irritants; and it would, I believe, be a valuable simplification of a very difficult subject if it could be agreed to class as eczema, diseases of the skin which show the successive phases of erythema, vesication and an exudation which dries into scabs and which stiffens linen fabrics. Regarded, then, as a complex of symptoms rather than a single definite disease, it is not surprising that eczema becomes one of the commonest labels to be attached to disorders of the skin. This catholicity, indeed, has been made a reproach. But there is much clinical convenience in the use of the term, if restricted to the well-defined group of symptoms indicated above, and we shall now proceed to discuss the clinical varieties commonly met with in practice. Much confusion has resulted, especially in the older writers, from the description of phases of the eruption as clinical varieties, to which, quite unnecessarily, individual names have been given, such as eczema erythematosum, vesiculosum, and a host of others. It must be remembered that the appearances of the eruption may be greatly altered by adventitious circumstances, such as pyogenic infection occurring secondarily on the skin, abraded by the breaking of vesicles, and that many of these older names were applied to the changed aspects of the eruptions thus conditioned. From the point of view of treatment the most practical and simple classification of the varieties of eczema is according as it is acute (*i. e.* of recent development) or chronic.

Acute Eczema.—In its earliest stages eczema probably occurs as an erythematous eruption, although this is denied by many authorities, who claim that even when apparently only erythematous, the eruption can be demonstrated histologically to be vesicular: this initial vesicle is always sterile. In this erythematous stage there is usually much heat and swelling of the part, which more often than not is on an exposed surface of the body, and especially the face. In this position it is frequently mistaken for erysipelas, from which it is to be distinguished by the absence of temperature and general illness, and the less sharply-defined demarcation between the affected and the healthy skin. The redness and swelling are usually symmetrical and are at their maximum round the eyes; the soft

tissues of the orbit offering little resistance to the swelling, the eyes are often buried in the swollen surrounding structures. The aspect is thus not unlike that of acute nephritis, from which the investigation of the urine will readily serve to distinguish it, since in acute eczema there is no albuminuria. There is usually a history of exposure to cold preceding the eruption, which is certainly commoner in winter than in summer; but not infrequently no external cause can be identified. Recurrences are very apt to occur, and there is probably a definite idiosyncrasy in certain persons in whom the resistance to these conditions is weakened.

The erythematous eruption may recede without obvious vesication, but more commonly this change takes place and the red area is studded with minute shotty vesicles which speedily coalesce and burst, producing a weeping discharge. At this stage the surface becomes inevitably contaminated with micro-organisms and suppuration may be very free. Since the initial erythematous stage is a transient one, cases are most often seen after the vesicles have formed or even after these have burst.

Eczema Solare.—Besides cold, bright sunshine may be the provocative agent in persons with special predisposition. It is probable that the light rather than the heat is the stimulus, for in two cases which I recall the eruption would appear when the patients were sitting indoors, in cool but brightly lighted sunny rooms. This is a very intractable form, and the idiosyncrasy tends to become more marked, so that subjects of it are often obliged to shun daylight completely. The parts unclothed are naturally the most vulnerable, the neck and face and hands being especially often affected.

Very closely allied to the two preceding varieties is the large class of cases of acute dermatitis due to a variety of *irritants*, too numerous to be specified. Some of the commoner causes may be summed up under the following headings—

Irritants—Mechanical Stimuli. One of the commonest instances is the eczematous inflammation produced by scratching in parasitic diseases, especially in young children, and in elder persons the subjects of prurigo and of pruritus ani et vulvæ. Ill-fitting, heavy and rough clothing may by friction produce localised eczema, especially in delicate areas of the skin such as the inside of the thighs and the flexures of the joints. The artificial eruptions occurring in hysterical girls are very frequently produced by friction and become truly eczematous. The so-called flannel rash—due to irritation produced by wearing rough woollen garments; localised eruptions caused by habitual move-

ments, such as treading or working of machines, bicycle-riding, etc., are examples of friction producing eczema.

Chemical Stimuli. Only a brief enumeration of some of these can be made, this group of causes being the largest. The *secretions of the body*, the urine and the sweat, may become chemical irritants. The so-called "napkin-rash" about the genitals and buttocks of young children is an example of the first; in elderly and neglected persons and in diabetes the same cause may start eczematous eruptions about the groin, scrotum and thighs. Disordered and exaggerated sweating gives rise to the so-called *dysidrosis* which is probably essentially eczematous.

Occupation or Trade Eczemas.—Persons who are exposed by their daily work to contact with irritating substances may develop eczematous eruptions in the exposed areas, which are usually the hands and arms. Frequent victims of these are furniture polishers, chemists' assistants, nurses and doctors who handle antiseptics, gardeners who are obliged to touch plants such as primula obconica, motor mechanics who deal with petrol, laundry hands, photographers who use irritants like metol, masons, house painters, gasworkers, sewage workers, housemaids, persons who handle sugar, such as grocers, confectioners, refiners; carpenters who deal with shavings of wood such as teak—the list can be extended indefinitely.

Eczema may be the result of local application of drugs, soaps, liniment, hair-dyes and hair washes. As examples may be mentioned sulphur, so widely used by the poor who resort to chemists for treatment; turpentine, which enters largely into the composition of the cheaper liniments such as camphorated oil; carbolic acid in the cruder soaps; many of the patent ointments prepared with rancid fats.

Parasitic Causes. One of the commonest forerunners of eczema of the scalp, neck and ears of children is pediculosis capitis. Scabies, especially in young children, produces, partly by scratching, partly by secondary pyogenic infection, the clinical picture of eczema. Pediculosis pubis may start an eczema of the groin and scrotum and vulva. The parasites of ringworm, and the newly-named and closely similar parasite, the epidermophyton inguinale, may cause an inflammation indistinguishable from eczema.

Microbic Causes. A secondary eczema may supervene on some microbic infections of the skin. Commonest among these is *impetigo contagiosa*, due to the invasion of the skin by the streptococcus, and often giving rise to the variety of eczema called eczema impetiginodes. The disease recently called seborrhœic eczema (Unna), but which is now extensively if not

universally regarded as a microbic affection of the skin caused by the presence of the microbaccillus seborrhœæ, is usually not attended by much inflammatory disturbance, but may be complicated secondarily by true eczema. The so-called eczema intertrigo of fat infants is probably always associated with streptococcal invasion (Bockhart). In all these cases it must be well understood that the microbic disease is primary, and the catarrhal inflammation we have agreed to call "eczema" secondary.

The causes so far enumerated have been chiefly external.

That constitutional factors play a highly important if not principal part I am personally convinced. A striking case of my own exemplifies the hidden share of deep-seated disease. The patient had repeated attacks of typical acute eczema, associated with occasional abdominal pain. The abdominal cavity was finally opened, and a thin-walled cyst of the appendix containing foul pus was found, after removal of which the patient had no further attacks of eczema. The alternation of acute attacks of eczema with asthma, and the association of eczematous eruptions with dietetic faults, especially overfeeding, with abuse of stimulants, with mental and physical overwork and with intestinal disorders, are matters of constant clinical observation, and strongly enforce the necessity of a careful consideration of the patient and all his functions; as Besuier puts it, "There is no such thing as eczema; there is only an eczematous patient." And, again, "Eczema is an image of life itself; the reflection in the skin of the constitution and functions of the individual at any given moment."

Treatment of Acute Eczema. While it is not intended to regard acute and chronic eczema as widely separated, the treatment of the two conditions differs so greatly that it is convenient to consider them separately. I shall therefore discuss the treatment of acute eczema here.

When the patient is seen soon after the onset of the disease, every effort must be made to reduce the inflammatory reaction, and the measures to be taken will vary with the severity and extent of this. When large areas are involved, it is best to insist upon putting the patient to bed, and confining him to milk diet or whey, or the rice and water diet recommended by Bulkeley, for some days. Stimulants at this stage are to be rigidly withheld. For local treatment, if the case is seen in the stage of erythema, an inert emollient powder is very refreshing, such as the common dusting powder of children's hospitals (zinci oxidi, amyli (vel kaolini), acidi borici aa). If, however, there is any vesication or moisture of the surface, powders are apt to cake and are

better avoided; in such cases an excellent application is the following—

Liq. Plumb. Subacet. $\bar{3}$ i
Acidi Salicyl. gr. ii
Lactis ad $\bar{3}$ i.

This should be painted over the inflamed area with a soft badger-hair shaving brush, or strips of butter muslin may be soaked in the lotion and laid on the part. When vesication is diminished it may be preferable to use an oily lotion, *e. g.*—

Calaminæ gr. lx
Zinci Oxidi gr. xx
Aq. Calcis $\bar{3}$ iii
Ol. Olivæ ad $\bar{3}$ i.

An excellent application for large areas, when there is much soreness and excoriation, is the cremor zinci of the St. Mary's Hospital pharmacopœia—

Zinci Oxidi $\bar{3}$ i
Lanolini $\bar{5}$ iii
Ol. Olivæ ad $\bar{3}$ i
Aq. Calcis $\bar{3}$ i.

This may be combined with ichthyol (gr. x ad $\bar{3}$ i) or carbolic acid (gr. x ad $\bar{3}$ i) when there is much itching. The cream should be applied to thin lint (smooth side) and kept in apposition with the inflamed area by means of a muslin bandage, on the face most conveniently by a lint mask freely anointed with the cream.

When suppuration has taken place, antiseptics will have to be added to the treatment. Compresses soaked in lotio chinolol (1 in 200–500) in lotio hydrarg. (1 in 4000), lotio hydrogen peroxid. (2–5 vols.) may be used; or hydrarg. perchlor. may be added to the lotio calam. oleosa above (gr. ss ad $\bar{3}$ vi). In the obstinate suppurative eczema of the scalp and face in children I have found much benefit accrue from an ointment of equal parts of ung. hydrarg. ammon. and olive oil, and covering the scalp with oil-paper. The pyogenic organism is usually a staphylococcus, and an injection of 100 million dead staphylococci once in four days will often clear up the suppuration better than anything else. It is of course essential to consider the possibility of an external irritant and to eliminate this when identified; the lines of inquiry will be indicated in the list of external stimuli given above. When an obvious cause of this nature is ascertained, the case is much simplified. When no such action can be ascertained—and this is especially true in chronic eczema—it is essential to investigate carefully for constitutional disorder, and I would urge the volumetrical analysis of the urine, with special attention to

acidity, phosphates and indicanuria. This is still more important in cases of chronic eczema, to the consideration of which I now turn.

Chronic Eczema.—The course of an individual case of eczema seldom follows with regularity the phases into which the evolution of eczema in general has been divided, and some of these phases may be unduly prolonged. The commonest cause for the prolongation is probably infection with pyogenic organisms. The breaking of the vesicles removes the outer layers of the stratum corneum, and thereby allows of microbial invasion, for which the discharge forms a sufficient medium of growth. The weeping stage of eczema is thus the most protracted and clinically the commonest met with. Where an external irritant has been the initial cause chronicity may result from the fact of the constant renewal, often unconsciously by the patient, of the irritant; for example, in cases where the use of irritative dentifrices may be the exciting cause of an eczema of the mouth and lips. This is still more clearly a reason for chronicity in cases in which the occupation of the patient itself supplies the exciting cause. But apart from these instances there still remains a large group of cases in which recurrences are so frequent as never to leave the patient really free from the disease; we have to assume a tendency in the patient to eczema, and this tendency would appear to be capable of hereditary transmission. Before, however, taking up this somewhat helpless attitude the practitioner must exhaust every sort of investigation into the patient's habits, dietetic and otherwise, his general constitutional health and his mental and physical environment. Close proximity to the sea certainly would appear to arrest the cure of eczema, and still more certainly life in ill-ventilated rooms or under circumstances of anxiety or overwork. The transformation in even chronic cases of eczema in the poor when taken into hospitals where rest, quietude and good nourishment are secured to them, exemplifies the importance of these considerations. Certain chronic local and general diseases predispose the sufferer to attacks of eczema and prolong its duration, notably ichthyosis; diabetes, in which the genitals are the usual seat of the eczema, which is due to the irritation caused by the saccharine urine; gout and "goutiness"; tuberculosis; varicose veins, which are associated with a special variety of chronic septic and eczematous inflammation.

After repeated attacks and with the lapse of time the eruption begins to alter, the skin undergoing thickening (lichenification), losing elasticity and tending to crack and fissure. Thick adherent scabs appear which look like scales, but may be distinguished from them by showing

a wet surface when they are removed. In cases of chronic eczema patients commonly show signs of general illness, such as anæmia, "lymphatism," arterio-sclerosis, nervous irritability or fatigue.

The part played by pyogenic infections in prolonging eczematous eruptions has long been clinically observed, and from some recent serological investigations there seems good reason for supposing that the individual becomes sensitised to the special toxin produced by the pus organisms and develops the cutaneous reaction involved in the clinical term eczema, just as patients with tuberculosis are specially sensitised to tuberculin. It is also highly probable that toxins may be produced by faulty diet, to which the individual becomes similarly sensitised, so that some habitual and unconscious indiscretion may be the causative factor; the success of mere change of diet in such cases is often remarkable.

The management of chronic cases, then, necessitates a wide application of general medical knowledge; only the essential principles of treatment can be sketched in the limits of this paper.

Local Treatment. The importance of *checking suppuration* will be manifest from the share which the absorption of the chemical products of pus may be assumed to take in maintaining the disease. It is essential that crusts should be removed before undertaking any local antiseptic measures; boric acid poultices, compresses of warm sweet oil, and occlusive moist dressings covered by impermeable tissue will achieve this end. When the surface is thus cleansed, the choice of antiseptic offered is wide. When there is free discharge it is better to use a lotion which will mingle with the exudation and serve to sterilize it; or compresses soaked in lotion may be continually renewed; in the latter case the solution must be definitely weaker, as the absorption is greater. If large areas are involved, antiseptic baths may be required of still feebler dilution. For the latter purpose saturated boric acid solutions, or iodine baths (iodi. gr. v, pot. iod. ̄ ii, aquam ad O i) are convenient. For lotions the famous "Eau d'Alibour" is much used in France, *e. g.* cupri sulph. gr. ii, zinci sulph. gr. vii, saffron gr. ss, water saturated with camphor ̄ ss. To be filtered and diluted two to ten times according to the area involved and the sensibility of the skin.

For compresses, carbolic acid one per cent. resorcin one per cent., alcoholic salicylic acid one per cent.; hydrogen peroxide (2-3 vols.), chinol (½ per cent.), alcohol (95 per cent.) may be used. When there is much lichenification salicylic acid with tar is very useful, *e. g.* ung. acid salicyl. ̄ i, ol. cad. ̄ i.

Recently I have used with great satisfaction the method of painting with crude tar, recommended by Dind and Brocq, which I prescribe as follows:—The tar as obtained from gasworks must be washed with distilled water to remove excess of ammonia; the product finally obtained should be a thick, creamy fluid, which forms a good adhesive coat when painted on the skin, the surface of which should be carefully cleansed before application. The tar is painted on and allowed to dry, and left uncovered, or the part treated may be bandaged over lightly while still wet. The application should be renewed when the coating shows signs of cracking—usually within two days.

The tar may be best removed by wiping with melted tallow. The skin must be free from pustulation before the tar is applied, and to secure this compresses of an antiseptic lotion (see above) should be used until suppuration is checked. This object may be hastened by the injection of vaccine. Films prepared from the pus should be examined and if, as is usually the case, the staphylococcus is found to be the infecting organism, injections of that vaccine should be made as is detailed above.

General Treatment. Patients who are anæmic, easily tired and irritable will require tonics such as iron, strychnine and phosphoric acid. The question of stimulants is often a difficult one; where the appetite is poor and is helped, as it so often is, by the taking of wine at meals, this should be allowed, notwithstanding the general principle that stimulants increase inflammation. Mere change of scene, with its accompanying breaking up of habits and general mental filip, is often useful. The spas and baths, such as Harrogate, Aix-le-Bains, etc., are particularly valuable for town dwellers, both because of the fresher air and purer water they offer, and also largely for the discipline practised, which involves regularity and rest. One of the incidental advantages, which may be obtained anywhere, is the greater intake of fluid. Patients with chronic eczema usually have urine of high specific gravity and are benefited by drinking more copiously of pure water. The cure at Aix-le-Bains is largely dependent on the excellent water, which is supplied and taken in large quantities.

The local use of water in eczema is usually condemned, I think often unnecessarily. Where there is much pustulation no doubt the unantiseptic bath is a means of spreading the suppurative organisms, and should be avoided. But in many of the drier forms washing with tar water, but without soap, may be allowed. I have found this "tar bath" very useful, and have seldom had to regret using it.

When water cannot be used the part should be wiped over with warm olive oil, especially to remove fatty applications.

Infantile Eczema.—Eczema in infants is often erroneously ascribed to teething and dietetic trouble. The special variety which attacks the scalp and face of young infants, generally before teething occurs, is probably in the majority of instances due to exposure to cold, and occurs more often in fat, overfed children. The same principles of treatment apply as in adults.

The frequency of impetigo contagiosa and intertrigo in children makes the secondary eczemas, which have been described as complicating these conditions, also more frequent.

Prognosis. The life of the patient is seldom threatened and the prognosis is so far good, but recurrences are likely to occur. The eruption can always be ameliorated and individual attacks controlled by careful management; the patient should never be allowed to accept the disease as unamenable to treatment.

E. G. G. L.

TOXIC RASHES

Toxic Rashes are many and various, both in form and degree, but the ones usually met with are either Urticarial or Erythematous. The *Urticarial Rashes* may be papular, a condition frequently met with in infants and children (*Urticaria papulosa* or *Lichen Urticatus*). *Urticaria pigmentosa* is rarely seen in general practice, but it must be just mentioned in passing. Ordinary urticaria is well known, but the thing to remember is that it may present itself as a bullous eruption. The *Erythemas* may assume a variety of forms, hence *Erythema multiforme*, *E. bullosum*, *E. iris*. At other times the toxic rash may be scarlatiniform, and it then gives rise to difficulty in differential diagnosis. Scarlatiniform eruptions differ chiefly in the mode of cutaneous development and distribution from true scarlatina. The latter's classical features must be borne in mind, and variations from that standard taken into account. Toxic scarlatiniform rashes may be accompanied, moreover, by sore throat and an elevation of temperature, but the careful analysis of other symptoms and appearances will usually exclude the acute exanthem. When in doubt, deal with the patient as if it were scarlatina, and keep the case under close observation.

The toxic onslaught may be so severe as to lead to hæmorrhages in the skin (*Erythema purpuricum*—*Purpura*), and in severe cases be complicated by hæmorrhages from the mucous membranes (bowel, etc.).

Again, the toxic rash may generalize, and even universalize, involving the whole of the

body from top to toe, as in Pityriasis rubra. This severe dermatitis is accompanied by copious desquamation and serious general symptoms, and may terminate fatally.

Among the more unusual forms of Lupus erythematosus there is generalized Lupus erythematosus supervening on precedent chronic trouble, and associated usually with albuminuria. In the very rare primary acute Lupus erythematosus, which the author has described, the toxæmia is so severe that here again a fatal termination (nine out of ten cases) is the rule.

There is also another unusual form of toxic eruption, the Prurigo of Besnier, which is very chronic and extremely pruritic, the latter feature being very marked and leading to scratch lesions.

Pruritus and scratch lesions are common enough as an expression of toxic processes. I may instance Pruritus senilis, due no doubt, in addition to peripheral end degeneration, to faulty elimination (renal inadequacy, etc.).

This is a mere outline of eruptions met with, but it will serve to shape a course.

Now as to causation. The causes may come from without or from within. As to the former there are—

Firstly, Foods.—It is well known how frequently so-called shell-fish poisoning occurs, giving rise to urticaria and erythema multiforme. I have seen prawns, for instance, lead to a severe scarlatiniform rash. But all kinds of fish, and especially the brilliantly coloured, such as mackerel, etc., may lead to trouble in this direction.

In a case I have described a symmetrical rash, which left behind it permanent dilatation of the superficial cutaneous blood-vessels in the areas affected, was due to eating rabbit that had gone bad. I need not insist on this matter of tainted animal foods.

Milk may be a cause. I have seen a severe bullous urticaria in a child who had been fed on pasteurized milk, but unfortunately the milk so carefully delivered in sealed bottles was bad!

Before leaving animal products, this is the place to refer to serum rashes. Antitoxin urticaria is well known. The important question of anaphylaxis, so much to the front just now, requires to be taken into account. There is no doubt that patients who have reacted cutaneously to some form of toxic foods, etc., tend to develop rashes afterwards in similar circumstances; and I have found that the recurrent eruption of this class may prove extremely obstinate.

As to fruit, strawberries, for instance, often lead to eruptions (urticarial, etc.) in the susceptible.

Secondly, Drugs.—A very large number of

drugs may lead to eruptions of various kinds. Bromide of potassium, which is so frequently ordered, gives rise in some cases to a characteristic condition, which in infants and children may look very formidable: raised, vegetating-looking lesions, which have been taken for syphilis more than once. In the case of an infant with such an eruption, shown by a dermatologist as a syphilitic condition, the author's diagnosis of bromide rash was opposed on the ground that the child had not had any bromides. I questioned the mother, however, who was suckling the child, and after a good deal of trouble I elicited the fact that she was an epileptic and taking bromides. The mother's milk was at the bottom of the infant's trouble. This is a point to remember.

The iodides are also responsible for eruptions of a papulo-pustular kind, but they may sometimes become very severe (bullous, etc.). Here, again, they must be distinguished from syphilis, especially the form that may resemble the bromide rash. Remember that quack blood-purifying medicines and "fits" mixtures all contain iodides and bromides respectively. Arsenic may lead to Herpes zoster. This fact was an important one in getting on the track of the Manchester beer poisoning epidemic Arsenical waters (Bourboule, etc.), when taken indiscriminately and over long periods, may give rise to an attack of shingles. Salvarsan I have also seen do the same. Other forms of arsenical skin conditions are the pigmentation and keratosis it may lead to. I have also seen long-continued arsenical medication followed by epithelioma.

Quinine and other drugs have led to rashes, mainly erythematosus and scarlatiniform.

Many of the synthetic remedies have also led to cutaneous eruptions. Among them antipyrin may be specially mentioned, the bullous erythema produced leaving pigmentation of affected areas behind. I have also seen veronal lead to Erythema papulatum, and in one instance to a bullous eruption. An interesting point to remember is that synthetic remedies may be re-christened by manufacturers, and thus old friends or enemies appear under new names (antipyrin, veronal, etc.).

It would take us too long to enumerate all the drugs that have caused cutaneous trouble. So the above remarks must suffice.

I will now examine the toxic conditions that arise from within, in contradistinction to those caused by bodies introduced from without. Here we are dealing with a large order. I do not consider it comes into the province of this article to go into the rashes of the acute exanthemata, and of the acute and continued fevers. Nevertheless, for purposes of diagnosis,

they must be borne in mind, as also the premonitory rashes of variola, etc.

I have seen various eruptions (erythematous, hæmorrhagic) due to the teeth and a neglected state of the mouth generally. It is important, therefore, as I have insisted for years, to examine the teeth and mouth in a routine manner, just as if one were buying a horse. Pyorrhœa alveolaris is the *fons et origo* in some cases.

The tonsils, again, may be at fault. In a hæmorrhagic cutaneous case I saw, I found that a septic tonsil was at the root of the business.

These facts are important, I need hardly add, from the point of view of treatment.

Constipation may, of course, be a cause of toxic rashes. The so-called enema rash is due to the fact that toxic products are mobilized in the gut.

In all cases the urine should be examined in a routine way, but especially so in toxic rashes. It is well known that albuminuria, sugar, indican, etc., are factors to be considered in this connection. In an Erythema multiforme I found the urine contained albumin and pus. Further investigation showed the presence of tubercle bacilli in the urine, and thus a tuberculous kidney was diagnosed. In another instance, a patient, who had been under the physician and surgeon in the wards and had developed an extensive dermatitis, was handed over to me in a moribund condition. It was a marked case of Pityriasis rubra. On examining the urine I found a quantity of pus. At the necropsy I found the left kidney was disorganized, a large pyonephrosis in fact, with an elongated calculus in the corresponding ureter.

The urine should also be examined bacteriologically if necessary, especially for bacterium coli commune.

Again in pregnancy and during the puerperium various scarlatiniform and morbilliform and other rashes may arise, to say nothing of the condition known as Herpes gestationis, allied to Dermatitis herpetiformis.

In gonorrhœa of the severe kind, with involvement of the joints and general symptoms, an unusual cutaneous condition called Keratosis blenorragica may appear, especially about the feet and ankles. This is a result of the general septicæmia, *plus*, no doubt, perspiration and want of cleanliness under dressings. There is an analogy in keratotic complications not infrequently occurring in sweating feet as a secondary microbic infection from without.

Treatment. Elimination of "peccant" bodies introduced from without must be aimed at. In this direction calomel is very valuable, followed up by salines. But purgation must be carefully considered in hæmorrhagic conditions,

and the possibility of the involvement of the intestinal mucous membranes kept in mind. In severe purpuric conditions rectal injections of anti-streptococcic serum have answered well.

Arsenic in appropriate doses is useful in bromide and iodide rashes, but here it must also be remembered that more iodide may be thrown into the circulation. Large doses of iodide are often more likely not to lead to an eruption, other things being equal, than small doses. In the former circumstances the diuretic effect helps elimination. Nor does the rash stop directly the bromide or iodide is left off. This holds for other conditions.

Every case must be taken on its merits, and an effort made to determine the cause and if possible attack it. Otherwise the patient must be dealt with on general lines. G. P.

VACCINAL AND DRUG ERUPTIONS

Under the heading of drug eruptions there should, strictly speaking, be included all rashes produced either by their ingestion or their absorption from external surfaces. The various local conditions resulting from irritating applications, antiseptic or therapeutic, are forms of dermatitis venenata.

Drug eruptions are not of universal occurrence. They are especially apt to occur where renal or cardiac disease or neurasthenia exist. Certain individuals have an idiosyncrasy for certain drugs. Women and children are said to be more susceptible because of the finer texture of their skin, and for the same reason blondes are more readily affected than brunettes.

A very large number of drugs can produce eruptions; most often these are of the erythematous class, and it is rarely possible to decide what drug is responsible without a history. The quantity taken is unimportant, for small doses can often occasion violent tegumentary effects; it is perhaps more a question of quality. No immunity is established by habit but, on the contrary, a condition of anaphylaxis occurs. As a rule, in an individual the drug will always produce an eruption of the same type. The time intervening before the appearance of the rash varies, but is usually short, often but an hour or so; bromide and iodide acne, and the pigmentary changes induced by arsenic, are exceptions.

Clinically, two main groups can be recognized—

1. More or less specific types, characterized by their mode of development and anatomical peculiarities. Such rashes usually affect certain definite parts of the body, and may be regarded as part of the physiological effect of the drug.

2. Anomalous eruptions, often in the form of an erythema, occasionally closely simulating scarlet fever or measles. If there be much

exudation an urticarial or even bullous stage may occur, while purpura is produced if there be vascular rupture.

The *diagnosis* is often difficult; the patient, being usually unaware of the cause of his disease, does not volunteer a history. It is an excellent rule in all unusual eruptions, especially if of an urticarial or erythematous type, to inquire whether any, and if so what, medicine has been taken. Of special importance is the differentiation of the morbilliform and scarlatiniform varieties from the exanthems they simulate. When there are constitutional symptoms, such as high temperature and sore throat, this is extremely difficult; even desquamation may occur. Such confusing phenomena are fortunately uncommon, but the absence of the tracheo-bronchitis of measles and the characteristically rapid pulse of scarlet fever help the diagnosis. As a rule the picture, although a good copy, gives a clue in other ways to its spurious character. It proclaims itself a forgery. Itching is a feature of drug eruptions. The appearance of the rash soon after taking the drug, and its equally rapid disappearance when this is withdrawn, constitute important diagnostic points.

The following list, although representative, does not by any means include every drug capable of exciting tegumentary lesions, but only the more common—

An **erythematous or polymorphic eruption** may result from antipyrin, arsenic—including salvarsan—boric and benzoic acids, bromides, copaiba (with marked itching), chloral, digitalis, iodides, morphia, quinine, salicylic acid, tuberculin, etc.

Scarlatiniform rashes sometimes appear after antipyrin, benzoic acid, belladonna, chloral, iodoform, ipecacuanha, mercury, nux vomica, salicylates, sulphonal and tuberculin.

Urticaria may be occasioned by copaiba, cubebs, benzoic acid, iodides, quinine, salicylic acid and valerian; while antitoxin, arsenic, chloral, copaiba, cubebs, iodides, quinine, mercury and sulphonal sometimes cause **purpura**.

A **morbilliform erythema** can be produced by antipyrin, belladonna, copaiba, cubebs, digitalis, diphtheria and other antitoxins, mercury and opium.

Eczema, it should be noted, never results from the internal administration of drugs, but a latent eczematous condition may easily be awakened into activity, a fact of importance in treating this disease.

Certain drugs produce effects of so definite a character that it is possible from inspection of the patient to decide as to their nature. The more important of these are considered below.

Bromides, usually taken in the form of potassium bromide, may determine an acne,

similar to acne vulgaris, except that there are no associated comedones. Sometimes the papulopustules become confluent, forming a sort of superficial carbuncle; rarely a bullous eruption occurs, which may vegetate. Children are especially susceptible to this drug, taken either through the mother's milk or as soothing powders. Pustules and fleshy masses result, symmetrically distributed over the face, trunk and limbs, often becoming confluent, and occasionally vegetating.

Iodides most often occasion an acne, similar to bromide acne. Erythemas, urticarial lesions, and purpura may occur. Iodide pemphigus is a rare but characteristic variety where large bullæ, similar to those of common pemphigus, are found. Perhaps most important of all, because of the serious results if the condition be wrongly diagnosed, is that type in which the lesions resemble gummata, for the iodides may be pushed or continued in an attempt to cure the condition, causing albuminuria, diarrhoea and even death.

Antipyrin. The eruption is of a very definite type. In susceptible individuals even a small dose will rapidly cause the appearance of round or oval erythematous and somewhat pigmented patches, which may even become bullous. If the drug be discontinued these are replaced by pigmented areas, which become rapidly congested if another dose be taken; subjective sensations are not uncommon.

Arsenic. The various forms of arsenical erythema, purpura, etc., have been considered above. After prolonged administration the extremities, face, and especially the abdomen, become the seat of a characteristic brown pigmentation. Hyperkeratosis of the palms and soles is not uncommon, and toxic symptoms, such as peripheral neuritis, will often be discovered if sought for.

Treatment. This is usually simple; the drug being withdrawn, the rash disappears. The diet should be simple, elimination promoted by free diuresis, and a purge prescribed. In patients with heart or kidney disease, and in neurasthenics, drugs liable to occasion eruptions should be administered with caution.

For the itching, any antipruritic remedy may be used. It is a simple and efficacious plan to apply freely a lotion consisting of a teaspoonful of liquor carbonis detergens, in a pint of warm water. Sometimes powders answer better, such as the following (Colcott Fox)

R Pulv. Zinci. Oxidi ʒ ii
Pulv. Camphoræ ʒ ss
Pulv. Amyli ʒ v.

The itching is often quickly relieved by a Turkish bath.

Against the acne of the bromides and the

iodides little can be done. Fresh yeast given internally or staphylococcic vaccines diminish the condition, and it is stated without much foundation that arsenic added to the prescription is a preventative. As this metal can produce pigmentation and hyperkeratosis its administration should not be continued for any length of time, although arsenical pigmentation will disappear slowly if the causal agent be discontinued (Stelwagon).

Vaccinal Eruptions.—The skin lesions consequent upon Jennerian vaccination may be divided into: firstly, those induced by the virus itself, and secondly those resulting from the introduction of some foreign pathogenetic agent with it.

The uncontaminated virus, besides causing

the typical local effects, may also produce roseolar, scarlatiniform, morbilliform, or urticarial eruptions and even typical erythema multiforme. A generalized vaccinia, where there is a widespread eruption of lesions resembling the primary vesicle, is very rare. Finally from implantation of the virus in some unusual situation, usually the face, an accidental vaccination may occur.

The latter group includes conditions such as erysipelas and cellulitis from streptococcal infections, or staphylococcal lesions such as boils and impetigo. Syphilis and tubercle are almost unknown. These infections may result either from accident or imperfect aseptic precautions, and are treated by the usual surgical measures.

H. MACC.

DISEASES OF NERVOUS ORIGIN

I.—HERPES ZOSTER

Herpes Zoster is an acute disease associated with some degree of constitutional disturbance, and characterized by an erythematous and vesicular eruption affecting areas of the skin corresponding to the distribution of the cutaneous nerves. When it appears in the intercostal nerve areas the eruption resembles a girdle passing half way round the body; very rarely both sides are affected.

Etiology. The disease occurs in both sexes and at all ages, but is most frequent in children and young adults between the ages of four and twenty. It is very rare in infants; its symptoms are usually slight in those otherwise healthy; when it affects the aged the disturbance is often severe, giving rise to much pain of neuralgic character and occasionally to necrosis of the affected skin.

Herpes zoster usually occurs without apparent cause; cases, however, occur in groups suggesting an epidemic influence, and it is more liable to make its appearance in children while they are suffering or recovering from other diseases, such as whooping-cough and diarrhoea. In adults various debilitating causes seem to predispose to attacks of the disease. The prolonged administration of arsenic is apparently a predisposing cause, in all probability from its debilitating influence. Certain diseases of the nervous system seem to be specially associated with herpes. Of these general paralysis of the insane and tabes dorsalis may be mentioned as examples of chronic nervous affections, cerebro-spinal meningitis as an acute affection, while spinal caries and new growths affecting the vertebral column apparently cause herpes from the spread of the disease to the posterior nerve roots.

Morbid Anatomy. The vesicles of herpes arise in groups on areas of erythematous and slightly swollen skin. The erythema is a diffuse blush, presenting a margin of more intense redness round the vesicles. The base of the vesicle is formed by the almost bare papillæ and by the interpapillary processes of the epidermis. The papillæ themselves are swollen and deeply congested, and, with the underlying layers of the cutis, present a certain degree of round-cell infiltration. Within the vesicle the epidermic cells derived from the stratum mucosum degenerate, becoming swollen—"ballooned." The contents of the vesicle, at first clear, become slightly turbid as the result of the degeneration of these cells and from the exudation of cells resembling leucocytes from the underlying tissues. A crust is formed from the roof of the vesicle and its drying contents; healing takes place under this crust by the formation of new epidermis. The amount of new fibrous tissue formed in the floor of the lesion varies. It is often so slight that the scar may not be easily observed by the naked eye; in other cases the scars are very obvious and may even become hypertrophied or keloid.

In addition to the local lesions changes of an inflammatory character occur in the ganglia of the posterior roots of the spinal nerves supplying the affected area, or in the corresponding ganglia of cranial nerves, probably in all cases of the disease. In most cases these changes seem to be slight and of a transient nature. In acute affections, as in cerebro-spinal meningitis, the posterior root ganglia are acutely inflamed. In several cases hæmorrhages have been observed in the posterior root ganglia; in chronic nerve diseases the ganglia may be affected by extension of the disease, ending in sclerosis, while in such diseases as vertebral tuberculosis, or new

growth, the posterior root ganglia are involved in the inflammatory conditions resulting, or by spread of the disease. In some cases the posterior root ganglia have been seen to be seriously injured, being transformed in part or entirely into scar tissue showing neither ganglionic cells nor nerve fibrils.

Symptoms and Course. The outbreak of an eruption of herpes zoster is preceded for a variable period, but usually for not more than four or five days, by feelings of discomfort in the area subsequently affected by the eruption. These disturbances consist of sensations of warmth, pricking, itching or definite neuralgic pain. The patient usually feels out of sorts; in the case of children there may be symptoms of loss of appetite, nausea or sickness, associated with rise of temperature to 101° or 102° F. The eruption appears first as a reddening of the skin. In the course of a few hours slight elevations make their appearance on this reddened area, these increase in size till they are seen to be vesicles or small bullæ containing clear fluid. These lesions are rarely more than a quarter of an inch in diameter, but by coalescence large flattened vesications may be produced of much wider extent. The lesions, at first translucent, gradually become opaque as the contents become turbid. Before the end of the first week they have commenced to shrivel, and they form crusts or scales which fall off in a few days, leaving on their site pink spots, presenting more or less scar. In the majority of cases the amount of scar is trifling.

The areas affected by the eruption correspond closely to the distribution of the cutaneous nerves. In cases of intercostal herpes this distribution is readily recognized. The eruption shows itself first of all, and more intensely throughout, in areas surrounding the points where the main branches of the intercostal nerves come to the surface, namely the cutaneous branch of the posterior primary division and the lateral and anterior branches of the anterior primary division. At one or all of these three points the early flushing and the subsequent vesication may be first seen, and from these centres the eruption may rapidly spread, so as to involve the greater part of the distribution of the nerve, so producing the half-girdle-like distribution from which the name is derived.

Occasionally the eruption overlaps the territory of the two adjacent nerves and may, very rarely, pass slightly over the middle line. In rare cases also an intercostal nerve of the other side is affected, but usually not on exactly the same level; in such cases a complete girdle of herpes may be imagined as passing round the body.

In the case of the nerves supplying the extremities and the head and neck, exactly the same phenomena occur, varying slightly

owing to position and the involvement of special organs. In the case of the upper and lower extremity the eruption has a linear distribution, corresponding to that of the spinal nerves affected. Attacks of herpes on the arm and thigh, forearm and leg are not uncommon, though it is rare to find the eruption affecting the palms or the soles.

In the case of the head and neck, herpes follows the distribution of the upper cervical and cerebral nerves. The most troublesome and dangerous cases of the disease occur in the area of the first division of the fifth cranial nerve. The eruption may spread over the whole distribution of the ophthalmic division; in some cases the frontal area, as far back as the posterior border of the parietal bone, is affected; in others the nasal branches supplying the skin over the side of the nose show evidences of the disease, while in yet other cases the conjunctiva and the eyeball are attacked. Facial neuralgia, when the fifth nerve distribution is involved, is sometimes of very severe degree, especially when the first division is affected. When the eruption attacks the eye and the neighbouring skin of the eyelids and nose the amount of pain and discomfort is extreme. The conjunctiva becomes deeply congested, superficial ulceration occurs which may involve the cornea, finally producing scars which interfere with vision; in some cases the iris is attacked, resulting in iritis, with troublesome adhesions to the lens, and cases have been described of destructive inflammation of the whole eyeball.

Attacks of herpes have been occasionally noted on the tongue, and on the buccal and pharyngeal mucous membranes.

Complications and Sequelæ. The lesions of herpes may become infected by pyogenic micro-organisms and in consequence give rise to ulceration which is not easy to heal; the scars remaining in such cases are larger and deeper than is usual, and are sometimes hypertrophied, resembling keloid. In other cases, especially in old people, the bullæ contain blood-stained fluid, and more necrosis of the skin results than in ordinary attacks.

A feeling of irritation of the skin and even of neuralgia is common during and after an attack. In some cases, however, especially in the old, the neuralgia is severe, and in the form of post-herpetic neuralgia may remain for months after the attack, seriously affecting the patient's health.

Treatment. The general health of the patient should receive careful consideration in cases of herpes. Very often no tangible indications of disease may be detected, but not infrequently errors of diet and obvious lapses from the rules of personal hygiene may be corrected, with much advantage to the patient.

Locally precautions must be taken to prevent injury to the affected surfaces. This may be done in many cases by applying a thin layer of cotton-wool, lightly bandaged on to the surface. The irritation may be relieved by using a fine, non-gritty dusting powder, composed of siliceous earth (such as cimolite) seventy parts and zinc oxide thirty parts. In cases where neuralgia is present a certain amount of relief will be obtained by the use of evaporating lotions containing spirit, or by local anæsthetic preparations such as menthol, used in the form of lotions, liniments or ointments. If the neuralgia becomes severe and the necessity for relieving the pain is urgent, by far the most efficient method is by the hypodermic injection of morphia into the affected area. J. G.

II.—PRURITUS

Pruritus is the peculiar disturbance of sensation of the skin and margins of the mucous membranes giving rise to the desire, which may become uncontrollable, to rub or scratch the affected surfaces.

Pruritus may arise in many conditions without visible skin lesions. Thus widespread attacks of pruritus may be originated by lightly stimulating a small area of the surface with a feather; even the suspected presence of a flea is sufficient in some cases to induce widespread itching. Various forms of disease of the internal viscera are accompanied by pruritus. This is especially the case in disease of the liver accompanied by jaundice or cholæmia, and in certain diseases of the nervous system giving rise to the peculiar sensation of formication. In glycosuria, pruritus of the most severe character may occur. In this case, however, the condition is usually localised to the external genital organs and is often accompanied by severe inflammatory lesions of the skin produced by the irritation of the glucose-containing urine and by rubbing or scratching. Changes in temperature have a distinct influence in producing the sensation; cold in winter increases pruritus in many cutaneous affections and gives rise to a variety of the disease known as **Pruritus Hiemalis**, in warm weather **Pruritus Æstivalis** may occur, both of these conditions having peculiar features. Certain drugs, such as opium are well known to produce pruritus.

In many cases the presence of foreign materials or of inflammatory exudations stimulates the nerve endings in the skin, and thus gives rise to local pruritus, which may frequently have widespread distribution. In the case of the disease specially known as "the itch," the presence of the *acarus scabiei*, its products and the local inflammation produced by it are obvious causes of the irritation. A similar

state of affairs occurs in pediculosis. In other diseases, such as lichen planus, severe pruritus is experienced far beyond the local eruption. In such cases the infiltration of new cells pressing on nerve terminals is no doubt the cause of the morbid sensation. It is noteworthy that by no means every form of inflammatory exudation in the skin is associated with pruritus; for instance, the exudation producing the characteristic papular eruptions of syphilis and tuberculosis are rarely accompanied by pruritus. A peculiar and very severe type of pruritus occurs in old persons, known as **Pruritus Senilis**. It is possible in such cases that the degeneration of the skin, and the destruction of its elastic fibres, may induce the sensation; in this type of pruritus the presence of pediculi or external sources of irritation should be excluded before coming to the diagnosis of this disease.

The consequence of rubbing and scratching induced by pruritus is the production of inflammatory lesions of the skin known as lichenification and eczematization, according to the type of disease which they resemble. These in their turn permit of pyogenic infection of the skin. The presence of such inflammatory lesions causes renewed irritation of the cutaneous nerves and perpetuates the disease, in some cases rendering it almost incurable. This sequence of events is particularly well illustrated in the varieties known as **Pruritus Genitalium** (*P. ani, scroti, vulvæ*, etc.).

Treatment. The treatment in all cases of pruritus should be preceded by a careful examination for its possible causes. In very many instances the presence of a local irritant, little suspected, such as the presence of pediculi in the clothing or on the body, or infection of the alimentary canal by thread-worms, may account for the phenomenon and permit of easy cure. So also the occurrence of such diseases as lichen planus, urticaria, factitious urticaria or the seborrhoic varieties of eczema may account for the symptoms, and their successful treatment underlies the cure. Treatment should never be commenced in any case of the disease without a careful examination of the urine, especially for glucose. Treatment on antidiabetic lines, or in other cases by controlling gouty tendencies, will often be successful.

Local treatment is always demanded, and requires careful arrangement. The use of baths in most cases is highly beneficial; warm baths, emollient baths made with bran, gluten or starch, and alkaline baths, are of great service in different types of the disease, while in other cases the medication of the bath by antipruritic remedies—*e. g.* liquor picis carbonis, the oleum betulæ albæ—will be of service. In certain

varieties of pruritus, especially those associated with seborrhoeic or infective types of eczema, mild sulphur baths produce good results.

In the intervals of treatment the skin should be kept as dry as possible, and the use of dusting powders of some fine siliceous earth combined with oxide of zinc is very agreeable; to such powders antipruritic remedies, such as menthol or camphor, may be added. Of the local antipruritic remedies carbolic acid is one of the best. It may be applied in dilutions up to 1 in 100 with beneficial results. Thus in severe cases of pruritus vulvæ the application of a solution of carbolic acid by a dressing carefully adapted to the surface will often give relief. In place of carbolic acid other antipruritics may be found to be successful, such as menthol, camphor and chloral hydrate, perchloride of mercury and the various tar preparations: Cocaine used locally, with prudence, will occasionally be of service. It must be clearly borne in mind in all cases treated by these methods that the relief is of temporary nature only, that every means must be used to prevent renewed rubbing and scratching of the parts, and to strengthen the patient's nervous control in order to resist the temptation to recommence scratching.

Various electrical methods have been used freely in the treatment of pruritus. Of these

the most satisfactory seems to be the prudent use of the X-rays, especially in cases where lichenification of the skin is present. The dose of X-rays must be carefully regulated, and repeated, only if necessary, after a considerable interval, usually not less than a month. This treatment should be carried out with great caution, on account of the dangerous consequences which may result. Occasionally the use of high-frequency currents has been successful in allaying the disease.

Internal treatment in cases of pruritus should be used in combating the general conditions which so often underlie the disease, such as diabetes and the gouty diathesis: For the treatment of the symptom the use of sedatives and hypnotics are sometimes necessary, but should always be given with much care and only when other means of treatment fail and in intractable cases. Patients suffering from severe pruritus are often of highly nervous disposition, and the establishment of the drug habit becomes easy. The remedies of most value are opium and its alkaloids; cannabis indica has occasionally been successful. Temporary good results are sometimes obtained by the administration of such drugs as phenazone and acetanilide; the depressing effects of such remedies must always be guarded against.

J. G.

DISEASES OF UNKNOWN ORIGIN

I.—LICHEN PLANUS (LICHEN RUBER)

THE term lichen, originally applied to many forms of skin disease, is now confined to a group of eruptions presenting papular lesions of chronic duration, and of these **Lichen Planus** is the most important. This disease is characterized by the appearance of small solid papules, which may increase in size up to about 5 mm. in diameter, and remain discrete throughout; frequently by coalescence they form larger patches of eruption. The discrete papule is the characteristic lesion of the disease. When fully developed its outline is angular rather than rounded. The surface is flat, smooth and even polished, and presents occasionally a granular stippling, often with a little depression corresponding to the position of a hair follicle or sweat duct. The colour is pinkish or brownish-red, in the later stages losing its brightness and generally leaving a considerable amount of pigmentation. Visible scarring is rarely produced by the eruption unless it is interfered with by treatment or by suppuration. In rare cases the papules, instead of being plane, are raised above the surface and their acuminate

shape is emphasized by the projection of a small epithelial plug from the hair follicle. In such cases the disease presents a close resemblance to the condition described as *pityriasis rubra pilaris* in this country—the *lichen ruber acuminatus* of some German authors. The disease may occur at any age, but is rare in children, more common in young persons and in adults. The eruption may occur on any part of the body and may also affect the visible mucous membranes, when it presents greyish-white points or streaks as on the mucous membranes of the cheek and lips, while on the tongue it gives rise to a condition resembling leucoplakia.

Etiology. The cause of the disease is unknown. The anatomical nature of the lesions suggests a local reaction to some widely diffused irritant of the skin. It is said to occur more frequently in persons of nervous disposition, who appear, at any rate, to suffer more severely from the disease than do others. Widespread outbreaks of lichen planus have been noted in persons of middle-age suffering also from glycosuria or with the tendency to obesity.

Three well-recognized varieties of the disease may be mentioned.

1. **Acute Lichen Planus.**—In a considerable number of cases, especially in young persons, the eruption shows itself simultaneously on many parts of the trunk and extremities, and even on the mucous membranes. The eruption is rapid, and in a week or two wide areas are covered by the characteristic red papules, which show a tendency to become confluent. This type of the malady has also been noted to occur in cases of glycosuria and in certain other disorders of metabolism. The eruption may last for some weeks, and then disappear quickly. More commonly considerable areas vanish, leaving patches of the chronic type of the disease on such positions as the extensor surfaces of the extremities, where the pressure of clothing is exerted, or the scalp. The discomfort and pruritus experienced by the patient varies; in some cases they are hardly felt, while in others, especially in nervous or debilitated persons, they are excessive.

2. **Chronic Lichen Planus.**—The majority of cases are more slow in their development and longer in their duration. The extensor areas of the extremities, the back and the abdomen are often affected, but lesions, even in the localised outbreaks, may be seen sparsely scattered over the body. They are occasionally so small as to be seen with difficulty, but the appearance is so characteristic as to be unmistakable when carefully inspected.

3. **Lichen Planus Verrucosus.**—In certain cases of the chronic type the disease remains localised, the lesions coalesce and gradually produce considerable thickening of the skin, with an increase of the horny epithelium. This form is recognizable on account of the peculiarly tinted, elevated roughened patches of skin produced. If careful search is made at their margins, the characteristic flat-topped shiny papules of the disease can nearly always be seen, and confirm the diagnosis.

Occasionally the eruption becomes confluent and covered with fine greyish scales. It then resembles at first glance certain varieties of psoriasis, but a very little care in observation will serve to distinguish the two conditions. The amount of pigmentation in the areas of skin which have been affected by the eruption is often pronounced; sepia-coloured or slate-brown patches remain for many months after the eruption itself has vanished, even in cases where no arsenic has been administered in the course of treatment. It is not uncommon to find small fine patches of atrophy of the skin remaining after an eruption of lichen planus.

Treatment. In most cases the first indication in treatment is the necessity of allaying the local irritation. In acute cases relief is best obtained by using a dilute lead lotion, such as glycerine of subacetate of lead, five per cent.

to ten per cent., to which may be added one-half to two per cent. of carbolic acid when the pruritus is considerable. Lotions of other antipruritic remedies, such as ichthyol, are frequently of service. In other cases immersion in a warm bran bath, followed by gentle drying of the skin, and the use of a simple lubricant, such as cold cream or vaseline, in small quantities gives relief.

In treating localised patches the application of an antipruritic ointment is more valuable, such as carbolic acid four parts, perchloride of mercury one half to one part, zinc ointment to one hundred parts. Resorcin, salicylic acid, oil of cade, and other tar preparations are all of service in local treatment. In the verrucose type it may be necessary to remove the thickened epidermis by the use of lotions of soft soap and alcohol, or by the applications of plasters containing salicylic acid. Fine superficial scarification of such patches has occasionally been followed by their resolution. Patches of long-standing on the knees and in other situations are sometimes benefited by careful exposure to the X-rays.

Internal treatment is usually necessary and should as a rule be of tonic character. Rest and relief from anxious and trying occupations must be obtained. The judicious use of digestive tonics, and nutritious food is nearly always of service. Phenazone and some of the allied preparations are frequently useful when there is much irritability of the skin and sleeplessness results. Arsenic has been much used in the treatment of the disease, but appears to be of comparatively little service. Small and repeated doses of perchloride of mercury in the early stages seem to have a distinct effect in relieving acute cases and in helping the resolution of more chronic types of the malady. G. P.

II.—DERMATITIS HERPETIFORMIS (HYDROA)

This disease is characterized by the appearance of a peculiarly polymorphic eruption, usually developing vesicles and bullæ. The distribution of the eruption is general; the whole surface may be attacked simultaneously, but even when definite groups of vesicles appear there seems to be little evidence of any localising cause as in Herpes zoster. The chief features of the eruption are its polymorphism, the appearance of the vesicles in clusters, and its tendency to recurrence. The eruption at various stages of an attack may present lesions of simple erythematous character, others resembling circinate attacks of exudative erythema, while others may be definitely urticarial, but the eruption of vesicles and bullæ is the most striking feature of the disease, and these are nearly always present at some stage or in successive attacks.

The disease is apt to recur. The early attacks may be severe or slight. Succeeding attacks may diminish in intensity, so that a few sparsely scattered vesicles only are seen from time to time. In other cases the attacks increase in severity, with shorter intervals, till the patient is never free from the eruption in some form or other. The skin is in a constant state of painful irritation and becomes atrophic and scarred. In some cases the skin becomes so seriously altered that the upper layers of the epidermis are easily detached by slight friction of clothing or by pushing the finger along the surface. The lesions may effect the conjunctival mucous membrane, producing much shrinking and scarring and interference with vision. The nasopharyngeal mucous membrane may also be affected, with resulting excoriation and ulceration of the surfaces, attended by much pain and great discomfort from salivation and during masticating and swallowing food, and even in respiration. The lesions, both on the mucous and cutaneous surfaces, are liable to accidental pyogenic infection. An important symptom which is rarely absent is the occurrence of various forms of alteration of sensation, such as irritation, pruritus and frequently distressing pain.

Pathology. The vesicles are formed at various depths in the epidermis, and are unilocular. The fluid present usually contains leucocytes, a considerable number of them being eosinophile. The proportion of eosinophile leucocytes in the blood is also increased. The tissues round the vesicles show the widened vessels characteristic of erythema, and sometimes a considerable amount of round-cell infiltration. The actual causation of the disease is unknown, but its course and the phenomena which it presents suggest very strongly a severe recurring toxæmia due to non-bacterial sources of poisoning. This suggestion is strongly supported by a variety of the disease known by the name of **Hydroa Gravidarum (Herpes Gestationis)**, which occurs in pregnant women. The disease in such cases usually begins about the third or fourth month of gestation, increases in intensity up to the time of the birth of the child, and diminishes gradually during convalescence. The attacks recur during successive pregnancies, usually becoming more severe, so that in some cases the patients do not become entirely free during the intervals of child-bearing. The eruption may not show itself till shortly before the full term, but it always lessens or may disappear entirely as the puerperium passes over. As yet no other disturbance of health except gestation is definitely known to cause this form of the disease.

Treatment. In mild cases little local treatment is necessary, except to protect the irritated

and raw surfaces produced by the blisters. In the severe forms with much eruption, the discomfort, irritation and pain are so great that local treatment is necessary. A solution of ichthyol in water, from ten up to fifty per cent. or even more, painted on the irritating surfaces and allowed to dry as a varnish, is often beneficial. Calamine lotion, thinly made, containing ten to thirty grains of calamine, with thirty minims of liquor calcis and twenty minims of glycerine to the ounce, gently dabbed on the surface, frequently relieves irritation, and to this may be added one per cent. of carbolic acid if the itching is very troublesome.

In the severer forms inunction of sulphur ointment is recommended as giving relief. In the majority of cases when the surface is excoriated unguentum acidi borici forms a simple and efficient dressing.

No known remedy given internally has a specific beneficial effect in this disease. Relief has sometimes been obtained by the administration of quinine; in others by the careful use of phenazone or phenacetin. In cases of any degree of severity complete rest and careful nursing are essential, with a properly arranged and nutritious dietary.

J. G.

III.—HERPES FEBRILIS

This name is applied to a vesicular eruption making its appearance usually about the mouth, the nostrils and the neighbouring portion of the face in certain febrile diseases. The diseases most often accompanied by **Herpes** are those affecting the respiratory tract. In many persons colds in the head and the infectious catarrhs of the upper respiratory passages are always associated with eruptions of labial herpes. It is frequently present also in the more severe respiratory diseases, such as acute bronchitis, and especially in the varieties of pneumonia. But febrile diseases of other organs may also be associated with this form of eruption, such as inflammatory diseases of the alimentary tract. The eruption is also frequent in certain acute infective diseases of the central nervous system, such as the different forms of acute meningitis and acute poliomyelitis.

The vesicles make their appearance on a slightly reddened base; one or two only may be present, while in other cases a large crop may develop, extending widely over the skin surrounding the mouth and nostrils. Usually the vesicles are discrete, sometimes they become confluent. In a day or two the contents become turbid; in some cases definitely purulent. A crust forms and usually separates and falls off in about ten days' time. Scarring is rarely left except in such cases where pyogenic infection is present and the eruption is confluent.

The etiology of this eruption is not well understood; numerous micro-organisms have been cultivated from the vesicles, but these are probably due to secondary infections. In the case of herpes arising in disease of the central nervous system, it is possible that the eruption may be truly symptomatic, and due to causes similar to those producing herpes zoster.

Treatment. The eruption is rarely of a serious nature, but produces a good deal of discomfort, and even pain. The inflamed surfaces should be interfered with as little as possible. Efforts should be made to keep them clean; occasional gentle bathing with a warm boric acid solution, especially after meals, followed by the application of a dusting powder, such as cimolite and oxide of zinc or bismuth, is sometimes advisable. In other cases, if the surfaces become broken and threaten to ulcerate, the application of an antiseptic salve, such as the unguentum acidi borici, or of a mild astringent lotion such as the glycerinum plumbi subacetatis, one in ten or fifteen parts of water, will be of service. If the vesicles suppurate the eruption must be treated on the lines of a pyogenic dermatitis such as impetigo.

An eruption resembling herpes febrilis occurs not infrequently on the genital organs—in the case of women on the inner surface of the vulva and on the labia, before the menstrual period, or in association with leucorrhœal discharges; in the male on the glans penis, the preputium and neighbouring skin following coitus, or from irritation of the affected area by the clothing or other causes. The eruption is apt to recur. These attacks give rise to difficulty in diagnosis from certain forms of venereal and syphilitic eruption, and frequently cause anxiety to the sufferers. With a very little care the differential diagnosis is easily made.

Treatment consists in strict attention to cleanliness, the use of drying dusting powders or of emollient or mildly antiseptic ointments or lotions as in the case of herpes febrilis.

J. G.

IV.—THE LICHENS

The old group of lichens included a number of rashes, but at the present time the term lichen is limited in application. Strictly speaking it would be better to restrict the name solely to Lichen planus, with which I will therefore deal first.

Lichen Planus.—The characteristic typical elementary lesion to be looked for (with a lens) is a flat, slightly raised papule, angular in shape, with a shiny surface in certain lights and more or less violet in hue. These features are the things to bear in mind when lichen planus

is suspected. The flat papules may be more or less discrete, or they may have become confluent, forming patches. The latter are slightly violaceous, unless they have been interfered with by treatment, etc. A patch of a violaceous tint is an important point to remember and should lead to a preliminary diagnosis of lichen planus, which must be confirmed by closer examination and search for the characteristic papule I have described. In chronic cases there may be but few lesions at the areas of election, which are the flexor aspects of the wrists and the inner sides of the knees. In some cases the lesions may form small rings. Another variety is the verrucose condition, usually on the shins, where patches may become large and hypertrophied. On the other hand, there is an atrophic form of lichen planus, but this is rare and is an involution stage. Many parts of the body may become involved, including the buccal mucous membranes. In diagnosis the mouth should always be examined when lichen planus is suspected, and papules, modified, of course, by position, and of a whitish tint, may be discovered on the buccal mucous surfaces, on the lips, or on the tongue. These buccal lesions may be well marked where only a small area of the cutaneous surface is involved; and few and far between, or even absent, when the rash is extensive. Again, the buccal mucous membranes may be alone involved for some time before eruptive elements appear on the skin.

The majority of cases are of the chronic type, with relatively small areas of involvement. But every now and then lichen planus may be extremely acute and become a formidable disease, owing to the intense itching of the skin, which maddens the patient and leads to serious disturbances of the system as a whole, from want of rest and consequent great exhaustion and nervous prostration. Indeed these acute outbreaks are most frequently observed in those individuals who have already suffered from nerve stress. The patients who present this form are most usually women, and a history of prolonged nursing—with little rest—shocks, etc., is frequently elicited. Not only may the itching be intense, but the cutaneous sensations may become perverted, and burning pain and tenderness of the skin may be also complained of, apart from pruritic manifestations.

Sometimes a single patch or several patches of lichen planus may be present for some time and then become complicated by a more or less generalized eruption.

Treatment. This varies with the kind of case. When there are a limited number of chronic patches local treatment is the important one. Ointments such as ol. rusci ℥ xx (or more), ung. hydrarg. ammon. ʒ i, or hydrarg. perchlor. gr. ii-v, acidi carbolici gr. xx, ung. zinci oxidi

ad $\frac{5}{2}$ i are useful; if the areas are small, electrolysis may answer. Ionization (zinc, copper) may also be useful, but it is slow in effect. I have found violet light clear up a very hypertrophied patch on the skin, but it took several exposures, and left a rather irregular vascular scarred condition behind. In another case the violet rays appeared to do very little good. X-rays and radium have given encouraging results. With these methods time must be given for the results to show themselves. Small areas have also been dealt with by means of carbonic snow.

In the generalized subacute and acute conditions internal remedies are very valuable. Here I would emphasize the fact that arsenic is not recommended. Indeed that drug may, especially in the acute cases, make matters worse. Salicin in fifteen-grain doses, taken regularly three or four times a day immediately after food, increasing to twenty grains or more has proved very valuable in my hands. So has a biniodide of mercury or a perchloride of mercury mixture, taken regularly, proved efficacious. In the very irritating cases—and it is the rule for the cutaneous symptoms to be very marked in the acutely eruptive conditions—local treatment is necessary. Here a large number of anti-pruritic lotions and liniments have been tried: calamine and tar, lead, carbolic and olive oil (gr. x ad $\frac{5}{2}$ i), etc. But the pruritic symptoms are in many cases very difficult to allay by these means, though antipyrin, phenacetin, opium, etc., be given at the same time as the local means are used. In my opinion the best method of dealing with this highly distressing symptom, which pulls down the patient considerably and may even lead to suicidal ideas, is lumbar puncture. And the sooner this is done, the better chance there is of stopping and allaying the irritation. Six drachms of cerebro-spinal fluid should be withdrawn. As pointed out by Thibierge and Ravaut of Paris, the effects are excellent, and indeed by this means the attack may be cut short, the lichen planus elements dying down and the patient improving in health, chiefly owing to the possibility of getting rest.

Lichen Scrofulosorum.—This is the name given to a chronic papular eruption consisting of inflammatory papules arranged in groups and circles, and occurring mainly over the lower part of the trunk, the flanks and the limbs. This condition is usually met with in children of a tuberculous or scrofulous type (hence the name). Though of course "scrofula" comes into the tuberculosis group, clinically the aspect of the scrofulous is more or less characteristic. The children are often fair, of the "non Angli sed Angli" tuberculous type (as opposed to the

coarse scrofulous patient), with some glandular enlargements. I have seen a typical case of Lichen scrofulosorum pass through measles and then develop into disseminated Lupus vulgaris. Phthisis may be present; at any rate the patients are vulnerable to the tubercle bacillus. There may be a family history of tuberculosis of the lungs, though the patient be free from any sign of this. But the tuberculous factor must be kept in mind in treatment, and also from the point of view of prevention. Insufficiency of food and of sunlight are also to be considered. Therefore the child should be fed and given cod-liver oil. It is common to give much too large doses of cod-liver oil by the mouth. It is better that the organism should assimilate a small quantity well, than that the child should be sickened and its digestion tried with too large doses. Fats in the dietary I consider most important: butter, bacon, sardines, dripping are all excellent for these cases, and also properly made suet puddings. Fresh air and light are required, since the rash is a signpost pointing to tuberculosis.

In addition to the above there are the following conditions, which are now rightly dissociated from the lichen group.

Lichen Urticatus.—An old name for what is better named Urticaria papulosa. It is dealt with under *Urticaria*.

Lichen Tropicus or prickly heat. This is a morbid condition of the sweat apparatus.

Lichen Syphiliticus.—This is a misnomer, and should be expunged from nomenclature altogether. Here we are dealing with the papular syphilides (see *Syphilis*).

Lichen Circinatus is the old name for *Seborrhœa papulosa et circinata*.

Lichen Acuminatus is the German equivalent for *Pityriasis rubra pilaris* (of Devergie).

Lichen Variegatus is a rare condition, with many synonyms, indicative of its multiform appearances. *Parakeratosis variegata* is a more applicable name. G. P.

V.—PEMPHIGUS

The name pemphigus might be applied to any condition associated with the formation of bullæ, but such a wide definition would include burns, erysipelas and many other eruptions. It is therefore limited to those diseases in which blister formation is a constant and essential, not an accidental or secondary, feature.

Acute Pemphigus occurs both in infants and adults. The infantile form (*Pemphigus neonatorum*, vel *contagiosus*), is really a bullous impetigo due to streptococcal infection. It is extremely infectious, spreading rapidly through maternity hospitals, or in the practice of

infective midwives. It is characterized by the presence of bullæ, varying in size, scattered over the body and limbs. The palms, soles and face are rarely involved. *Treatment* consists in isolation, improvement of the general condition, prolonged antiseptic baths, and locally mild antiseptic ointments.

In adults a grave variety is met with, probably due to a specific micro-organism, the diplococcus of Demme. It is practically confined to individuals who handle carcasses—*e.g.* butchers and cooks. The organism gains entrance through a lesion on the hand, a whitlow often marking the point. The eruption is ushered in by diarrhœa, vomiting and fever and, after a period of about forty-eight hours, bullæ arise on erythematous areas, at first discrete, later confluent, often involving mucous membranes. The prognosis is bad, only twenty-five per cent. recover. The patient's strength should be maintained by every means, quinine administered, the blisters opened and antiseptics applied.

True pemphigus may be subdivided into: pemphigus vulgaris, pemphigus foliaceus and pemphigus vegetans.

Pemphigus Vulgaris.—A chronic disease, lasting months or years, characterized by the formation of bullæ on healthy skin or mucous membranes. The bullæ are numerous or scanty, tense or flaccid, varying from a pea to a pigeon's egg in size. At first clear and sterile, they soon become contaminated by organisms. The cause of this disease is not understood, but it is probably associated with changes in the central nervous system, the result of some toxic poisoning. In the more grave types itching may be extreme and constitutional symptoms very marked. The lesions appear in crops, and the mucous membranes are especially liable to become affected.

Pemphigus Foliaceus.—In this type flaccid bullæ are formed, the fluid contents of which cake into flaky scales, like pie-crust, so that the primary lesions are sometimes recognized with difficulty. The patient exhales a characteristic nauseous odour, the hair falls, and there is progressive emaciation.

Pemphigus Vegetans.—The bullæ usually originate on a mucous membrane (mouth or vagina), and from their bases condylomatous masses spring up; the condition progresses steadily to a fatal termination.

Certain conditions in which the formation of bullæ occurs, including the Pemphigoids of Colcott Fox, should be separated from true pemphigus. The more important are given below.

Epidermolysis Bullosa.—A congenital and often hereditary affection, where bullæ form with abnormal facility, especially over points

of pressure. If the finger be rubbed over the skin the epidermis is detached (Nikolsky's sign). The nails are often disfigured and destroyed, and tiny cysts are common.

Dermatitis Herpetiformis.—A rare chronic disease, characterized by a multiform eruption of erythematous patches, and grouped itching or painful vesicles or bullæ. Eosinophile cells are found to excess in the blood and in the fluid of the blisters, but this is probably of little significance. In congenital syphilis blebs may appear a few days after birth, especially on the palms and soles, and may be the first evidence of the disease.

In diseases where peripheral nerves are affected—*e.g.* certain forms of leprosy and peripheral neuritis, well-marked bullous formation may be found. Self-inflicted blebs are sometimes observed in hysterical girls (pemphigus hystericus).

Bullæ may also be met with in urticaria, after certain drugs (iodides, bromides, antipyrin, etc.), and in the course of erysipelas and impetigo.

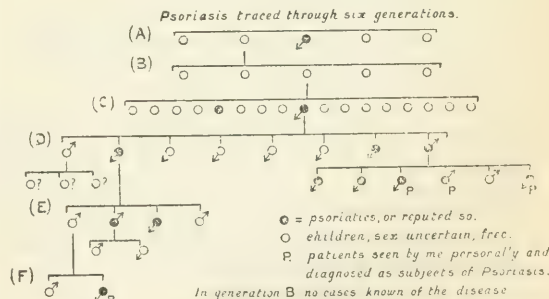
Treatment. Arsenic, salicin or quinine should be administered. The lesions may be protected from rupture, and the consequent secondary infection, by cotton wool, or if broken, dressed with boric acid ointment. Some prefer to open and dress each bulla. A boric acid bath is often useful. The patient should be confined to bed, certainly during any exacerbations.

Opium may be tried in pemphigus vegetans.

H. MacC.

VI.—PSORIASIS

Nothing is definitely known as yet of the causation of psoriasis, and none of the hypotheses which severally ascribe it to parasitic, nervous, arthritic or "humoral" causes are



satisfying. We are on firmer ground in recording that heredity certainly plays an important part, and I append a remarkable pedigree of six generations which I was able to obtain from a private patient in whose family a long and careful record had been kept.

Yet the disease is one of the commonest and most clearly differentiated; of 12,500 cases of skin disease recorded in my register at St. Mary's Hospital 474 were cases of psoriasis. It is probably commoner in northern climes than in southern, and it would seem that the disease is exceptional among black races, a circumstance which led the late Dr. Hyde to propound his remarkable view that psoriasis was due to deprivation of sunlight.

The elementary lesion is a round papule, at first hardly different in colour from the surrounding healthy skin, but eventually becoming pink and surmounted by a stratified white scale; at this early stage two tests which are valuable diagnostic methods may be applied. The first is that when the scaly summit is scratched a glistening white surface is exposed, which has been compared to a smudge of candle grease (*tâche de bougie*). If the entire scale is removed by deeper scratching, a red shining surface comes into view, with multiple minute points oozing with blood; this, which is known as the "bleeding test," depends on the increased local vascularity of the papule, and is very significant of psoriasis.

The lesions extend to form patches of varying size, and unnecessary names have been given to the varieties of eruptions so caused, according to the size of the patches. Very large plaques may result from fusion of the contiguous patches. Spontaneous involution frequently occurs, the middle part of the patch clearing up while the peripheral margin extends, so that rings and segments of circles may be formed. Except in rare cases the eruption remains dry throughout. In a very rare type, known as psoriasis rupioides, exaggeratedly heaped-up scales form which appear moist and resemble rupia; but the limpet-like mass when removed shows a dry surface beneath, quite unlike the suppurating base of a rupial scab.

Distribution of Lesions. This in adults is extraordinarily constant; the favourite sites are the backs of the elbows, the fronts of the knees and the scalp; in young children the trunk is quite often equally, in fact more, attacked than these sites. In more widespread cases the extensor surfaces of the limbs and the trunk, especially in the midline, back and front, are involved; the face and hands usually remain exempt longest, but ultimately the whole integument may be invaded; the nails show a very characteristic pitting of the surface, like needle-pricks, and often a thickening of the entire nail; the hair is seldom much affected and does not fall as it does in seborrhœa capitis. The mucous membranes are never in any way altered; it must be remembered that the glans penis is covered by skin, not mucous membrane, and is frequently the seat of psoriasis.

Psoriasis would seem to be specially prone to appear in sites of superficial injury, *e.g.* from scratching; linear streaks of disease may thus result which are very characteristic, and the frequent cases of eruption of psoriasis on vaccination areas is probably to be explained by this tendency.

Incidence and Course of the Disease. It is very uncommon in children under the age of two years, but has been recorded; from statistics collected by Crocker it would appear to occur with equal frequency in the three decades, ten to twenty, twenty to thirty, thirty to forty, and to decline progressively after the latter age. Females and males suffer equally. The blond and red-haired type in both sexes seems especially subject to it. Victims of the disease are usually robust, high-coloured and otherwise healthy persons, even when they have suffered for years.

Untreated, the eruption may spread with more or less rapidity, persist indefinitely, or retrocede, as has been mentioned, by healing in the centre of the patch. Exceptionally the eruption of psoriasis may become generalized and pass into a perfect simulation of pityriasis rubra (exfoliative dermatitis). The specific fevers seem to have an influence in dissipating the eruption, and there is a curious seasonal variation, differing in different persons, but most commonly in the sense that the eruption becomes more active in the spring and autumn. Recurrences, even when the disease appears completely cured, are always to be feared. The interval of freedom is probably in proportion to the completeness with which the eruption has been cleared from the body—a point of importance in encouraging the patient to persevere.

Treatment. Since the disease is extremely chronic, interferes but little with the general health and commonly spares the exposed parts, patients usually decline to submit to treatment which involves disturbance of their work or pleasure. Thus two classes of patients arise, according as they will or will not consent to confinement to bed. When the latter can be enforced the treatment is much more satisfactory, and considerably shorter in duration. In my experience no application can equal chrysarobin in efficiency, in spite of its drawbacks, and I am accustomed to rely on local treatment almost exclusively. Arsenic has been so much abused in this disease, and is so liable to cause serious mischief when taken in the prolonged doses required by so chronic an affection, that I seldom use it, and I am personally little impressed by the claims of salicin and thyroid extract. If the patient can be treated in bed, continuous application of an ointment containing chrysarobin should be made;

the ointment should be spread on lint, and kept in position with a bandage. Vaseline is perhaps the best excipient for use in these continuous dressings. The proportion of chrysarobin at the beginning should be small, not more than ten grains to the ounce; when it is ascertained that there is no special susceptibility the dose may be increased to half a drachm or even one drachm to the ounce. It often happens that with this treatment the greater part of the eruption will be cleared, but some small obstinate patches remain. These may be cleared with stronger applications, such as the following ointment-stick—

Chrysarobin 3
Wax 2
Lanoline 5.

Where there is intolerance to chrysarobin, and where this cannot be used, oil of cade is probably the next best application. As chrysarobin stains the hair it cannot well be employed on the scalp, and an ointment containing oil of cade may be used for this part, *e. g.* ung. ol. cad. et quill.

Ol. Cadin. ̄ i
Ext. Quillaë ̄ v
Glycerini Amyli ̄ xlv
Essent. Caryoph. ̄ v.

This can be washed out easily from the hair, which it does not stain permanently.

If used on the smooth skin the oil of cade may be painted on, either pure in the case of small patches, or diluted with olive oil (ol. cad. ̄ i-iv, ol. olivæ ad ̄ i), or mixed with an ointment, *e. g.*—

Ung. Acid Sal. ̄ i
Ol. Cadin. ̄ i-ii.

For psoriasis of the face in the neighbourhood of the eyes chrysarobin may be used if great care is exercised that the conjunctiva is not touched; but as there is much risk of this, many authorities consider its use here prohibited. I have used very adhesive chrysarobin ointments, and especially the ointment-stick (mentioned above), on the face without harm.

For very resistant patches a pastille dose of X-rays is often successful when other methods have failed.

When the patient is unable to give himself up to the treatment and is required to make his appearance daily in public, he can still keep his eruption under control by night applications of chrysarobin. I recommend such patients to sacrifice an old pair of pyjamas to the treatment, and to wear with them cotton gloves and socks, so that the sheets are spared from

contact as much as possible. An adhesive ointment base is the following—

Kaolin Levigati, Amyli āā ̄ ii
Paraff. Moll., Paraff. Fluid āā ̄ i

Chrysarobin (x-xl ad ̄) is added to this and the ointment rubbed on the skin and left unbandaged. No treatment will keep off attacks; but if a careful look-out is kept for fresh eruptions and the new lesions treated immediately, the disease can be kept well under control.

Vegetarianism, partial or complete, is strongly recommended by many authorities. I am not personally convinced that there is much advantage in it. Excitants like alcohol are obviously mischievous. Brocq regards psoriasis as a "cutaneous reaction," the reflex of a general state of health. I am inclined to think that hypoacidity to Joulie's tests is associated with exacerbations of eruption and still more probably with exacerbation of itching, and that correction of this fault is an important help in treatment.

E. G. L.

ALOPECIA

The term alopecia includes all forms of baldness, but the cases fall naturally into three groups—

1. Ordinary or seborrhœic baldness, which may be senile or premature.

2. Alopecia areata, at one time thought to be seborrhœic in origin, but considered here as a special disease of unknown origin.

3. A small group comprising congenital, toxic and cicatricial alopecia.

Senile and Premature Alopecia.—Senile alopecia is generally attributed to the degenerative processes incident to old age, and premature alopecia might reasonably be attributed to similar processes, due to an inherited tendency to baldness. Senility, however, is not necessarily accompanied by loss of hair, and even an increase in the growth of the latter may sometimes be observed. It seems probable, therefore, that some other cause underlies both senile and premature alopecia. This may be found in an inherited or acquired tendency to seborrhœa and the action of a special bacillus in the soil thus prepared.

Clinically there is little difference between the two varieties, the loss of hair begins on the vertex and temporo-frontal region and slowly spreads until the whole crown is completely denuded, leaving a gradually diminishing fringe at the sides and back of the scalp.

The fact that seborrhœa is or has been present in the majority of cases of ordinary baldness, especially in men, can hardly be disputed, but some dermatologists regard the increased sebaceous secretion as merely a functional change.

Others, again, believe the micro-organisms to be merely saprophytic, while Sabouraud attributed both seborrhœa and baldness to his microbacillus. According to this observer, seborrhœic alopecia is preceded by a scaly condition or pityriasis simplex (caused by the bottle bacillus) which affects the scalps of children between the ages of ten and twelve years. At about fifteen years of age the dry scales become fatty and loss of hair occurs (pityriasis steatoides). In males this condition progresses to a third stage, in which the scales become thick, yellow and greasy and the change is accompanied by progressive loss of hair (seborrhœa decalvans), constituting the common masculine type of baldness. In women the third stage is not usually reached, but the fatty scales persist and frontal or temporo-frontal alopecia results.

According to this hypothesis the hypersecretion of sebaceous matter and the loss of hair are caused by a microbacillus which gains entrance to the follicular orifice and becomes encysted in a cylinder of horny cells, giving rise to hypertrophy and hypersecretion of the sebaceous glands and atrophy of the hair papillæ.

Other factors which have a possible bearing on the etiology of baldness are a peculiar shape of the head, excessive sweating of the scalp and mental strain.

It has been suggested that interference with the arterial flow and venous congestion which result from compression of the vessels when hard hats are worn, especially when the head protrudes at the sides, are contributing causes of alopecia. A localised interference with the blood supply, if sufficiently intense and prolonged, might reasonably be supposed to lead to malnutrition of the hair papillæ, but there is no proof that any such process occurs, and anatomical reasons render it extremely improbable.

Excessive sweating of the bald scalp is a familiar phenomenon, but it is also observed without loss of hair. An excessive or perverted secretion might conceivably be injurious to the hair growth, especially when acting as a culture medium in such an excellent incubator as the ordinary unventilated hat worn at the present day.

Sudden mental shock has been known to cause baldness as well as canities, and prolonged worry may also be conceded a possible influence by the inhibition of tropho-neurotic stimuli.

Congenital Alopecia.—This is a rare form of baldness which may be inherited or occur in several members of a family. There may be simply a delayed or scanty growth of hair, but occasionally permanent bald patches or total baldness occur. Defective development of the teeth and nails have been recorded in associa-

tion with some of the cases. Imperfect or delayed hair growth may also be seen in association with monilithrix and ichthyosis.

Toxic Alopecia.—It is well known that loss of hair sometimes follows febrile or wasting diseases. Erysipelas, enteric, scarlet fever and influenza are instances of the former, diabetes and myxœdema of the latter. Whether the alopecia is due to the pyrexia or to toxic substances circulating in the blood or to simple malnutrition of the skin and hair papillæ, it is difficult to say. In myxœdema the dry, ill-nourished skin and scanty hair appear to be a part of the general malnutrition of the disease, and there is very little evidence of any direct connection between the function or absence of function of the thyroid gland and the growth of hair, although some observers have claimed beneficial results from the administration of thyroid in cases of extensive alopecia.

Toxic alopecia is as a rule diffuse or complete, seldom circumscribed, although occasionally a febrile disease seems to determine an attack of alopecia areata.

The loss of hair accompanying secondary syphilis may be included under this group; it is also diffuse, but cases indistinguishable from alopecia areata are met with. An interesting example of toxic alopecia is that provided by the administration of thallium acetate, a drug sometimes given for the excessive sweating of phthisis.

Cicatricial Alopecia.—Disease or injury causing atrophy or destruction of the hair papillæ or follicles may lead to localised patches of baldness. Such are the lesions of tertiary syphilis, lupus erythematosus, morphœa, favus, etc. The patches are often multiple, circular and depressed in syphilis, irregular and shiny in lupus erythematosus, ivory-like and sometimes corresponding to nerve areas in morphœa, disseminated and extensive in favus. Bald ringworm and alopecia areata are not cicatricial and are followed by recovery; permanent bald patches may, however, result from kerion or from the use of excessively strong applications.

Pseudo-pelade, folliculitis decalvans and various pyrogenetic infections, such as pustular folliculitis and boils or acne varioliformis may lead to cicatricial baldness in large or small areas. Contagious impetigo is occasionally followed by small alopecia patches but, as a rule, without definite scar formation.

Another cause of cicatricial alopecia is X-ray dermatitis, occurring in large or small patches according to the area exposed.

Alopecia Areata.—*Etiology.* Alopecia areata is a disease of unknown origin characterized by the formation of one or more circumscribed and usually circular areas of baldness, which spread

at the periphery and coalesce to form larger patches. Children are affected more frequently than adults, males more than females, and dark more often than fair-haired patients. Norman Walker found that in 4000 cases of skin diseases five per cent. suffered from alopecia areata, there was a greater susceptibility in males, and the most common age of incidence was between ten and twenty. In a recent analysis of 200 cases Sabouraud found that the disease occurred between the ages of four and fifty-eight, its maximum frequency being from the sixth to the eleventh year, and that 130 men were affected to 70 women. This observer also showed that in at least 22 cases out of 100 examined the affection was hereditary or familial, 11 being directly inherited.

Three theories as to the cause of alopecia areata may be considered—the tropho-neurotic, the parasitic, and the toxic.

The Tropho-Neurotic Theory. The acute generalized form, which is often preceded by mental shock or worry, suggests a nervous causation, and the same factor is also sometimes present in the localised form. There is also a small group of cases in which patches of baldness have followed nerve injury or blows on the head causing neuritis.

In a considerable number of patients, chiefly adults, alopecia areata is accompanied by persistent headache, and severe neuralgia is an occasional cause. Sabouraud describes an alopecia areata of the menopause. According to Jacquet the cause is to be sought in some form of peripheral nerve irritation, chiefly that caused by dental caries, Whitfield has seen cases which he attributed to eye-strain, and I have seen several in which ear trouble was the apparent cause. In hospital patients I have noticed that alopecia areata is often associated with or preceded by severe pediculosis of the scalp, but this is rare in adults and in private patients. Some cases occur in association with leucoderma, itself regarded as a tropho-neurosis. The fact that excision of the cervical ganglion in the cat may result in loss of hair is in favour of a nervous causation, but on the whole the evidence is scanty and the majority of patients are in perfect health.

The Parasitic Theory. There is much in the clinical appearance and course of alopecia areata to suggest a microbic causation, but the evidence practically resolves itself into a few somewhat dubious epidemics which have occurred, chiefly in French barracks; the constant presence of the microbacillus, which led Sabouraud to regard alopecia areata as an acute localised seborrhœa; and the fact observed by Sir Jonathan Hutchinson, that many cases had previously suffered from ringworm of the scalp. But all attempts at inoculating the

disease have failed even in susceptible persons (Jacquet), and in all probability the so-called infectious cases are really instances of bald ringworm in which the diseased hairs have been absent or overlooked.

In two children with alopecia areata, under my care, in whom there was a suggestion of contagion from sleeping together, sections of skin from the bald patches showed cellular infiltration in the neighbourhood of the vessels and hair follicles, but no micro-organisms except a few surface cocci, and cultures gave negative results. The examination of stained "note of exclamation" hairs from a large number of cases showed microbacilli in only a small proportion, and cultures from these hairs implanted on Sabouraud's acid peptone glycerine agar medium and grown aerobically resulted, for the most part, in raised, opaque, greyish, wax-like colonies of the common coccus of the skin.

The Toxic Theory. The sudden fall of the hair and rapid extension of the disease all over the body in some cases, the spontaneous recovery with relapses and the absence of marked inflammatory signs, are more easily explained by the temporary presence of a toxic agent than by other theories (Adamson). The fact that the leucocytic infiltration, found in sections, chiefly occurs around the blood-vessels, and consists of mononuclear and lymphoid rather than polynuclear cells, is also in favour of toxic action. It is also known that various poisons circulating in the blood may give rise to loss of hair.

Sabouraud's recent statement, that in 200 cases examined by him there was hereditary syphilis in the child, or old acquired syphilis in the adult in twenty to twenty-five per cent., and active syphilis—as shown by the Wassermann reaction—in ten per cent., may perhaps be taken as further evidence of a toxic effect.

Symptoms. Clinically two chief types may be distinguished, the acute generalized type and the chronic localised type, but there are gradations between these varieties.

The acute rapidly spreading type is sometimes preceded by a mental shock, such as a fright or bereavement. The hair may fall out almost simultaneously in masses, but if the history be carefully elicited, it will usually be found that there has been a rapid fusion of circular areas of baldness. Within a few days, or even a few hours, all the hair of the scalp and body, including the lanugo, may be shed, and sometimes the nails are lost. Recovery may take place, but as a rule the prognosis is bad in these cases and the baldness remains permanent.

The chronic localised or common type of alopecia areata may run a rapid course, but usually stops short of universal baldness, or this stage is only reached after several months or years.

Sometimes the beard is affected alone or with the scalp, and the eyebrows and eyelashes may also be lost, but in the majority of cases the disease remains localised to the scalp.

A common situation for the first patch or patches is the occipital or parietal region of the scalp. In the earliest stages the skin of the bald area may be slightly red and irritable, but usually the first thing noticed is a circular, oval or crescentic patch of smooth, white, bald skin, around which the apparently healthy hairs are loosely attached, so that they can easily be pulled out with the fingers. The so-called "note of exclamation" hairs are noticed at the spreading edge of the patch or occasionally dotted all over it. These are almost pathognomonic of alopecia areata and indicate that the disease is in active progress; they are not seen in the very early or in the later stages of the disease when recovery has commenced, nor are they observed in the rapidly spreading cases. Under the microscope they present a narrowed proximal end and an atrophied root; the distal end, which represents the normal calibre of the hair, is relatively swollen, deeply pigmented and often terminates in a frayed-out brush-like extremity. Similar atrophied hairs may be produced when X-ray exposures fall short of epilation, but the ends of the hairs are usually pointed and not frayed-out. The alopecia patch may be slightly depressed below the level of the surrounding skin, owing to loss of the hair roots, but there is no atrophy or alteration of sensation, and the skin is usually white, smooth and freely movable. In exceptional cases the bald area is roughened by prominent follicles.

A curious form of alopecia areata, chiefly occurring in children, in which the bald area takes the form of a band around the back and sides of the head, is known as the ophiasis type. Another variety begins as a sickle-shaped patch above the ear. A patchy but less definitely margined type associated with marked seborrhœa, and not showing "note of exclamation" hairs, may also be mentioned here, although it appears to be essentially seborrhœic and different from the ordinary type of alopecia areata. A similar kind of alopecia occurs in the frontal region of patients suffering from seborrhœa and acne.

Diagnosis. A typical patch of alopecia areata can scarcely be mistaken for any other disease, with the exception of bald ringworm. The discovery of hairs containing fungus will put the diagnosis beyond dispute, moreover ringworm is rare after the age of sixteen. In small-spored ringworm the surface of the patch is scaly and covered with short stumpy hairs, which break off when pulled with forceps and show a whitish powdery spore sheath. The

club-shaped hairs of alopecia areata pull out with a sort of click and are rarely found in ringworm.

Under the microscope the distinction between the two kinds of hairs is easily made. Favus is distinguished by scarring, the presence of yellow cups, and of fungus in the hairs and epidermic scales.

Pseudo-pelade of Brocq usually occurs in irregular-shaped areas, is very slow in its course, and the skin is tense and atrophic. In folliculitis decalvans there is a pustule or ring of inflammation at the base of each hair where the disease is spreading. Lupus erythematosus causes shiny areas with irregular margins and rarely affects the scalp alone.

Small alopecic areas due to tertiary syphilis, acne necrotica, boils, folliculitis, etc., are easily distinguished. Alopecia of secondary syphilis is usually diffuse or in small scattered patches, occasionally in ridges or furrows like a ploughed field.

Prognosis. The course of alopecia areata is extremely variable, some early cases recovering in a few weeks, others running a course of many months or years and repeatedly relapsing at varying intervals after apparent cure, or recovering in one part of the head and spreading at another.

When a patch ceases to spread, the "note of exclamation" hairs are no longer seen and a fine growth of down appears on the bald area. The new hair is often white at first, but gradually becomes pigmented from the root upwards. In the majority of cases the prognosis as regards re-growth is good, but in people over forty-five years of age and in total cases there is little hope of recovery.

Treatment. When the hair is once lost in middle-aged or old people, little can be done to restore the growth, but the use of stimulating lotions and ointments containing ammonia or cantharides or perchloride of mercury is sometimes successful in arresting the process.

Both senile and premature baldness are probably due in a large degree to neglected seborrhœa of the scalp during childhood and adolescence. The application of water to the hair every day without drying or the use of grease conduces to seborrhœa and is a common cause of loss of hair in young men.

If there is no constitutional defect or hereditary tendency, treatment of the seborrhœa will usually prevent the spreading of premature alopecia.

The scalp should be frequently washed with soft soap dissolved in spirit to remove the grease and scales, and sulphur, mercury or resorcin lotions or ointments rubbed in thoroughly once or twice every day.

Vaccines of the microbacillus of seborrhœa

have been tried, but without very encouraging results.

Neurotic cases must be treated on general principles and stimulating applications used locally; constitutional diseases such as syphilis or myxœdema require the treatment suitable for these conditions, and local causes such as favus, pyrogenetic infections, etc., also require appropriate local measures.

Alopecia areata is usually treated on anti-seborrhœic lines in the same way as ordinary premature seborrhœic baldness, but stronger applications may be required, such as blistering fluids, painting with pure carbolic acid or iodine solution, high frequency currents, ultra-violet rays, etc., and other methods which stimulate the scalp and produce hyperæmia.

The X-rays have also been used in small stimulating or in epilating doses. Considerable success may be attained with the latter method when other measures have failed; the patch and surrounding hair are exposed, and in the majority of cases epilation is followed by a growth of new hair on the patch. This method does not, of course, prevent fresh patches appearing on other parts of the scalp, but as a rule there is no relapse in situ. In extensive cases the whole scalp may be exposed to the rays, as in the treatment of ringworm, and be followed by re-growth, but in cases of total baldness this method is of little use. In some cases hypodermic injections of gr. $\frac{1}{4}$ of pilocarpine nitrate every week or fortnight have been successful in restoring the growth of hair.

Drugs given internally do not seem to have any special action, but iron, strychnine and glycerophosphates may be given with advantage, and occasionally arsenic seems to exert a beneficial effect.

S. E. D.

NEW GROWTHS OF THE SKIN

Molluscum Contagiosum.—The points to bear in mind specially are that these epidermal growths are solid and have a central depression. They vary from a pin's-head to a pea in size as a rule, but they may attain to a larger size. As the name indicates they are contagious. They are chiefly met with on the face, scalp, breasts and genitals. There may be a few only, or, again, they may be extremely numerous and closely aggregated. They must not be mistaken for varicella; the lesions are not vesicular but solid, as I have said. Remember that molluscum contagiosum may be contracted from birds (pigeons, etc.).

Treatment. Whenever possible, the best line is to slit the small growths up with a sharp knife and squeeze out their contents. In some instances I have had a good result by removing them boldly with a small sharp spoon. In

young children, carbolic acid, iodine or acid nitrate of mercury carefully applied on a sharpened wooden match-end and pushed into the growth answers, but I prefer slitting them up with a knife. When the lesions are very small touching them individually with one of the above applications is good treatment.

Xanthoma.—I will here allude only to *Xanthoma palpebrarum*, the well-known yellow lesions imbedded in the corium of the eyelids. When very small they can be excised and the edges of the wound brought together with fine stitches. I have had good results from this method. Another method is electrolysis with a current of two or three milliamperes. It is better to repeat this in several sittings.

Xanthoma Multiplex. Here I refer specially to the plates of xanthoma on the tips of the elbows and the front of the knees (familial xanthoma in some cases). In such X-rays answer well.

Rhinoscleroma.—This is so rarely met with in this country as scarcely to deserve mention here. The condition is a new growth of stony hardness involving the anterior nares and neighbouring parts and developing slowly. It must not be confounded with syphilis and epithelioma. X-rays are the best treatment.

Keloid.—Here one must distinguish between true keloid and hypertrophic scar. In the former, bear in mind the slow extension with claw-like processes. Excision is worthless in the case of true keloid. I have obtained some improvement by means of electrolysis and of thiosinamine local injections, but better than these are X-ray exposures for large keloids and solid carbonic acid for small ones. As to hypertrophic scars, such as those after severe burns, I have had excellent results from repeated local thiosinamine injections, in one case enabling the arm to be extended to full extent where it was previously flexed at a right angle; and in another a bad burn of the face was flattened and improved considerably. But this method is slow and somewhat painful. I would therefore recommend the more recently introduced treatment of using X-rays on such cases whenever possible. Hypertrophied scars arise from suppurating and septic healing surfaces.

In this connexion I would mention the little tumours of the skin called Botryomycosis (or Granuloma pyogenicum) which arises as the result of septic infection (staphylococcal) or trivial injuries. They are small pea or cherry-sized pedunculated tumours, which some patients cherish for years. An instructive case came under my observation some years ago. The growth occurred on the chin of a lady, who had unfortunately consulted a notorious firm of cancer-quacks before she came to me. Of

course the growth had been diagnosed as a cancer and various sorts of moonshine ordered under constant supervision. The growth was really what is called (not very appropriately) botryomycosis. I got rid of it by ligature, but it was some time before the "cancer" idea could be driven out of her head.

Fibroma (Neuro-fibroma).—This class of tumour is usually multiple. An extraordinary large number of fibromata may be present, and the variations in size are great. The trunk is the part most affected. In some cases pendulous growths are present as well. The very large, fibroma pendulosum, which is solitary, comes under general surgery.

In a special type of case, in addition to the fibromata and neuro-fibromata there are pigmentation anomalies. This is usually called Recklinghausen's disease. Other degeneration symptoms (mental, etc.) may be present.

Sometimes fibromata undergo a process of involution and disappear, leaving an empty pouch behind.

Where very numerous, treatment is out of the question, large pendulous growths may be removed on general lines of surgery.

Carcinoma Cutis. Paget's Disease. Melanotic Cancer. Rodent Ulcer.

Cancer of the Skin may arise from a variety of precedent skin lesions: fissures, moles, nævi, senile warts, etc. Cancer may also develop as a result of long-standing lupus vulgaris, old-standing tertiary syphilitic ulceration, varicose ulcer, and so forth. Chimney-sweep's cancer, resulting from irritation, must be mentioned here, as also the cancerous condition arising in X-ray workers after frequent and careless exposure. The latter I have compared with what has been named sailor's skin, also a result of exposure to sun and storm. I have in this way seen a large fungating cancerous growth develop on the back of the hand of an old sailor. Again, I am of opinion that lupus vulgaris should not be treated by X-rays indefinitely and without proper precautions. It has appeared to me that the rays in some of the cases of lupus vulgaris have played a part in producing cancer. Lupus vulgaris of long standing may lead to cancer as a complication on its own account. That had been observed before the X-rays were known. Cancer may also be a complication of arsenical keratosis, and even lead to the amputation of the hand at the wrist, for instance. In that rare family disease, xeroderma pigmentosum, some of the growths may become cancerous. I would also refer to the tangerine-like tumours in an unusual case which I examined and looked upon as carcinomata.

Sufficient has been said to put the reader in

the way of diagnosis. The important point is to think of the possibility of cancer in a number of circumstances.

It is not necessary here to go into the various histological types of cutaneous cancer, for whatever they may be, the clinical features of the growths are more simple than their intimate architecture. The points to bear in mind are growth; extension, ulceration, fungation, hardness to the touch and involvement of glands; but suspicious growths should not be "watched" indefinitely, as they too often are. "Wait and see," is a futile policy here. Remember it is important to identify malignant growths before glands have become infected. Moreover, a biopsy and microscopical examination can always be carried out if there is any doubt.

In this place it is only possible to mention cancer of the lip, which must be distinguished from primary chancre. There is no doubt the latter has been frequently excised under the idea that the lesion was cancer. The duration, appearance, induration, adenitis and symptoms indicative of syphilis would have to be carefully considered, to say nothing of the search for the spirochæte pallida. The same may be said of suspicious lesions about the margin of the anus. Duration is important. But no single clinical symptom should be relied on, but the case taken as a whole and the various features of the growth carefully analysed.

Paget's Disease of the Breast may now be considered. Here chronic eczema of the nipple and areolar region should be excluded by using the fingers. Mere looking at the trouble is useless. Touch will reveal a thickening which has been aptly compared with feeling like a penny in a cloth. The duration, again, is a point of importance. It should be borne in mind that careful examination will make all the difference as to whether a lotion is ordered or excision of the breast recommended. Paget's disease may affect the scrotum, and other parts of the body, but this is very exceptional.

Melanotic Cancer must next be considered. Whenever a spot of pigment in the skin or a dark, and especially a black, mole commences to get larger, to grow, the possibility of malignant development must at once arise in the mind. The cardinal rule is this: a growing melanotic lesion must be excised without delay. Melanotic malignant growths may rapidly generalize. Bear that in mind. A case of the kind came before me again quite recently. Two years previously a mole of a dark mahogany colour on the right big toe began to get larger and warty. When I saw it there was a fungation about the end of the big toe, with hardness of the surrounding edges. There was an enlarged femoral gland close to the groin. My diagnosis was melanotic epithelioma

and I recommended immediate removal. Before operating, the surgeon had the growth examined. It was epithelial. After the removal of the growth and glands it was found histologically that the tumour was made up of epithelial down-growths, the cells in parts containing pigment. The glands were apparently slightly infected by growth. If I have insisted on this it was partly to call attention to the existence of melanotic cancer as opposed to melanotic sarcoma. When I was a student every melanotic growth was classed as a sarcoma without further ado. This is not correct, and more recent investigation has demonstrated melanotic cancer as a fact.

Rodent Ulcer.—This is a common affection, frequently overlooked, especially in the early stages, owing mainly to insufficient examination with a lens. The point is the slightly raised rolled edge, translucent, showing coursing vessels. Later, duration and evolution should at once lead to suspicion of rodent ulcer and the lesion be closely examined from that point of view. The growth, though an epithelial one and developing from the epithelium of the skin appendages, is clinically not malignant, that is, does not infect the lymphatics as long as it remains a true rodent ulcer. For years and years the rodent ulcer may go on slowly but surely extending without becoming infective, though it destroys as it goes. But remember that rodent ulcer may take on a downward true cancerous growth as a complication. In some cases this epitheliomatous extension may be rapid and acute. The so-called crateriform ulcer is a clinical variety of this change. The moral is that a rodent ulcer should be got rid of, if possible. In the early stages this can be done, but when a large area has been destructively interfered with, as in the very old-standing rodent ulcers one sees in infirmaries, for instance, treatment becomes a very difficult business, if not an impossibility. Therefore aim at early diagnosis and immediate curative treatment, without wasting time with futile ointments. Nowadays a ready means of dealing with rodent ulcer is carbonic acid snow applied for forty seconds, every case being of course taken on its merits as to duration of exposure. Radium is also very useful, and I have had good results with it. X-rays are also employed, but less so than was the case a few years ago. But, whatever treatment is carried out, it is essential that the case should

be kept under supervision and an absolutely permanent cure not promised, in order that any sign of recurrence should be dealt with at once. Excision, widely done, answers in some cases very well, but here, again, after-observation is necessary, for I repeat rodent ulcer is very prone to recur. Internally arsenic in small doses persevered with has given good results, it is said. One more word. Rodent ulcer must not be tinkered with in a futile manner with caustics. If caustics are going to be employed they must be strongly and thoroughly applied. That line, however, I do not commend. The ultimate cosmetic results are to be held in view, for rodent ulcers are usually on the face.

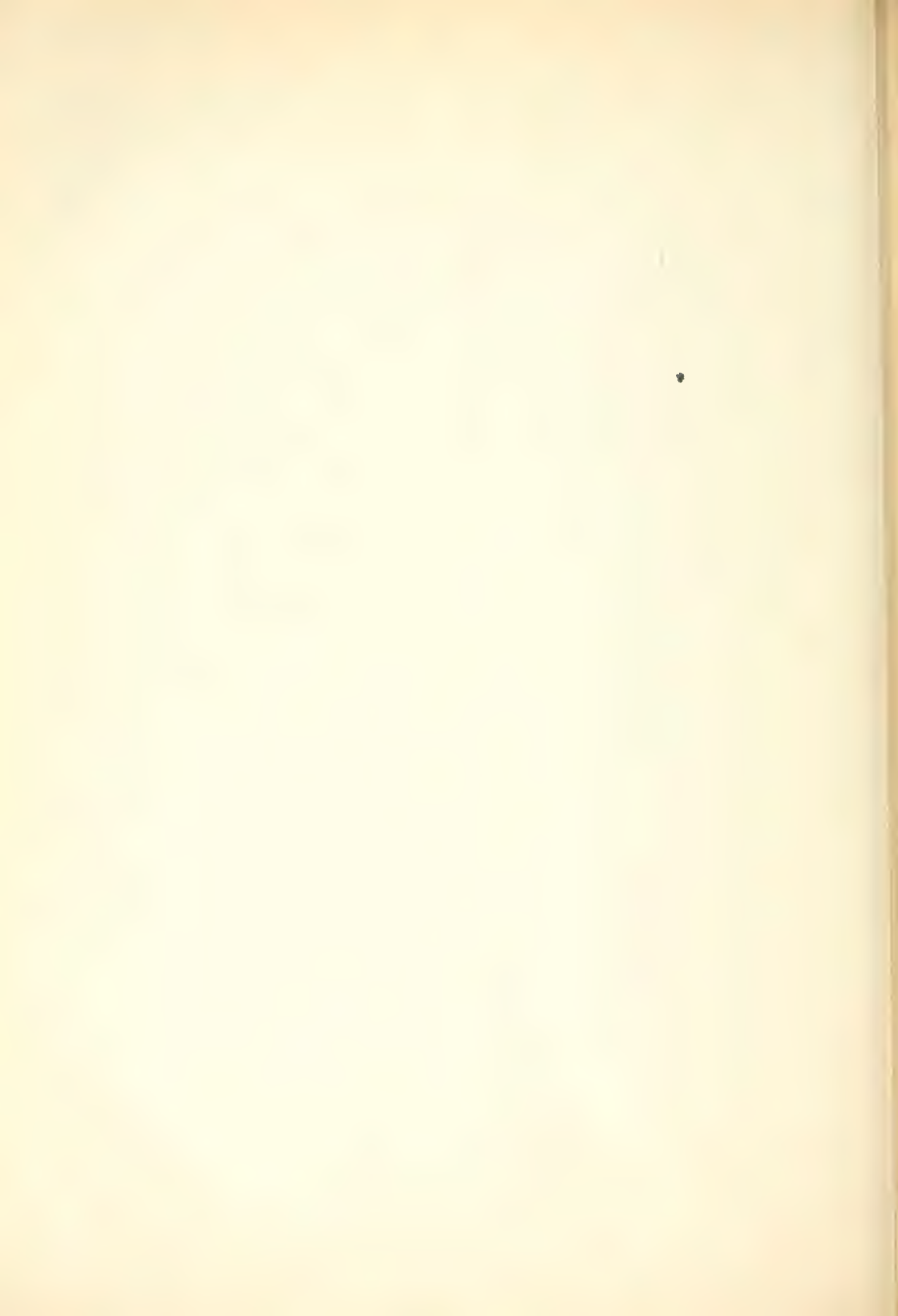
NOTE.—Multiple carcinomatous growths of the skin may occur secondarily to visceral cancer—of the liver, for instance.

Sarcoma Cutis.—True sarcomata are not common in the skin: and some conditions labelled as sarcomatous are not strictly so, such as idiopathic multiple hæmorrhagic sarcoma, for instance. Bear in mind that sarcoma cutis may be secondary. I have already stated that so-called melanotic sarcoma is a misnomer, and that in most cases the growths are really carcinomata. Carcinomata of the skin may be non-pigmented or pigmented, and in the latter case the pigmentation may be truly melanotic or due to blood, that is hæmorrhagic. This class of growth may be congenital.

Altogether the subject of skin sarcoma is one that is somewhat involved. From what has been said, a basis for *diagnosis* has been afforded. Here, again, a biopsy and the microscope would help. But melanotic conditions which develop as described under cancer should be dealt with without loss of time. As to whether one is dealing with cancer or sarcoma, this can be elucidated afterwards. The great malignancy is the important point. Injections of arsenical solutions into the tumours have answered, it is said. Coley's fluid has proved useful in combating inoperable sarcomata, and should be thought of in last resort in this connexion.

NOTE.—There are a variety of other growths of the skin, such as multiple myoma, lymph-angioma tuberosum multiplex (better named nævi cystepitheliomatosis disseminati), etc., for which a reference to a textbook on dermatology is necessary, owing to exigencies of space.

G. P.



PART V.—SPECIAL FORMS OF TREATMENT

HYPNOTISM AND SUGGESTION

THE chief characteristic of the condition known as hypnosis is increased suggestibility. This is seen throughout all its stages from the lightest to the deepest, and the hypnotic state may be regarded simply as a condition of artificially increased suggestibility. Many of the phenomena occur in other states than hypnosis. Somnambulism, the anæsthesias and paralyses of hysteria, the stigmata of certain religious devotees, are cases in point.

The results of hypnosis present great variations in individual instances, the differences being mainly dependent upon the degree of suggestibility manifested. Some people are easily rendered extremely suggestible, some only slightly so, and a few—under ten per cent.—cannot be hypnotized at all.

Broadly speaking, there are certain well-defined characteristics which mark the various stages through which the subject passes as he goes from the light to the deeper condition.

In the earliest stage, as Heidenhain pointed out, very frequently the only sign of hypnosis is inability to open the eyes when the suggestion is made that they cannot be opened. At this stage it appears that only those movements which are usually carried out reflexly by voluntary muscles can be inhibited, such as movements of the lids, swallowing and breathing. It is worth noting that one action, sneezing—which, though carried out by voluntary muscles, is entirely reflex in character—can be more readily inhibited than any other. Practically no one, when assured that if he takes a pinch of snuff or pepper he will be unable to sneeze, can do so.

Later on any voluntary movement can be inhibited, and in the still deeper states the subject can be compelled to initiate voluntary movements. One phenomenon, contracture, can usually be evolved at a very early stage, the limbs becoming rigid when stroked, with an accompanying suggestion of stiffness.

As hypnosis deepens, other functions can be influenced. Loss of memory for particular facts (*e.g.* the subject's own name) and local analgesia or anæsthesia may be induced. In many subjects the action of the bowels may be profoundly influenced, especially in the deepest stage (somnambulism), and a suggestion may cause evacuation; vomiting, too, can be suggested. Excessive salivation can often be obtained even in quite early stages, and local

sweating—the latter generally in still deeper hypnosis.

For practical purposes we may distinguish the deeper stage (somnambulism) from the lighter by the fact that the subject when awakened from somnambulism forgets all that has passed while he was in that particular stage, and that, if somnambulism be reinduced, he can again recall the experiences of his previous sleeps.

But the onset of somnambulism is also marked by an almost total loss of spontaneity. The subject of experiment initiates no movement for himself, but rapidly carries out any suggestion, afterwards remaining practically motionless. If asked what he is thinking of, he usually answers "Nothing." Hallucinations of almost every kind, visual, auditory, tactile, etc., as well as anæsthesia, can be readily evolved in this stage.

The most practically important phenomenon of somnambulism is the possibility of enforcing post-hypnotic suggestion. A post-hypnotic suggestion is one which is to be carried out after the subject is awakened, generally at some definite moment or at the time of some particular occurrence. These suggestions in many cases are quite faithfully fulfilled, although the subject is altogether unaware of the suggestion and has no idea that he is acting under its influence.

So far no satisfactory explanation of the phenomenon has been advanced. On the physiological side the theory of dissociation appears to be the best as yet proposed. It supposes that the resistances in the various neurones to the flow of neurokyme is increased or diminished during hypnosis, but the theory is from its very nature almost entirely speculative. As to the psychological side, various theories have been advanced. The best-known theory assumes that during hypnosis disintegration of consciousness takes place, the total consciousness being split into two, the waking or primary consciousness, and the secondary or subconsciousness (the consciousness present during somnambulism). It is the subconsciousness alone which is supposed to be affected by suggestion. Others are opposed to this idea. Munsterberg supposes that hypnosis is really due to a change of attention—which becomes fixed entirely on the hypnotist. To this, as to every other theory so far advanced, there are grave objections, and the problem must still be regarded as far from completely solved.

For the induction of hypnosis certain conditions are necessary, which have been admirably summed up by Sidis.

They are: (1) fixation of attention; (2) monotony; (3) limitation of voluntary movements; (4) limitation of the field of consciousness; (5) inhibition (*i.e.* the inhibition of all extraneous ideas). Of all these conditions the one essential is the fourth—the rest being necessary to secure it.

It is not difficult to devise a number of methods based on these principles, but it is important to remember that it may take many trials before a patient can be habituated to conform to them.

The induction of hypnosis, then, depends entirely on a successful training of the subject. The condition which patients find the most difficult to secure is inhibition, that is, the exclusion of all thoughts and ideas except those on which the attention is fixed. A simple plan is to direct the patient to gaze at a small bright object for a short time, on which he must fix his attention, at the same time making repeated suggestions that his eyes are becoming heavier and closing. Generally this succeeds very well, the eyes often closing in less than a minute. When the eyes are sealed a suggestion that they cannot be opened is almost always successful. Repeated suggestion of sleep, the patient lying with the eyes shut, will often induce the state.

It is to be noted that in most patients very light hypnosis can be at first induced. In only about fifteen to twenty per cent. can somnambulism ever be induced at all.

The most important method of inducing suggestibility other than hypnotism is the production of the so-called hypnoidal state of Sidis. This is the condition between sleeping and waking through which every one passes as he falls asleep or wakes. There is no doubt that suggestibility is increased in this condition, though perhaps not to the same extent as in hypnosis. After all, the condition is extremely transient, the patient either almost immediately falling asleep or oscillating between the waking and hypnoidal states. This phase is readily induced by any means that will bring on natural sleep. The patient lies with closed eyes in a darkened room, and a monotonous sound, such as the beating of a metronome, the ticking of a watch, or the sound of running water, or even of monotonous speaking, will generally suffice to bring it about. The breathing becomes slightly irregular, and the patient resents any attempt to move the limbs. Therapeutic suggestions given during the hypnoidal state have been found most successful.

Dr. Bramwell's method of giving suggestions in a monotonous tone of voice, while the patient lies quiet, trying to attend, not to the operator,

but to some restful train of thought, depends for its success on the occurrence of the hypnoidal state.

Dubois has advocated suggestion without hypnosis—under the name of persuasion. The method consists roughly in reassuring the patient that he will get well, and in insisting that he shall always make such suggestions to himself. But it is applicable only to patients who can be convinced by argument, and who can carry out the necessary mental discipline required.

In treating cases by suggestion the lightest possible hypnosis is often sufficient. Many patients are as suggestible in the light states as others are in deep hypnosis. In the hypnoidal state there is, of course, no distinction between light and deep stages, the condition being a state complete in itself.

The therapeutic use of suggestion is not confined to purely mental disorders. Other affections, such as constipation, dysmenorrhœa, metrorrhagia, amenorrhœa, hyperhydrosis, etc., have been successfully treated by its means. It is also useful in the treatment of symptoms arising in complaints which cannot be directly touched by it. Thus pain can often be diminished and the mental condition improved. But it has been more specially applied to certain functional conditions. Forel gives the following list:—Spontaneous somnambulism; pains of all descriptions; insomnia; functional paralysis and contractures; organic paralysis and contractures (as palliative means); chlorosis; disturbances of menstruation (metrorrhagia and amenorrhœa); loss of appetite and all nervous digestive disturbances; constipation and diarrhœa (provided that the latter does not depend on catarrh or fermentation), gastric and intestinal dyspepsia (including pseudo-dilatation); psychical impotence, nocturnal emission, masturbation, perverted sexual appetite, and the like; alcoholism and morphinism (only by the suggestion of total abstinence); chronic muscular and arthritic rheumatism, lumbago; the so-called neurasthenic disturbances; stammering, nervous disturbances of vision, blepharospasm; pavor nocturnus of children; sickness and seasickness, and the vomiting of pregnancy; enuresis nocturna; chorea; nervous attacks of coughing; hysterical attacks of all kinds; bad habits of all kinds. All hypochondriacal paræsthesias, irritable weaknesses, conceptions of impulse and the like, are more difficult to influence.

Many other complaints have been mentioned as favourable for suggestive treatment, but the above list gives a fair indication of the general scope of cases suitable for hypnotic treatment. A few of the more usual, more important conditions are here mentioned.

Insomnia.—In cases of "acute" insomnia, where it is necessary to produce deep sleep immediately, in the course of an illness, in a patient who has never been previously hypnotized, hypnotism is generally of no avail whatever. It is not suitable for emergency cases of insomnia. But in chronic cases the results are good. A regular course of suggestive treatment is generally necessary, though in some cases a single hypnotization may be sufficient. Insomnia patients are, however, often difficult to hypnotize.

Drug Habits.—Chronic alcoholism is a disease in which suggestion is perhaps more successful than in any other. Whatever treatment is adopted in these cases, whether by confinement in a home or by means of suggestion, all that can be done is to induce the patient to determine to remain a total abstainer, and to give him power to do so. The resolution must in all cases come from the patient himself.

By suggestion, however, we can (1) prevent craving; (2) strengthen the patient's will-power and self-control; (3) sometimes create an active dislike for alcohol.

However deeply the patient can be hypnotized no good result will accrue unless he has determined to try to be an abstainer.

Suggestions should be made also to counteract as far as possible any known definite existing cause for the attacks. Such causes are over-exertion, mental overstrain and worry, and in women, not infrequently, menstruation. Special suggestions against the advent of craving when the peculiar exciting conditions recur are of great importance. In women it sometimes happens that menstruation is much prolonged, and that it is only at the periods that cravings are dominant. It is sometimes possible not only to compel the absence of craving during the periods, but also to fix the date of their onset, and even of their duration, by suggestion. Thus irregular periods lasting, say, ten days, are converted into regular periods lasting three or four days.

In all cases of dipsomania it is advisable, if circumstances permit, to see the patient at long intervals, after the cure is apparently complete, for an indefinite time.

The results are exceedingly good, but the prognosis depends largely on the brain condition of the patient. Patients who have suffered from severe head injury, or whose brain is obviously damaged by prolonged alcoholism, syphilis, or other causes, cannot as a rule be made into permanent abstainers. But the attacks, when they come, can often be cut short and the patient again started on a comparatively long interval of immunity.

With regard to other drugs the results are not so encouraging. Morphinism can sometimes

be permanently cured, but more often the cure is a temporary one. In cocaineism the results are very discouraging.

Sexual Impotence in the male, if of psychical origin, can often be completely cured, even after a duration of years. The idea causing the impotence should be sought for and counteracted by suggestion; sometimes psycho-analysis must be employed in order to discover the idea which produces the condition. Often, however, even if the idea be not discovered, direct suggestions against impotence are sufficient.

Sexual feeling in the female may sometimes be restored or awakened. Primary vaginismus often yields very readily, though as a rule incurable by any other means.

With regard to bad sexual habits in young children who are not fully sexually developed, masturbation is generally readily checked, often ceasing after the first treatment, even though the habits are of some years' standing.

In fully developed adults the cure is much slower and more difficult—though in general the trouble is enormously diminished, and often cured if sufficient patience be exercised. But as a rule many sittings are required for its complete removal.

It is unnecessary to say much of the graver forms of sexual perversion. Every such patient who really wishes to be cured should be treated by suggestion—no other method of treatment is of the slightest avail—and many can be permanently cured by its means.

Disorders of Menstruation.—Dysmenorrhœa of the so-called spasmodic type often yields readily.

Prolonged menstruation, too, can in many cases be successfully treated. In some cases, as stated above, the duration of the period can be exactly arranged. But occasionally, even if the patients can be deeply hypnotized, the suggestion has no effect.

Hysteria and Allied Conditions.—Whilst in many the symptoms of hysteria disappear under suggestion, in others suggestion alone is singularly unsuccessful. These cases are best treated by a process of psycho-analysis, either by itself, or in combination with suggestion. In neurasthenia also psycho-analysis will often relieve the symptoms when other methods fail.

In hysteria there is often considerable difficulty in inducing hypnosis of even the slightest degree. Hysterics are frequently extremely self-suggestive—a condition always unfavourable to hypnosis. It is in these un-hypnotizable cases that psycho-analysis, as elaborated by Freud, is so successful. But the method is not only difficult but very tedious. The treatment may have to be carried on for months or even years. It is therefore practically inapplicable except to a very limited number of patients. Psycho-analysis, first brought

forward by Freud of Vienna, consists in an attempt to discover the idea or ideas represented by the symptoms of hysteria. These ideas do not exist in the ordinary waking consciousness. They are always due to some painful impression afterwards suppressed from memory, and, according to Freud, always have a sexual basis. Hysterical pain is a conversion of unbearable mental anguish into the more tolerable physical pain, and may often be definitely traced to some accidental pain at the time of the original impression. Thus a case of acute hysterical pain in the face, of five years' duration, was found to be due to the fact that the patient had five years previously learned that the man she loved was engaged to another, and it happened that at the moment of receiving the news she was suffering from slight toothache.

Paralysis may be induced in the same way. For example, a girl had her arm hanging over the back of a chair, and went to sleep. At this moment the painful event occurred, and she was afterwards attacked with hysterical paralysis of the arm.

Often the mere discovery of the original idea, and the bringing it to the consciousness of the sufferer, will cure these patients; but suggestion may help considerably when the morbid idea has once been discovered. The methods of psycho-analysis do not come within the scope of this article, but they may often be advantageously combined with hypnotic suggestion.

In cases of insanity the successes are not so far very encouraging, at least in this country, though Freud makes claim to have obtained better results. But it seems probable that psycho-analysis may succeed in many cases where suggestion fails when used alone.

Melancholia has been successfully treated by suggestion, and also some cases of imperative ideas and of *folie de doute*. But the results of treatment cannot be foretold in any given case. Cases of obsession, such as the various phobias, of which claustrophobia, agoraphobia and train phobia are the most common, are often benefited by suggestion. It is sometimes possible to cure these cases by psycho-analysis combined with suggestion when the latter fails by itself.

Thus a lady was unable to go out alone in the street without an attack of extreme terror, though she did not know what she feared. Suggestion failed to remove this; but psycho-analysis not only showed that what she dreaded was that she would be suddenly seized with insanity and hurried off to an asylum, but discovered the origin of the dread. Suggestions directed against this delusion resulted in an immediate cure, and she could walk out by herself without fear.

Other Affections (not Definitely Mental in Origin).—Constipation can very often be re-

lieved, and often permanently cured. The suggestion should be made that the bowels will act at a certain specified hour. If a daily evacuation cannot be obtained, it is sometimes possible to cause action every second or third day. Even the hour can be fixed exactly. As mentioned before, menstruation can often be regulated both as to time and duration, and the pain of spasmodic dysmenorrhœa relieved.

Chorea, even of long standing, may yield almost immediately.

Cases of eczema, presumably of nervous origin, are reported to have been completely cured by suggestion after other means have failed. Nocturnal enuresis often yields to suggestion, but in many instances is quite untouched by it. Only a trial can determine whether these cases are suitable for treatment. Suggestion should be made that the child should always wake before passing water, but the enuresis often happens in such deep sleep that he is quite unconscious of it, and so does not respond.

Stammering.—The most favourable results are obtained in young persons of fifteen years of age or under, but success is often attained in adults. In these cases it is well to make the patient employ self-suggestion, in addition to the suggestion of the physician.

In chlorosis the effect of the hypnotic sleep alone, without any definite suggestion, is said to have been productive of good results. Forel states that the results are "extremely favourable."

Asthma.—Asthma, at any rate of the spasmodic variety, is very easily relieved during the attack, and onsets can in many cases be repelled almost permanently.

Sea-Sickness.—Sea-sickness is very amenable to treatment, and may be prevented from occurring during even a long voyage by a suggestion made before the start.

The vomiting of pregnancy is also said to be relieved. The anaesthesia produced by suggestion has often been put to practical use. Esdaile used it in India for major operations; and it has been successfully used in recent years for that purpose. But as a rule the patient must have had some previous hypnotic training, and the introduction of anaesthetics has provided a far more satisfactory substitute. But it is still useful for the removal of pain, such as headache or neuralgia, and is, I think, especially suitable for confinement cases.

For surgical procedures the deep state of somnambulism is generally required—a condition obtainable in comparatively few (sixteen per cent.).

The dangers of hypnotism are very few. Braid's method, if often used on a patient, may result in spontaneous catalepsy, and for this reason should be avoided. Increased suggesti-

bility to others than the physician can be readily prevented by the suggestion that only he can induce hypnosis. It is not advisable for a patient to be hypnotized by two different people in immediate succession, unless suggestions have been made by the first hypnotist that the subject can be hypnotized and also awakened by the second. Otherwise there is sometimes a temporary difficulty in awakening him if he happen to pass into somnambulism.

H. E. W.

BIER'S HYPERÆMIC TREATMENT

The two forms of congestion applicable in treatment are described respectively as passive or venous hyperæmia and active or arterial. Passive hyperæmia is the form for which there is most scope in surgical affections. It is induced either by means of an elastic bandage or by the application of a suction cup, and is of special value in the treatment of sepsis and of many forms of inflammation both acute and chronic, including tuberculosis in the limbs. Active hyperæmia is best produced by means of hot air, and as its main effects are stimulation of the circulation and increase of absorption from the tissues it is used almost entirely for chronic and non-infective conditions.

Previous to Bier's work in 1891, congestion pure and simple was rarely employed. It had been used for delayed union in fractures, but Bier was the first to induce passive congestion by the bandage both for acute and chronic infections and to use hot air for treatment by active hyperæmia. Cupping had been used by the ancients and in modern times, but chiefly for poisoned wounds or for deep inflammations, under the impression that it acted as an antiphlogistic; in this method of treatment also we are indebted to Bier and to his assistant Klapp for elaborating the technique and for defining the indications, as well as for explaining its action on rational lines.

The theoretical grounds for treatment by passive congestion rest upon the modern conception of inflammation as a beneficent process. The principal changes in inflammation are hyperæmia, and slowing of the blood stream, with lymph exudation and emigration of leucocytes whereby infection is resisted and a natural cure accomplished. The object of passive congestion, therefore, is to increase the natural reaction of the tissues.

To obtain uniform success with hyperæmia strict attention is necessary to the details of treatment and to the indications for or against its use. Bier's first attempts at treatment by passive congestion were in cases of tuberculosis of the bones and joints, and it is instructive to

note that the recorded poor results until his present technique was evolved. In the case of suction cups also, the results were indifferent, and in fact Bier practically gave up their use till the technique was modified and improved by Klapp.

Passive Hyperæmia by the Elastic Bandage.—The limbs are particularly suited for this method, but it can also be employed for the head and scrotum. It is best to apply the bandage well on the proximal side of the lesion and to shift the site if possible each time it is applied.

Technique for the Limbs. For the upper limb the bandage is placed around the upper arm, but a special method is necessary for the shoulder.

In the case of the lower limb the bandage is always applied around the thigh which, like the upper arm, allows of the most uniform compression of the veins; the hip joint cannot be satisfactorily treated.

A thin rubber bandage, two and a half inches in width and of sufficient length to surround the limb six to eight times, is applied over a layer of lint, the turns overlapping so that the pressure is distributed; the last turn is fixed by tying tapes stitched to the end of the bandage. When correctly applied there should be some fullness of the superficial veins below and the part should appear distinctly congested and of a slightly bluish or bluish-red colour; at the same time the pulse beyond must not be diminished in volume.

In a suitable case, when the bandage is properly applied, pain should be relieved and any increase of pain points to the bandage being too tight or suggests the presence of pus requiring incision.

Apart from the subjective symptoms tightness of the elastic bandage produces other easily recognizable signs; obvious danger signals are a rapidly developing cyanosis, the appearance of reddish blotches or of small hæmorrhagic spots in the skin, or diminution of the pulse with the part becoming cold to the touch. The temperature of the hyperæmic zone should never be lowered; in acute cases the congested part should actually feel warmer than before, but in chronic cases little or no elevation of temperature will occur. After the bandage has been on for a few hours a certain amount of œdema appears and the superficial veins become less conspicuous, the amount of swelling being proportional to the acuteness of the condition. At the end of twenty hours the circumference of the limb is often increased by more than one inch.

Technique for the Shoulder. Bier recommends that a strong piece of rubber tubing should be passed across the axilla and fixed, well padded, above the shoulder. To prevent slipping of the tubing a handkerchief is passed through the

upper part of the loop and tied around the patient's neck, and, to ensure that the whole shoulder is congested, the tubing in front and behind is pulled towards the middle line by two pieces of bandage which are tied together in the opposite axilla. It is impossible to continue the above treatment for more than a few hours daily as the position of the tubing cannot be changed. Proper adjustment is difficult and the tubing is apt to prove irksome. For these reasons the method is not so valuable here as in other situations.

Technique for the Head. An elastic bandage one and a quarter inches in width is applied around the neck low down and tightly enough to produce a slight congestion of the face, but without causing the patient any discomfort. The presence of arterio-sclerosis and heightened blood pressure must be considered a contra-indication. If the patient lies down it may be necessary to loosen the bandage slightly to avoid discomfort.

Technique for the Scrotum and Testicles. Two or three turns of tubing or of a narrow rubber band are made over lint around the root of the scrotum above the testicles. Although only one side is affected a better congestion is obtained by including both testicles.

The Treatment of Pyogenic Infections by the Congestion Bandage.—Suitable conditions are septic wounds, lymphangitis, cellulitis, bursitis, whitlow, gonorrhœal and pyogenic joint affections, acute osteomyelitis and epididymitis.

In all of these conditions striking results are seen when the treatment is begun early, and passive congestion has great value as a prophylactic in infected wounds.

Duration of Application. For acute infections the bandage is worn for twenty to twenty-two hours daily. It is advisable to keep the patient under observation for half an hour after the application of the bandage to ascertain that it is not too tight. The patient also must understand that the bandage is at once to be removed should the pain increase or the limb become numb or cold. In any case the bandage is taken off two to four hours before the next application. Whilst the bandage is off the œdema should in great part disappear, assisted if necessary by elevation of the limb.

As the condition improves reaction diminishes and the intervals should be lengthened.

Relief of Pain. In favourable cases relief of pain may be noticed within half an hour. The greater the capacity of the part to swell the greater is the relief, but if the tissues are already swollen and tense, passive congestion will only increase the pain and embarrass the circulation unless tension is relieved by an incision. An explanation of this anæsthetic action is that, by increasing the amount of

serum in the tissues, the nerve endings are separated and the toxins diluted. Increase of pain following the application of the bandage means either faulty technique or the presence of pus.

General Condition and Temperature. When the bandage is worn for several hours toxic absorption is diminished. In a short time the patient may feel a distinct improvement and the temperature generally falls.

After the removal of the bandage there may be a rise of temperature due to the increased absorption of bacterial products.

Treatment of Suppuration. The presence of pus demands immediate incision. Much smaller incisions will usually suffice when passive congestion is employed. The advantages are obvious: healing is quicker, the scars are less disfiguring and the function of the part, as in the case of tendon sheaths, can be better preserved.

No general rule can be given as to the size of incisions, as each case must be judged on its merits. If any doubt exists it is safer to make a large incision. If the surrounding tissues are not much infiltrated, and if there is little tension after the pus is evacuated, the incision may be kept small, otherwise a large one is better.

At first the amount of pus is increased chiefly by the freer flow of serum, the discharge becoming less turbid, then purely serous, and as the inflammation subsides the wound rapidly dries up.

Drainage. One effect of passive congestion is to increase the flow of serum from open surfaces and thus to improve the natural drainage. It is often possible, therefore, to do without a tube; but if there is any chance of the wound closing or of the discharge not draining away some form of drain must be used.

A small piece of dental rubber is often sufficient. Bier does not recommend packing in conjunction with passive congestion.

Dressings. The dressings should be loosely applied to permit of swelling. For unbroken surfaces, as in a cellulitis of the arm, ichthyol in glycerine (ten per cent.) is suitable. When there is much discharge a copious dry gauze dressing is required, but if the pus is thick or small in amount a boracic fomentation is much more comfortable.

Acute Lymphangitis, although due commonly to the streptococcus, reacts well to passive congestion. It is essential to place the bandage well above the level of the inflamed lymphatics.

Erysipelas. The results have not been very striking.

Cellulitis and Bursitis. Passive congestion is particularly useful in infections of the prepatellar and olecranon bursæ which are so commonly associated with cellulitis and pus

formation in the surrounding tissues. In cases of diffuse suppuration with widespread undermining of the skin large incisions are necessary.

Whitlow. The method is specially useful in early cases before the stage of suppuration and in tendon sheath infections. When the tendon sheaths have to be opened it is best to give the patient an anæsthetic and to make the incisions deliberately. In extensive suppuration Bier recommends multiple short incisions placed opposite the phalanges, avoiding the flexures of the fingers, so that when the sheath is opened the tendon does not spring from its bed. Provided tension is relieved and the pus evacuated, this method is a great improvement on that of free exposure of the tendons; of course there is no object in limiting the incisions if the tendons have already sloughed.

Gonorrhœal and Pyogenic Joint Affections. The acute form of gonorrhœal joint without suppuration, common in the wrist, elbow and knee, is particularly benefited by passive congestion. Under hyperæmia pain is much relieved and passive movements to obviate stiffness are soon possible.

Excellent results can also be achieved in the early stages of suppurative forms of pyogenic joint disease. The diagnosis may be confirmed by exploratory puncture; if the fluid is serous it should be aspirated and passive congestion induced. Should pus be present incision and drainage are necessary in addition.

Acute Osteomyelitis. Open operation, of course, is the most important step in the treatment of this condition. These cases are always serious and the risks of delay are very grave. Passive congestion is valuable in the earliest stages, before infection has gone on to suppuration.

Should pus be suspected an incision must be made at once and passive congestion employed. With this addition, according to Bier, many cases can be got to heal without necrosis, or the latter can often be limited. An important point in the technique is to avoid packing the wounds, for, as long as the pus has free exit, it is better for the nutrition of the bone to keep it in contact with the soft parts.

Acute Epididymitis. The results in this condition are encouraging. Provided that the swelling is not excessive and that the cord is not tender, a rubber band can be applied above both testicles and left *in situ* for eight to twelve hours daily. The relief of pain in these cases is often remarkable and within two or three days there is usually marked diminution of swelling and tenderness, whilst the associated hydrocele begins to subside. Out of ten cases which I have treated in this way, with the exception of two all induration had vanished within three weeks.

The Prophylactic Treatment in Badly Soiled

Wounds.—The application of passive congestion can be strongly recommended. If wound infection seems probable, after cleansing, all the stitches should be inserted and tied with the exception of one or two, which are left long, to be tied later if no inflammation appears. The elastic bandage can be applied at once or in a few hours' time if there is much oozing. For the first few days congestion should be continued for twenty hours daily, but thereafter the period may be shortened or the bandage discarded if the case progresses favourably.

The above technique is of great service in the conservative treatment of workmen's injuries, for accidental inoculations of septic material at operations or post-mortems, and for all doubtful wounds of the extremities, including compound fractures. I have tested the value of this method of prophylactic treatment in a series of thirty-five cases of recent wounds of the hand, with very favourable results. Injuries, the result of severe crushes and badly contaminated wounds of several hours' duration, were selected, including cases of compound fractures, exposure of joint surfaces and division of tendons necessitating operative interference. To avoid complicating the issue, no antiseptics were used, the wounds being simply washed with saline and gross dirt removed. With two exceptions all the cases healed practically by first intention, although in fifteen of them some transient signs of inflammation appeared. These results support the contention that passive congestion is very efficient in the early stages of inflammation.

Passive Hyperæmia by Klapp's Suction Cups.—Glass cups of various shapes and sizes are required to suit different parts of the body. The vacuum is produced either by a rubber ball connected by tubing to the cup, or by a suction pump, which is more convenient for the larger cups. The edges of the cup are dried and smeared with vaseline, and should fit the part closely without requiring much pressure.

As the air is exhausted the area encircled by the cup becomes congested and gradually swells, projecting into the cup which adheres by atmospheric pressure. During the production of the vacuum there is first a comforting sensation of warmth, then a feeling of tightness and fullness, and finally, if the suction is continued, there is intense pain, especially in the presence of inflammation. Suction should always stop short of causing pain. When it is overdone, in addition to pain, the skin becomes cyanosed, the tissues are engorged and hæmorrhages with stasis of the circulation may occur. Such an abuse of the treatment can only do harm.

Short repeated applications are better than a single prolonged one, the requirements varying in different cases. In most cases of boils,

abscesses or sinuses three to six applications of five minutes' duration each should be made, with intervals of three minutes.

When applied to healthy skin the congestion subsides rapidly, but in the case of an inflamed area the effects of the suction remain for some time after the last application.

Various forms of large suction apparatus have been introduced by Klapp for congesting different parts of the limbs. Of these the most useful is the one for the hand and wrist. A rubber sleeve, tightened if necessary by a few turns of elastic bandage, serves to make the apparatus air-tight. One effect of suction is to pull forward the hand within the apparatus so that if the fingers touch the end they become gradually flexed. This action has to be avoided in inflammatory affections, but has been made use of by Klapp to increase the range of movements in stiffness of the fingers or wrists. For such cases he employs an apparatus fitted with special pads or handles so placed as to direct the movements of flexion or extension as required. In Bier's clinic elaborate forms of suction apparatus on this principle are used for correcting the deformities of club-foot and for straightening contractures of all kinds, including those of the knee and elbow. In favour of this method are the graduation of the movements and the sedative effect of the hyperæmia on the associated pain, but against these points may be placed the expense of the apparatus and the fact that massage and other forms of treatment have proved at least as satisfactory in similar cases.

The Treatment of Pyogenic Infections by Suction Cups.—The use of suction is confined to the treatment of localised affections such as abscesses, sinuses, boils and carbuncles, and of lesions which are not conveniently situated for congestion by the bandage, and its effect depends on the hyperæmia and on the mechanical withdrawal of the discharges. Apart from the diminution of organisms and pus cells after suction a still more important change is the increase in the opsonic content of the serum which is extracted. Wright has shown that the opsonic index of pus is relatively low. If the discharge after each application of the cup is examined the opsonic index will be found to rise till in the serum from the last application it is practically the same as that of the blood.

If suction is used to withdraw the pus small incisions will suffice in many cases. It should be employed when suppuration is copious or tends to persist after simple incision and drainage. As a rule, however, suction is of no advantage if the abscess is associated with much glandular enlargement as in some cases of suppurative adenitis.

Intra-mammary Abscess. Suction has been much recommended for abscess of the breast,

and is a very valuable addition to the treatment of this condition, if employed with discretion. In a series of forty cases of breast abscess, when I employed small incisions and suction, healing was complete in an average of nineteen days with a minimum of scarring and damage to the breast tissue.

A large cup to include the entire breast should be used. The size of the incisions must depend upon the amount of induration around the abscess; if this is slight, although the abscess may be large, one or more short incisions of $\frac{1}{2}$ to 1 cm. are sufficient; but, if the abscess is large and the pus thick, or if there is much surrounding brawny induration, larger incisions are required and the finger should be introduced to ensure that all pockets of pus are drained. The latter type of abscess corresponds to the severer forms of staphylococcus aureus infection.

Carbuncles. The value of suction in the treatment of carbuncles, at least of moderate size, is not sufficiently recognized. It fulfils all requirements by arresting the spread of the infection, relieving the pain and hastening the separation of sloughs. In twenty-five cases of carbuncle which I treated in this way a healthy granulating surface was obtained in from three to twelve days. As a rule a small incision should be made, but occasionally it may be dispensed with. Cross incisions and scraping are not required.

Whitlow. In the severer forms of whitlow the elastic bandage is to be preferred to the suction cup, but the latter is better in chronic cases, especially for suppuration at the nail fold and for necrosis of a phalanx.

Sinuses. Suction may be used alone or in combination with the administration of vaccines derived from the organisms in the discharge.

Gonorrhœal Urethritis. Suction treatment of acute gonorrhœa of the anterior urethra is very highly recommended by Miles, who considers the method to be better and safer than treatment by injections.

After the patient has micturated, the apparatus, consisting of a special glass cylinder seven inches long and two inches in diameter, is passed over the penis and fixed near its root by an encircling rubber cuff. When suction is made the organ becomes turgid, swollen and bluish in colour. The discharge is mechanically removed and microscopical examination shows that phagocytosis of gonococci is increased. Pain and scalding on micturition are often relieved after the first application, and the purulent discharge ceases as a rule within fourteen days.

Complications are very exceptional. In over three hundred cases recorded by Miles acute epididymitis and gonorrhœal rheumatism occurred only twice respectively; in three cases there were buboes, whilst acute prostatitis,

abscess in the prostate, cystitis or periurethral abscess were not observed.

The treatment can quite well be undertaken by the patient himself.

The results in chronic gleet have been disappointing.

The Treatment of Tuberculous Affections by Passive Congestion.—Tuberculosis of the bones, joints and tendon sheaths and of the epididymis are the chief lesions suitable for treatment by the elastic bandage. The suction cup is useful for tuberculous sinuses, and may be employed alone or in conjunction with the use of the bandage; in the latter case the cup is applied whilst the elastic bandage is off. One thing that should be recognized is that the treatment must be continued over a long period. For this reason it is inadvisable to congest the limbs with the bandage for more than one to three hours daily. Longer spells of congestion if repeated daily for many weeks would produce a chronic oedema, a condition of lowered resistance which in Bier's earlier experience was found to lead to spread of cold abscesses and occasionally to erysipelas. If worn for two hours daily no oedema will be produced and a slightly firmer application of the bandage may be made than for acute conditions, always ensuring, of course, that the patient has no discomfort. It is often helpful to increase the congestion by first bathing the limb in hot water.

The treatment may be applied to all the joints of the limbs with the exception of the hip joint. A certain amount of movement is allowed by Bier in early cases when pain is absent, especially in joints of the upper extremity. Complete fixation in such cases is avoided, as healing may be associated with a considerable return of function.

Retention of movements in the knee joint can scarcely be expected, and ankylosis in a good position should be the aim. If pain is present in a joint some easily removable form of fixation apparatus should be worn. In the case of the lower limb the patient should be treated in bed for some time with extension if necessary to relieve starting pains or to correct deformity. Later, when the symptoms have improved, the patient is allowed up with a Thomas' knee splint or other simple form of support.

In advanced cases of tuberculous disease, especially in poorer class patients, time may be saved by operating at once. When the disease cannot be completely eradicated passive congestion should be used in the after-treatment.

If a cold abscess forms during the course of the treatment it should be aspirated and injected with iodoform emulsion. An alternative procedure, preferred by Bier, is puncture of the abscess and daily application of the suction cup.

Tuberculous Epididymitis. Passive conges-

tion is a valuable addition to the conservative treatment of this condition. The technique already described should be employed for a period of one to two hours daily. The treatment is certainly indicated if both sides are affected or if one testicle has already been removed and the remaining one becomes tuberculous. Cold abscesses which may form during the treatment should be incised and subjected to suction.

Delayed Union of Fractures.—In addition to massage passive congestion may be induced, by means of the elastic bandage, for two to four hours daily.

Active Hyperæmic Treatment by means of Hot Air.—Arterial hyperæmia stimulates absorption from the tissues and for this reason it is undesirable to use it for acute infective processes.

Chronic or non-infective lesions are the most suitable for treatment. It should not be employed for tuberculosis. It is especially valuable in hastening the absorption of exudates or effusions, particularly those in joints or tendon sheaths due to trauma, chronic rheumatism or rheumatoid arthritis.

In these conditions and also in many forms of neuralgia active hyperæmia acts as a sedative to pain.

With dry hot air a greater degree of congestion can be attained than by moist forms of heat, and, as burning is prevented by the cooling action of the blood stream and by sweating, very high temperatures can be borne.

The electric and radiant heat baths which are now commonly used are efficient for the purpose, but Bier's apparatus is possibly more generally useful for practice as the source of heat is either a spirit lamp or gas burner, and there is, therefore, never any difficulty in treating the patient in his own home.

The apparatus which he uses is very simple, and can be made quite cheaply. It consists of wooden boxes which are adapted for the different parts of the limbs, such as the knee, leg and foot, shoulder, etc.

They are made of some well-seasoned wood such as alder or poplar. The upper half of the box folds back like a hinged lid allowing the limb to be placed in position. Surrounding the opening for the limb is a cuff of felt which is lightly fastened around the limb to prevent escape of heat. For the elbow and knee a similar opening is present at the opposite end of the box, so that the hand or foot lies outside.

Hot air is generated by a spirit lamp or gas jet placed below the funnel end of a metal chimney which passes upward to open into the side of the box. Within the box, opposite the entrance for air, is a small wooden partition to prevent the hot air striking directly on the limb, which should also be covered with an asbestos towel.

In the lid of the box there are one or two small holes to allow of the air circulating and to prevent it becoming laden with moisture.

Through one of the holes a thermometer may be inserted, but as a rule it is unnecessary, as the patient can tell by commencing discomfort when the temperature is getting too high.

With Bier's apparatus a temperature up to 120° C. may be borne, and this can be regulated by altering the flame and by approximating it to or removing it from the funnel.

The treatment should last on an average for half to one hour daily. At the beginning of the exposure the heat should be increased gradually, and then kept steadily at a comfortable temperature, which at the end should be allowed to fall so that the transition to the temperature of the room is not too sudden.

Hot-air Douche. A simple form of hot-air douche can be made by attaching to the chimney already described a long metal cylinder which is either jointed and flexible or provided with a ball-and-socket joint. Special forms of electric hot-air douche can also be obtained.

The douche is useful for treating local indurations such as in the breast after mastitis or for relieving the pain of sciatica or for neuralgia elsewhere.

Chronic Rheumatism and Rheumatoid Arthritis. The value of hot air in relieving the symptoms and in preventing the progression of this condition is well known. In the subacute stages passive congestion is better.

Stiffness of Joints and Tendons. Hot air is beneficial for stiffness either the result of trauma or following septic or gonorrhœal inflammation. The absorption of effusions into joints whether serous or of blood-clot is also hastened. It is advantageous in these cases to employ massage after the exposure to hot air.

Callous Leg Ulcer. I have found the hot-air bath the quickest method of dissolving the callous edge of a chronic leg ulcer. Such forms of ulcer are always associated with impaired circulation locally and they improve very quickly with active hyperæmia. As the tissues are somewhat devitalized the temperature must not exceed 70° to 80° C. J. M. G.

CLIMATOLOGY

The general principles which underlie the application of climatology to therapeutic purposes are not difficult of comprehension; but the practice of such application entails a wide acquaintance with localities, combined with that faculty of estimating the reactive power of the individual, which only experience can confer. It must be remembered that an invalid demands from a climatic station a great deal

more than mere climate. He expects the accommodation to be such that he will not want for the ordinary comforts to which he is accustomed. He demands distraction and amusement and the society of people of his own class, and more often than not he will regard his case as being insufficiently treated unless, in addition to the climate, the chosen locality affords some special therapeutic measure such as baths and waters.

The question of stations which have baths and waters to offer is discussed under a separate heading (*Spa Treatment*). In this article only those places are noticed which are prized on account of some special feature in their climatic conditions.

The climate of a particular locality is popularly spoken of as being either bracing or relaxing, and the adjectives are sufficiently near to accuracy to warrant their retention. The word "sedative" is, however, preferable to "relaxing."

A bracing climate is one which promotes metabolism and leads to the expenditure of vital force. Suitability to such a climate connotes a considerable degree of reserve, of recuperative power in the individual, such as can reasonably be expected only of comparatively young and relatively vigorous people. A well-constituted convalescent from acute disease, such as a man on the right side of forty, who has recently fought a successful battle against influenza, pneumonia or even typhoid, would supply an example. A relaxing or sedative climate has the opposite effect: it retards metabolism and spares the expenditure of vital force. It is suited, for residence, to the very young and the very old and the constitutionally delicate. It offers a fitting milieu to sufferers from heart disease, renal disease, and to such as the emphysematous, the bronchitic and the convalescent from exhausting disease or severe operations.

The climate of a place is either distinctly bracing or definitely sedative, or is midway between the two, in virtue of certain fairly constant meteorological factors, into the details concerning which it is impossible to enter here. The most important are humidity, altitude, sunshine, rainfall and wind, all of which must be carefully studied if the therapeutic value of any individual station is to be gauged. In a general survey such as this article offers it is possible to consider two of these only, the most potent of all the determining factors, namely humidity and altitude.

Humidity is generally expressed in percentages of saturation of the atmosphere with aqueous vapour. Thus saturation being one hundred, a high relative humidity would be anything approaching ninety; a low relative

humidity would be anything less than sixty. Humidity has no ascertainable relation to the rainfall. There are many places with a low rainfall whose humidity is high, and vice versa. Dry climates are bracing; humid climates are sedative or relaxing. Dry climates are liable to sudden and considerable variations of temperature, and very brisk reactions are demanded of those subjected thereto. Humid climates show a temperature record which is remarkably equable, not only diurnally, but seasonally. The aqueous vapour in the air acts the part of a poultice and prevents that rapid radiation of heat from the earth which in a dry climate is inevitable. A dry climate produces the effect of a series of cold baths; a humid climate produces the effect of a prolonged warm bath. Dry climates are agreeable to people with plenty of reactive power. They are stimulating—"like champagne without the headache." Moist climates are disagreeable to young healthy adults, who find themselves thereby rendered lethargic, somnolent and irritable. In a dry climate the active metabolism permits of the consumption of meat foods and alcohol not only without ill effect, but with benefit. In humid climates the diet should be in consonance with the comparatively inactive tissue change, and meat foods and alcohols should be strictly limited. Those who exchange a moist climate for a dry one are liable at first to be troubled with constipation, so that purgatives, especially mercurials, are called for. Those who leave a dry climate for a moist one, especially if the latter be at the seaside, are apt to develop skin troubles of a minor sort. This is more likely to occur if the question of diet fails to receive the attention which it deserves.

It would be possible to give many examples of these types of climate, but a few must suffice. It is not possible to find a really dry climate in Europe. If such a climate is thought essential, then it must be sought in Africa. Egypt has Cairo, Assouan and Helouan to offer; Algeria presents good examples in Biskra, Hammam R'Hira, Hammam Meskoutan and Algiers. Farther south there are many places between Rhodesia and the Cape at which, though the climate may be suitable, the accommodation and medical supervision are both insufficient. Of humid and sub-humid climates there are many well known examples. Chief amongst them is the island of Madeira, which enjoys a just reputation for equability and sedative conditions. The Canary Isles have also a warm equable climate and good accommodation. At home, the division between dry and moist climates is sufficiently definite to warrant a general classification. The driest and therefore most bracing place in England is Margate, with which may be bracketed Westgate and

Ramsgate. The sea-coast stations farther north are less conspicuously bracing, but they are infinitely more so than the coast towns of Devonshire and Cornwall. Of the intermediate stations from Deal to Bournemouth it may be said that they are progressively sedative in character. West of Bournemouth there is not very much to choose between the stations in the matter of climate. A town at which accommodation will be found exceptionally good and the general requirements for invalids very carefully considered is Sidmouth, in Devonshire. Torquay is well known and well managed; Falmouth has some points of advantage.

Altitude or height above sea-level is a very important factor in determining to which type, bracing or sedative, the climate of a particular locality shall approximate. Low-lying places, especially when sheltered by surrounding hills, are sedative; those which are well elevated, especially when fully exposed to the prevailing winds, are, generally speaking, bracing. A moderate elevation may be regarded as 1000 feet. Below this figure a station inclines to be sedative; anything above this figure may be regarded as definitely bracing. At an elevation of 2000 feet the climate is that of a moorland and is called submountainous. Such a climate is generally very bracing. Anything above 3000 feet is called a station of high altitude. Such stations, in addition to being very bracing, have for the most part fairly distinctive characteristics, which confer upon them a special value and special contra-indications. Most of these places are above the snow-line. The air is intensely cold, but inasmuch as it is also very still the cold is not disagreeable. The relative absence of oxygen in the air—called rarefaction—promotes fuller, deeper and more frequent respiration. It also calls forth a greatly increased number of red corpuscles, the oxygen carriers, in the blood. There is less atmospheric pressure on the whole surface of the body, with the result that perspiration, both sensible and insensible, is increased. Blood pressure is raised, and the influence of substances of such common use as coffee, alcohol and tobacco is very much intensified.

From these considerations it is obvious that stations of high altitude make very great demands upon the reactive powers of those who visit them, and when it is remembered that the bracing conditions and general social atmosphere are such as to invite to the so-called winter sports, most of which entail vigorous muscular exercise, it is not difficult to realize that great caution must be exercised in recommending such stations to those who are unable to respond to brisk stimuli. In general terms the contra-indications may be summed up by saying that high altitudes are altogether

unsuited to people who suffer from organic disease as opposed to mere disturbances of function. This is pre-eminently the case where renal disease, disease in the circulatory system or the pulmonary system, or indeed any condition which interferes with the aeration of the blood are concerned. Very especially necessary is it to caution any one suffering from high blood pressure against visiting such places. The alteration in the outside pressure may very easily cause, and has all too frequently caused, a sudden, violent and fatal hæmorrhage. The proper utilization of climates of high altitude in cases of pulmonary tuberculosis is a complex matter into which it is impossible to enter, but the general rule holds good that it is only those patients with plenty of reserve power who should be subjected thereto. It used to be thought that high altitudes had a special value, one might even say a specific virtue, in this disease, an impression which still seems to linger in unenlightened public places.

There are many good examples of stations of high altitude in Switzerland. The best known among them are Davos (5000 ft.), Arosa (5500 ft.), St. Moritz (5800 ft.) and Leysin (4700 ft.).

A favourite centre for trying various degrees of altitude is Montreux, on the Lake of Geneva. Easily accessible from this centre are Les Planches (1400 ft.), Glion (2250 ft.), Caux (3600 ft.), Les Avants (3500 ft.), and Rochers-de-Naye (6570 ft.), all of which, except the last-named, are winter as well as summer resorts. They all have excellent accommodation. A very good station which, though below the snow-line, is still and cold is Vernet-les-Bains, in the Pyrenees.

The choice of a climate for an individual case is always fraught with difficulty. Idiosyncrasies of constitution, questions of suitability to the needs of other members of the family, prejudices against certain countries, and other matters apparently subsidiary, have all to be considered. Moreover, invalids are exacting and weather is capricious, so that however excellent our choice may be in theory, it not infrequently proves unsuccessful in practice. Such want of success is apt to be discrediting, but we may save ourselves from the humiliation of doing actual harm if we are careful to observe certain well-defined rules. They consist in an estimate of the patient's powers of response to metabolic stimuli, and the application of the above-mentioned general divisions of climates. It is a very common mistake for the prescriber to select for his patient the type of climate which he has found most suited to his own case. As most prescribers prefer a bracing climate to a sedative, and as it is necessarily a few only who have any personal acquaintance with foreign stations, the aged and the organically unsound

are not infrequently hurried to bracing places, often of high altitudes, in distant countries, to their undoing. It is necessary to repeat, then, that really bracing climates are suited only to those who have ample recuperative power, and should never be suggested for such as demand that their vital powers should be husbanded. This has very special application to the subjects of cardio-vascular disease, renal disease, and disease of the central nervous system, more especially in connection with high altitudes. For patients of this kind, and for those suffering from emphysema and other decreascent disabilities, the sedative climates of our west and south-west coasts are eminently suited. Abroad, Pau and Arcachon may be mentioned as sedative winter stations to which such patients may be recommended with confidence. Biarritz, though more bracing than either, may be regarded as well within the sedative category.

The climate of the Riviera does not fall strictly within either of the above categories. Most of the stations, especially Mentone and San Remo, inasmuch as their humidity is relatively high, are of the sedative order, but they are nevertheless subject to very rapid and decided changes of daily temperature. It is warm and relaxing during the day, but at sundown it suddenly becomes cold and bracing. The amount of sunshine, and the excellent accommodation to be obtained at most of the stations from Cannes to San Remo, have made the coast justly popular with English people, who go there, however, to seek amusement and distraction rather than health. L. W.

SPA TREATMENT

A spa is a health resort possessing natural mineral waters which are used therapeutically, either for ingestion or external application, or both. The name is derived from the town of Spa in Belgium, whose chalybeate waters have been famous since the days of Charlemagne. Until recently it was the laudable, but futile, fashion to attempt classifications of such places according to the chemical analysis of their waters. The discovery of radium and the demonstration that many of the best known waters are radioactive has shown the uselessness of such classifications. The mineral constituents being for the most part inert so far as local application is concerned, it is evident that such advantages as are to be obtained from the use of these waters for bathing must reside in some element or principle allied to radioactivity which so far defies detection, or in the method of application, or in the temperature of the water.

In the matter of waters used for internal consumption it has been proved that the powers

of such waters when taken actually at the spring itself are very much more pronounced than under any other circumstances; that there is a something in a water in its nascent state which it rapidly loses on exposure. Most, if not all, of these waters, even when bottled *in situ*, and rapidly and securely corked, for consumption at a distance, are found to be much less efficacious than when taken at the spring itself. The fact that these waters cannot be constructed synthetically so as to produce even the effects of the bottled natural water is further evidence of the existence of a *tertium quid* which so far has escaped identification. It is, for example, a simple matter to analyse, chemically, the purgative water of Marienbad and to imitate it in the laboratory. This has been done on many occasions, with the only result of producing a solution of sodium, magnesium and other salts which is not only comparatively innocent of purgative properties, but whose use is unattended with the results—renal, stomachic and general metabolic—which the real article may be relied upon to produce.

Very few spas depend for their therapeutic effects solely upon the use of their waters, whether these be taken internally or applied externally. Those, for example, which base their claims upon the presence of such ingredients as iron or arsenic in their waters, ingredients which are admittedly inert when applied to the unbroken skin, usually reinforce the purely drinking cure by baths, douches, electricity, Zander and other exercises; whilst the stations at which the external application of the natural water constitutes the chief claim to efficacy almost invariably call in the aid of special dietetic and other régimes, not even excluding ordinary drug therapy. A spa, whatever its major claim may rest upon, may thus be regarded as a station at which every facility will be found for what is called in America physiological therapeutics, that is, climate, natural mineral waters, baths, douches, massage, exercises, electricity in all its forms, together with a specially "suggestive" therapeutic atmosphere. The influence of this last is by no means the least important factor in many of the "cures" which are effected.

Some spas, most of them indeed, may be said to have specialized in certain complaints or in certain types of invalid. This evolution in each case has been dictated in the main no doubt by clinical experience, but it has certainly been determined to some extent, and in some cases to a great extent, by the popularity and skill of the individual physicians who originally brought their particular stations into vogue. A wise selection of the measures at his disposal and the use of tact and skill in applying them to the needs of individual patients is the part

of a really good spa physician; and for the physician at a distance success depends not only upon being able to point to the right spa, which is a matter difficult enough, but upon the choice of the physician at that spa, a question which involves not only a knowledge of the patient's responsive powers, but a more than passing acquaintance with the place.

From the above considerations it follows that in the present state of our knowledge it is useless to attempt a classification of spas upon any pseudo-chemical or quasi-scientific basis. All that it is possible to say is that certain types of invalid are more likely to find relief at certain spas than at any others; and that the decision in favour of any particular station is a matter in which a very large number of considerations are, or ought to be, involved, amongst which experience may certainly be said to predominate.

Some one has described the skilful spa physician as an expert in chronic disease, and it is certainly against disease in its chronic form that his therapeutic efforts are mainly directed. It is nevertheless the case that the first effect of spa treatment is not infrequently that of inducing an acute ebullition of symptoms which had so far been either chronic or dormant, and it is well to remind patients of the possibility of something of that kind occurring during the first week of treatment. The general principle nevertheless holds, that spa treatment is suited only to the earlier stages of chronic disease, and that no circumstances justify the subjecting of acute or advanced cases to the fatigue of long journeys, the expense, the anxiety, the unfamiliarity with surroundings and the absence from minor comforts which such treatment of necessity entails. The subjects of chronic disease who have a wide margin of reserve reactive power are alone suited to such treatment, and in many of them the very factors which provide contra-indications for acute and advanced cases are those which contribute quite definitely to their cure. Change of air, of scene, diet, language, customs, and the removal from the daily round of the ordinary treadmill are factors of great importance to those patients whose reserves are sufficient.

Chronic Diseases are due for the most part to disorders of metabolism, but there is one, namely syphilis, which is the result of infection. Tubercle may also be cited as an instance of infection, but as it is due not so much to the power of the infecting agent as to weakness in the natural defences, it can scarcely be considered in the same category. Except in the pre-tuberculous stage, before there is any active tuberculous process in operation, spa treatment has nothing to offer in this condition. It is, however, right to qualify this statement by

saying that in strumous glandular children sea-water baths, as at Margate and Sidmouth, and the strong brine baths of Bricous-Biarritz, in France, of Rheinfelden, in Switzerland, and Droitwich, in this country, have a well-ascertained value, especially when resorted to for several successive seasons.

Syphilis is pre-eminently suited to spa treatment. This view remains unaffected by the extraordinary "furore" which greeted the introduction of salvarsan. Mercury is used at the spas by inunction and subcutaneous injection, but chiefly by inunction, the baths and concomitant methods being merely accessory. There is theoretically nothing to be said in favour of spa treatment which may not be urged in favour of similar methods employed at home, but practical experience shows that the results of spa treatment are so immeasurably superior to any other, that it is not too much to say that by neglecting to advise such treatment the physician is not doing his best for the patient. The advantages are not confined to any stage of the disease, though it is naturally in the earliest that the best results are to be expected.

There are four spas which have specialized in this direction: Aix-la-Chapelle (or, more properly, Aachen), Wiesbaden, Luchon and Uriage. The first-named is so immeasurably superior to the others that the only excuse for mentioning them is to supply an alternative for those people (and they are many) who object to go to Aachen for fear that by so doing they may be advertising the nature of their complaint. The choice between Wiesbaden, Luchon and Uriage must rest upon considerations of fancy and convenience.

Gout and the Gouty Diathesis is held responsible for so many metabolic disorders, and is believed to express itself clinically in so many different ways, that there is scarcely a spa which does not, in one form or another, cater for the gouty patient. Such a patient may have different symptoms at different times. He may suffer from gastro-intestinal troubles, he may be the subject of respiratory disorders, his circulatory system may be affected, he may be troubled in his joints or suffer from cutaneous eruptions. One gouty person may be irritable, another melancholic; some are plethoric, others anæmic. In the case of a disease of such protean aspects, it is not surprising that a great variety of spas should undertake the management of its victims and perform it with considerable success. For the fact is, the successful treatment of the gouty state depends upon general hygienic considerations—diet, exercise, and activity of all the emunctories—which can be imposed at one spa almost as readily as at another, so that the choice in an individual case, though it should depend upon the indication afforded by the most

troublesome manifestation, may within certain limits be decided by questions of predilection.

Gouty Arthritis, with which is usually associated a certain degree of fibrositis and myalgia, is very well treated at many spas. Amongst them Aix-les-Bains, in Savoy, must be given the first place. It has a world-wide reputation, and the physicians are very experienced in all matters pertaining to disorders in the joints or their neighbourhood. The season lasts from May to the end of September. August is the busy month, and the excellent hotels are then crowded by distinguished people from all over the world. There is a drinking water spring called the "source de deux reines" which materially assists in getting rid of the waste products which the treatment forces from the joints into the circulation. Baden Baden, in Germany, is a station of almost equal reputation with Aix-les-Bains, in comparison with which it has a much finer etablissement, much inferior accommodation, and a much less agreeable climate. There is very passable golf at both.

At home, Bath, in Somerset, has many exceptional advantages. It is a winter station, very accessible from London, at which the accommodation is good and the climate essentially suited to elderly and debilitated people. The waters issue from the spring at a very high temperature, and the baths are admirably equipped and well administered. In summer, Harrogate, Buxton, Llandrindod and Strathpeffer are all stations which can be thoroughly recommended. The climate of Harrogate is very bracing, the accommodation is exceptionally good, and the authorities do their best, by concerts and other forms of entertainment, to render the stay of invalids attractive. The same may be said to a rather less extent of Buxton. Llandrindod is an agreeable place just over the Welsh border, and Strathpeffer, in Scotland, is a station which is making laudable efforts to bring itself abreast of modern developments.

Gastro-Intestinal Disorders, with which may be associated general metabolic disorders, such as glycosuria and obesity, are well treated at Carlsbad, Marienbad, Vichy and Brides-les-Bains. The treatment at the two first-named is suited only to the robust type of invalid, for the waters are strongly purgative, and the general régime, which is not infrequently imposed with military precision, is apt to be exhausting. These spas are nevertheless deservedly popular and in suitable cases are very efficacious. The special indications are provided by the type of person who in this country is believed to have earned an aldermanic figure by habits aldermanic. A person with a tendency to obesity, to gallstones, to glycosuria, to acid dyspepsia and to constipation may be

sent there with every confidence. The same is true of Vichy, which has, however, this additional advantage, that its waters not being purgative and its régime very far from exhausting, it can undertake the treatment of patients who have not sufficient reserve for the severities of the other two. Vichy is a very agreeable station with good accommodation and plenty of amusement. Certain other stations, such as Homburg, Kissingen and Wiesbaden, have attained to a reputation in the gastro-intestinal disorders of the gouty. Inasmuch, however, as they all contain a considerable amount of common salt in their waters, they cannot be regarded as altogether free from objection. In disorders of the large intestine, Plombières, in the Vosges mountains, has long enjoyed a great reputation. This is due to the success of the methods of irrigation which were originally introduced at this spa, methods which have been copied at several stations, so far with very partial success.

Respiratory Disorders are much more frequently caused by an underlying gouty state than most people imagine. This is particularly true in the case of children of gouty parentage, in whom nasal, pharyngeal and bronchial troubles are very liable to occur, and in whom the orthodox treatment is often very disappointing. In adults, asthma, and chronic bronchitis with occasional acute ebullitions, should always raise a suspicion of the responsibility of goutiness for the attacks. The three principal stations which have specialized in these conditions are Mont Dore, Ems and Caunterets. Mont Dore is situated in the centre of France (Puy-de-Dôme), at an elevation of 3500 feet. The waters contain a small quantity of arsenic, which is erroneously supposed to confer upon them their special qualities. The "cure" is conspicuously beneficial in cases of asthma—more especially bronchial asthma—and chronic bronchitis. Pure nervous asthma and other functional nervous disorders also derive benefit. Ems is a much more sedative station than Mont Dore. Its elevation is but 260 feet, but it is very beautifully situated among wooded slopes on both banks of a small river. The only objection to it is that it is apt to be unduly hot in July and August. Caunterets is situated at an elevation of 3200 feet in the Pyrenees, and is a very popular resort for all respiratory disorders, more especially for those which affect the larynx. It is invaded during the season by actors, orators, singers and others who use their voices much.

Circulatory Disorders.—The French have a saying that gout is to the arteries what rheumatism is to the heart; and a timely recollection of this association would often lead to a prevention of arterial disease. By ridding the

system of the poisons whose gradual accumulation leads to such disease, spa treatment may effect a great deal; but the appeal which is made in such circumstances is a general one for increased metabolic and excretory activity rather than one which is directly addressed to the vascular system. There is, however, one exception to this generalization which deserves more than a passing notice. One of the most troublesome forms in which the gouty state is liable to show itself is an inflammatory disturbance of the veins, especially of the lower extremities, which is particularly rebellious to ordinary treatment and very liable to recurrence. There is a station called Bagnoles-de-l'Orne, in Normandy, which in such conditions is capable of producing effects which approach the miraculous. It is unfortunately very little known in this country, but its accessibility and its admirable equipment, no less than its agreeable climate, render it well worthy of the attention of English physicians.

In France there are two stations which have specialized in cardiac disorders, namely, Royat and Bourbon-Lancy. Both these spas are in the Puy-de-Dôme district, not far from Mont Dore, both are pleasantly situated, and both are admirably equipped for the treatment of those cases which they seek to attract. Royat was originally, and to a large extent still remains, a spa at which the treatment of all the manifestations of the gouty state are undertaken, but the impetus which recent investigations have given to the study of cardio-vascular disorders, together with the presence of carbonic acid gas in the waters, have caused Royat during the last ten or fifteen years to specialize in the treatment of the cardiopathies of the gouty state. Hence it is that functional cardiac troubles, and the numerous cases in which the central organ is bending under the burden of increased peripheral resistance, no less than those in which vascular tone is deficient, find at Royat a degree of amelioration which is scarcely to be found elsewhere. Bourbon-Lancy is to heart affections of rheumatic origin what Royat is to those of gouty origin. It is not that any pretence is there made that valvular lesions can be cured, but the two claims that are put forward are usually amply justified by results in well-selected cases. These claims are, first, that a course of treatment there tends to eradicate the rheumatic habit, and thus guards against a recurrence of endocarditis, and, secondly, that in recent cases, more especially in young people, the functional capacity of the heart is educated to overcome its mechanical disabilities. There are very few spas which fulfil their claims so satisfactorily as Bourbon-Lancy.

It is of course impossible to discuss the question of the spa treatment of circulatory

disorders without a reference to Nauheim. The truth is that this station and its therapeutic methods have been discussed and boomed *ad nauseam*. The fanciful claims originally put forth on its behalf have resulted in the pendulum, on its return swing, taking an even wider excursion than is usual in such cases. The Nauheim methods are useful in a limited number of cases. These methods are very well administered in all the principal British health resorts, and in nursing homes in many of the large towns. There is no magic in the natural waters of Nauheim, and the climate of the place is very far from agreeable. To send a patient with serious cardiac trouble to a station so distant is to undertake a very grave responsibility, and if the trouble is not serious it can be equally well treated at home.

Renal Disorders are very closely associated with circulatory disorders. The effect of high blood pressure both upon the heart and kidneys is now so well recognized as to need no emphasis. This high pressure is believed to be due to the action of endogenous toxins circulating in the blood, and treatment, to be successful, must be directed to encouraging their removal. Inasmuch as these toxins are a form of nitrogenous waste, and the kidneys being the main excretory route for normal waste of this description, it is clearly to these organs that an appeal should be made for ridding the system of the offending material. If the other emunctories, the skin and bowels, can simultaneously be pressed into the service, so much the better. This aspect of the importance, both prophylactic and curative, of efficient renal activity is a matter of comparatively recent recognition, and there is only one spa which may be said to have specialized definitely in this direction. This is Evian, opposite Lausanne on the Lake of Geneva. The cure here is primarily a drinking cure, but there is a splendidly equipped bathing establishment at which every form of accessory treatment is well administered. The season lasts from May to October. The accommodation is as good as is to be obtained anywhere in Europe, and the climate is eminently suited to the kind of patient for whom the waters may be prescribed with the greatest confidence. Evian does not deal so much with disorders of the urinary passages as with general metabolic disorders, which are relieved by way of the kidneys. The spas which make a special feature of such maladies as renal and vesical gravel and calculi are Contrexeville, Vittel and Martigny. These three spas are situated close to one another in the Vosges mountains. There is little to choose between them in the matter of the composition and efficacy of the waters. Contrexeville is well known, but not very progressive. Vittel is, owing to its energy and enterprise, deservedly

becoming very popular. Martigny is more suited than the other two to those of moderate means.

Disorders Peculiar to Women are very well treated at many spas. The best-known "ladies' spa" is certainly Franzensbad, which affords an excellent example of a station which has made and retained a great reputation not from any special virtues in the waters, but from the skill and industry of the physicians. In France, Luxeuil, in the Vosges, is a ladies' spa of great renown. Woodhall Spa, in Lincolnshire, has likewise a well-merited reputation.

Anæmic Blood States are, many of them, very amenable to spa treatment. Spa itself, in Belgium, presents a good instance of a station which is very efficacious in chlorosis and in anæmias due to considerable loss of blood. Schwalbach, in Germany, not far from Wiesbaden, has a well-deserved reputation in the anæmias of young people and in those who are suffering from the anæmic aftermath of tropical diseases. Inasmuch as the presence of arsenic in waters of this class is obviously an additional advantage, a spa which contains both **arsenic and iron** in reasonable proportion is certain to find favour with most physicians. This accounts for the growing popularity of Levico, in the Austrian Tyrol, not far from the head of Lake Garda. Levico is in reality a double spa, Levico-Vitriolo. Levico has an elevation of 1700 feet, whereas Vitriolo is 3000 feet higher. The accommodation at Levico is exceptionally good and the general conditions very agreeable. The accommodation at Vitriolo is quite sufficient, and though it is rather inaccessible, its elevation renders it attractive in warm weather. The waters at both places are the same, and are very useful in all anæmic conditions. They are bottled and exported for use at home.

Cutaneous Disorders in which benefit may be expected from spa treatment are those in which the dermatosis is of general rather than local origin, and the treatment resolves itself consequently into that of the underlying cause. Many of the sulphur-water spas make a special point of the treatment of cutaneous affections, especially of such as are associated with the gouty state. In this country Harrogate and Strathpeffer enjoy a well-deserved reputation; in France, Luchon, in the Pyrenees, and Uriage, in the Alps, are very agreeable and much-patronized stations. Mention ought also to be made of St. Christau, a spa which has the unusual merit of being open in winter as well as summer. Its waters contain a salt which is a very uncommon constituent in natural mineral waters, namely, sulphate of copper. St. Christau is in the Pyrenees, close to Pau. It is a very agreeable and well-regulated little spa, which deserves to be better known. L. W.

TRAINING

This consists in the physiological development of the body to meet the extra strain involved in the indulgence in some form of competitive athletics.

Training, when kept within physiological boundaries, presents features of little interest to the medical man. Unfortunately it is quite common, either from inherent constitutional disease or want of proper appreciation of what he is striving to achieve, for the athlete to be driven to seek medical advice. Hence practitioners should be familiar, not merely with the system of training generally adopted, but also with its probable effects on any given individual.

I shall, therefore, endeavour briefly to outline the system, indicate the most frequent maladies to which it gives rise, and then lay down the lines upon which treatment should run.

The System.—Physiologically considered, training has three main objectives—the development of—

1. The skeletal muscles,
2. The cardiac muscles, and
3. The activity of the excretory organs.

The proportionate development of all three groups is essential to success, and to this end the athlete modifies his normal life in respect of his—

1. Diet.
2. Rest.
3. Exercise.
4. General hygiene.

1. *Diet.* Under this heading I will simply submit the ordinary menu of a crew in training for the inter-university boat race, because this represents perhaps the most stringent régime adopted in any form of athletics, and consequently offers itself as a suitable standard. I may add parenthetically that this diet is based upon practical experience only and no subtle hypotheses of calorific values have entered into it. Hence, though adopted as a standard for convenience, its adoption does not preclude the possibility of change in the future.

For the following tables I am indebted to Mr. R. B. Etherington-Smith.

7.15. A glass of milk and a biscuit.

8.30. Breakfast: Fish (usually fried)—soles, whiting, etc. Grilled cutlets or beefsteak. Poached or scrambled eggs. Toast, butter (in small quantity). Marmalade. One or two cups of tea. Fruit—oranges, grapefruit, peaches, strawberries, etc.

1.0. Luncheon: Cold meat—roast beef, mutton or chicken. Salad. Toast, small quantity of butter. One or two glasses of draught beer, claret and water or plain water.

4.30. A cup of tea and a biscuit.

7.30. Dinner: Fish—plainly cooked, without sauces. Joints—beef, mutton, or chicken. Vegetables—cauliflower, cabbage, spinach. Fried potatoes. Sweets—milky puddings (rice, tapioca, sago), with stewed fruit. Dessert—fruit as at breakfast, with dried figs and prunes. Two glasses of water, draught beer or claret and water.

10.0. A glass of milk or barley water.

From this menu it is apparent that, beyond the elimination of rich and indigestible food and a certain restriction in fats and carbohydrates, there is nothing unusually severe in a training diet. The dietary is not usually commenced until about five to six weeks before the race, unless a man chances not to have been taking a sufficiency of exercise for some months before the start of "practice." In such case an experienced "oar" will change his ordinary habits a week or two earlier than his better-conditioned associates.

I would here call attention to the fact that the ideas as to the permissible quantity of fluids prevalent some ten or more years ago have undergone considerable changes. Then two and a half pints in twenty-four hours was the rigid maximum, a practice that had nothing to recommend it except that in some measure it tended to a more rapid reduction of superfluous fat.

2. *Rest.* Bed at 10 p.m. and unbroken sleep from 10.30 to 7 a.m. is the rule. Experience has shown this allowance of sleep to be ample; any addition tends only to produce inertia and lassitude.

3. *Exercise.* The actual work done in any day should be, and commonly is, proportioned to the "condition" of the athlete. Thus, once more to cite rowing, a commencement is made with very mild exertion in a pair-oared gig, where a very slow rate of stroke is maintained. As the muscles grow more supple and ready for work, the eight is manned and a mile or two covered, still at a slow stroke. In short, not until the muscles are very fairly hard is any attempt made to increase the rate of stroke, and thus no heart strain is involved. The next stage concerns itself more with the development of the cardiac muscle and lung expansion; in athletic parlance, it is a process of "training the wind." This graduation of exercise gives the third objective in training, opportunity for quiet and steady development, and the process of elimination of catabolites becomes increasingly efficient. What is true of rowing holds also true of other forms of athletics, with minor differences to suit particular needs.

Beyond the practice for the impending competition little other exercise is enjoined. A short walk or sprint before breakfast is usual,

and possibly a walk after the day's "practice" is finished. The morning sprint is occasionally omitted in cases where a man is found to lose all relish for his breakfast if he exercises his muscles beforehand. On Sundays a five or six miles' walk is enjoined to keep the muscles in trim.

4. *Hygiene.* With the commencement of strict training all tobacco is stopped. Crowded rooms, theatres, etc., are avoided and fresh air sought in all circumstances. Hence open windows in all weathers at night and airy rooms by day are the rule. Finally, the athlete finds in his morning cold tub an excellent corrective to any tendencies that might shake him from his rigid vows of celibacy.

Summary. The process of training, by means of carefully adjusted diet, rest, exercise and hygiene, results in the evolution of an individual characterized by a cheery and virile presence, an elastic and muscular gait, and by the maintenance of a more or less constant body weight.

Looked at from a clinical point of view, he presents the following points of interest—

1. A chest of good expansion, with a somewhat abnormally deep and resonant note on percussion.

2. A heart that gives evidence of ventricular hypertrophy, with consequent outward displacement of the apex beat. Its first sound is prolonged, lowered in pitch but increased in volume over that of the normal non-athletic heart.

3. A pulse that is subnormal in rate, a rate that is but little disturbed by exercise.

4. A definite increase in the number of red corpuscles, of anything up to six million, with a corresponding rise of colour index.

With this cursory view of the system of training before us, the next point demanding attention is that which deals with the possible ailments to which such a system may give rise. These may for convenience and brevity be classified into two groups, the clinical and the pathological.

In the first group we find—

(a) Staleness; (b) boils; (c) palpitation and heart pains, and (d) insomnia, named in order of their relative frequency; while in group two are (a) albuminuria and (b) heart strain.

(a) *Staleness.*—The word calls for some explanation. Venturing a definition, I would suggest, "a state of fatigue characterized clinically by a loss of body weight, appetite and muscular energy during training, with an increasing desire for sleep." Conforming to this definition, the athlete complains first of lassitude and inertia in the morning before taking exercise, a total inability to get the accustomed work out of his muscles during exercise, and an almost irresistible craving for sleep shortly after the

day's work. Now, in the absence of any laboratory investigation as yet undertaken into this condition, I am tempted to hazard an hypothesis as to the causation of staleness, based upon a personal experience of the symptom-group, with a view to justifying my subsequent advice as to treatment. My impression, then, is that staleness is due to a failure on the part of the organs of excretion to keep pace with the rate of catabolism resulting from sustained and heavy exercise. It is, in short, a condition of auto-intoxication. Further, bearing in mind the insatiable appetite for sleep that is engendered by overwork, my unhesitating advice to any who suffer from staleness is, "sleep more!"

I emphasize the point, because I am well aware that in advising an increase of sleep I am in absolute opposition to current opinion. My own practice, however, was always to indulge in a ten or twenty minutes' siesta after lunch whenever in the course of training I began to recognize the symptoms of incipient staleness, and I am confident that by so doing I averted more than one attack of this ailment. Long before I had any knowledge of physiology I was wont to question the authority of current opinion on this head, and used to argue that if every animal and even the human infant slept after a meal, why should the athlete, who was living a very animal life, be excluded from the blessings of repose in which to digest? Hence in view of the frequency with which staleness manifests itself in training, I submit that it is high time for a serious reconsideration of existing dogmas.

Treatment. This depends upon two main considerations—

1. The stage during training at which staleness appears.

2. The degree of staleness manifested.

1. The stage is important. Occurring about a month or more before the actual date of the contest, staleness is of little importance. Practice under racing conditions does not as yet obtain, so that any sudden surcharging of the blood with catabolites does not take place; hence, left to itself the excretory mechanism will readily adjust itself to the gradual increase of work, with the possible assistance of the "day off" on Sunday in each week.

Occurring, on the other hand, during the last week or ten days of practice, when high-pressure conditions are the daily lot of the athlete, any deficiency in excretion has no chance of adjustment, and, once started, can only lead on to a definite breakdown unless energetically treated.

2. Like the surgical phenomenon of "concussion," there are all degrees of staleness, passing imperceptibly from one to the other. It may, on the one hand, be so slight as to consist more

of mere laziness, which the athlete shakes off readily as soon as he commences his afternoon's practice; or, on the other hand, may render a man chronically unfit, mentally and physically, for any effort, however much he may strive to fight against the lethargy that clings to his senses.

Usually, if the degree be but a slight inertia, half a pint of champagne or one to two glasses of port are added to the evening meal. This, by presumably increasing the circulatory activity, tends to promote more effective elimination. With staleness a little more advanced all exercise, such as the morning sprint or walk, other than that immediately bearing on the forthcoming contest should be interdicted. At a yet further stage a regular afternoon siesta of twenty to thirty minutes should be enjoined in addition to the former adjuvants. Finally, a complete cessation of training for forty-eight hours or more, if circumstances permit, with the exception of the rules pertaining to hygiene, must be ordered, accompanied by a change of air and scene at the seaside.

(b) **Boils.**—In this connection it is only necessary to remark that there is but one point peculiar to the incidence of this malady among men in training. It occurs chiefly among rowing men, and in them is found distributed mostly on the buttocks or other parts similarly liable to friction and abrasion. The important point is that it is liable to be very contagious and assume the character of an epidemic among the members of a boat club.

Men unfortunately are prone to spend much thought in the invention of this, that or the other mechanical contrivance that will enable them to continue their rowing in spite of the inconvenience and pain involved, rather than seek medical aid from the commencement. Treatment, therefore, in addition to the measures, both surgical and medical, usually adopted, should consist in the adoption of rigid prophylaxis. The patient should be forbidden access to the boat-house until all signs of activity in the boils have subsided, his clothes be thoroughly disinfected, and—a point often overlooked—his seat in the boat which will be occupied by a substitute should receive a vigorous scrubbing with a powerful antiseptic.

(c) **Palpitation and Heart Pains.**—Turbulent action of the heart after a race—or practice under racing conditions—may be said to be the rule in training: in fact, a man who is not thus distressed is looked upon with considerable suspicion as a “shirker.”

The precordial distress, however, is normally short-lived, three to five minutes sufficing to establish the heart's equilibrium and enable the athlete to regain his dressing-room fatigued but comfortable. With the abnormal case that

occasionally presents itself, a certain degree of precordial constriction persists for some hours, during which any exertion, however mild—e. g. that of walking home—brings on a palpable disturbance of the heart beat. Such cases on examination will prove to be suffering from heart strain—and will be further considered under that heading later. I may here just add that those cases are curiously prone to vomit directly after the race.

(d) **Insomnia.**—Definite wakefulness is decidedly rare in training, and if a man complains of having had a “bad night,” cross-examination will usually reveal a night of restless tossing, disturbing dreams and a semi-wakeful consciousness whenever he changed his position in bed, but there will have been no lying awake for hours at a stretch without any attempt at somnolence.

The common causative factors of a bad night are—

(1) *Overfatigue* of the skeletal muscles with general aching and a tendency to sharp attacks of cramp. The condition is usually associated with the early days of training, when perhaps rather more work has been prescribed for the day than the then condition of the muscles warrants. Insomnia from this cause is negligible and disappears automatically as the muscles improve. (2) *Climatic conditions*, such as sometimes obtain in thundery weather during the summer months, make reposeful sleep impossible. Should these conditions continue for three or four nights, the athlete should be advised to modify his athletics somewhat, so as to make it proportionate to his rest for the time being. (3) *Digestive disturbance*. This is commonly confined to the novice, who is apt to let his appetite run riot and eat more than he really needs, and perhaps more important still is the fact that he is liable to eat too fast. Treatment, therefore, resolves itself into advice as to how to eat. (4) *Cardiac hypertrophy*. This has been noted as a cause of insomnia by some observers, but cannot, I think, be at all common. Certainly one may become conscious of one's apex beat against the chest wall when lying on the left side, and this consciousness in a man at all given to be nervous about himself may suffice to determine a disturbed night. The remedy, however, consists in a change of posture and the assurance of a medical man that there is no heart disease present, but that simple hypertrophy is an essential to efficient training, and insomnia, if due to it, an entirely transitory phenomenon.

To turn now to the more strictly pathological changes which may be met with in the course of, or resulting from, training we have to consider the two phenomena of **Albuminuria** and **Heart Strain**.

They are both conditions to which but scanty

research work has been devoted, and closer investigation is called for before we can assume a position of dogmatism in dealing with either the causation or treatment of these affections. However, as valuable contributions to a better understanding of the effects of training, the work of Dr. William Collier, at Oxford, on albuminuria, and Dr. Michell, at Cambridge, on heart strain, stands out prominently. It is to them that we owe such insight as we possess of the processes at work in the physical development of the body.

Albuminuria.—Collier conclusively shows that the occurrence of albumin in the urine must no longer of necessity be considered an indication of constitutional weakness when manifested after exercise.

He examined the urines of men in training for the "torpid" races before and after racing, and found that after the race fifty-seven per cent. of them showed considerable amounts of albumin on boiling with dilute acetic acid and also with the cold nitric acid test. Similarly examining the members of one Oxford crew after hard exercise, he found albumin in the urine of all eight men. In four out of the eight there was a very considerable amount. In short, the better trained a crew was, and the greater the turn of speed it could show, the greater the amount of albumin found. These observations, forced to a logical conclusion, reveal the paradox that unless a man pass albumin after exercise, his training must be considered defective. In this connection it would be interesting to know whether the phenomenon of staleness is accompanied by albuminuria or not. I am unaware of any experiments that could supply an answer to this query. As tending to show that this functional albuminuria does not apparently induce organic disease prematurely, the notes of Dr. Morgan, of Manchester, are of interest. He followed up the lives of 294 old Blues who had taken part in the inter-university boat race, and found that the average span of their lives was above that of the general population. In the face of such evidence the question naturally arises as to what degree or kind of albuminuria calls for medical interference. Before attempting a reply to this question it would be opportune to recall that Möerner has shown that all urines contain twenty to eighty mg. of serum albumin per litre in addition to containing seven to twenty mg. of substances which precipitate albumin, and that the precipitate resulting from the interaction of the serum albumin and these precipitins is commonly but erroneously called "mucin." Hence the necessity for the adoption of some practical standard of the amount of albumin permissible before a given case is labelled as one of even functional albuminuria. The only obvious standard that is at present available is

the one set up by the work of Collier, *i. e.* that those urines which show a ring with the cold nitric test or a precipitate on boiling with dilute acetic acid should be labelled albuminuric. To return to the main question as to the dividing line between functional and organic albuminuria. Our present knowledge of the subject demands that we should err on the side of safety, and therefore the following tests should be adopted. All cases must be deemed organic that—

1. Show the presence of endothelial or hyaline casts;

2. Yield albumin on boiling, etc., after twenty-four hours' rest in bed;

3. Yield albumin with concomitant arteriosclerosis.

To these tests I may add another, the value of which, however, has not yet been determined in cases of albuminuria after exercise. Dr. Otto Grünbaum has found that the administration of calcium lactate will inhibit the deposit of albumin in all cases of postural or cyclic albuminuria, and suggests that it might be tried with advantage as a distinguishing test for the functional cases occurring after exercise. The drug has no effect upon the organic cases.

In conclusion I need hardly add that no case giving evidence of organic albuminuria should be allowed to train.

Heart Strain.—I cannot do better in this paragraph than reproduce a summary of the article written by Dr. R. W. Michell on this subject, as it is at once the most accurate and the most up-to-date account of any work done upon the heart in training.

The points calling for particular notice are—

1. That throughout the athletic life of an individual there is a progressive fall in the pulse rate.

2. That even the onset of some acute febrile complaint does not at once raise this rate. As a result, during the early stages of an illness the pulse yields no guidance as to the severity of the disease, while, per contra, a sudden rise in the rate after the first forty-eight hours or so does not of necessity imply the presence of a grave crisis.

3. Successful training is accompanied by a continuous rise in the number of red corpuscles, with a corresponding rise in colour index. With overwork and a falling weight this increase is succeeded by a decrease, and may be regarded as one of the earliest pathological signs of incipient staleness.

4. The earliest clinical sign of over-fatigue is the rise in the pulse rate before exercise, which later is succeeded by a similar rise in rate after exercise. Later comes an alteration in the heart's rhythm. In place of the prolonged cardiac first sound followed by a sharp second and then a pause, which is characteristic of the

athletic heart, there is a transition to the equalization of intervals and a tendency to "space."

5. Cases of heart strain are divisible into two main groups, the one in which the right side is chiefly affected, the other involving the left.

In the former case the patient is usually but an embryonic athlete in whom the history of ailment is short—perhaps not more than a day or two. The complaint is of fluttering or vague precordial discomfort. The cardiac area shows a wavy impulse, epigastric pulsation, feeble apex beat over a small area, tender spots over the sternal ends of the second or third intercostal spaces, a small twanging first sound, with a high-pitched second. This train of signs is sometimes supplemented by an important one, viz. engorgement of the veins of the neck.

In the second case the patient is a more experienced athlete who has been overdoing his exercise for some considerable period—i. e. a year or more—in order to attain some specially prized distinction. Here the complaint is of malaise of a week to ten days' duration, with sensations of thumping of the heart while in bed; a feeling of irregular action while at rest, but with *improvement* for three to four hours after exercise, and a rather rapid loss of weight. Examination reveals extension to the left of the area of cardiac dullness, sudden and heavy impulse and an irregular rhythm. The heart signs do not differ materially from those found in the healthy but non-athletic heart. Further extension of this condition yields a pulse markedly irregular, in which beats are dropped owing to abortive ventricular contractions, as well as beats that are "grouped." While the patient is standing the blood-pressure drops to 100–80 mg. of Hg., and the pulse becomes definitely dicrotic. The patient is very liable to faint under examination and complains of sensitiveness to pressure by the stethoscope over the apex, such that nausea is readily induced. Later still, regurgitation through tricuspid and mitral valves may be established.

This third stage, however, is seldom met with in men in full training, but rather in those who have attempted work out of proportion to the degree of their training at the time.

Treatment. (1) When the right side is affected.

As the blood-pressure in these cases is high, efforts should be made to lower it. To do this a hot bath should be prescribed or a hot pack applied to the chest wall; which done, an initial dose of diuretin, gr. xv, should be administered and the patient put to bed. The effect of the diuretin should be closely watched, and if the pressure has not dropped in four hours a second dose of gr. x given. The drug requires

watchfulness because of a tendency to lower pressure suddenly in some subjects, causing sighing respiration, dimness of vision and sensations of syncope. In the administration of the hot bath care should be taken to keep the patient horizontal by laying him on a blanket at the bottom of the bath, on which he is subsequently lifted out of the water. This treatment results in a cessation of the radiating precordial pain and an increase in the volume of the first sound, but the murmur along the left side of the sternum may become more distinct. The degree and extent of this murmur is of prognostic value, as it picks out the cases in which a relapse may be anticipated, if hard exercise be again attempted, even after apparently complete recovery.

When convalescence is established and the patient allowed to leave his bed, the amount of permissible exercise should be carefully laid down for him—all excitement or sudden effort avoided, and alcohol, tea, coffee and tobacco rigidly banned.

2. When the left side is affected.

The patient should be put to bed and there kept as long as the rhythm shows steady improvement. In those cases in which tricuspid and mitral murmurs are evidenced, treatment tends soon to re-establish a normal balance. The tricuspid murmur may disappear in as short a time as forty-eight hours, but even after a return to normal equilibrium its irregularities may for a time be readily reawakened. Hence exercise should be tentatively tried and very gradually increased. The mitral murmur is much less amenable, often requiring a year before full resumption of function is possible. Should dilatation persist in spite of treatment, a history of diphtheria, scarlet or rheumatic fevers will nearly always be obtainable, indicating the existence of valvular trouble antecedent to the strain, and hence the prognosis assumes a very different complexion.

Diet. Whatever side be involved the patient must be told to restrict his food to that amount of solid and fluid necessary to avert actual hunger and thirst. Where regurgitation is present this abstinence must be continued as long as cardiac improvement is maintained.

Drugs. Diuretin has already been alluded to, but in a few cases of marked arrhythmia its action is very slow or negligible, and then resort must be had to the hypodermic use of *morphia*, carefully guarded with an admixture of strychnine. *Manganese*, in the form of the glycerophosphates, and combined with hæmoglobin, is the best mixture with which to combat the anæmia which soon manifests itself in these cases. *Digitalis*, in the after-treatment of these cases, calls for comment. When the blood-pressure is low, the pulse small and frequent,

digitalis is sometimes efficient, sometimes not. It is liable to affect this type of heart more readily than others, but it is more difficult to obtain and maintain the desired rhythm. This difficulty arises from the liability of another rhythm to superimpose itself, in which beats are dropped and the interval followed by a thumping beat. Reduction of the dose does not always result in the reappearance of the desired rhythm. The addition of *strychnine* will gain the desired end with smaller doses of digitalis, but the mixture is apt to cause an increased sensibility of the cardiac pulsations by the patient, with a sense of constriction in the left and middle of the chest. Such sensations, if continued, often give rise to anxiety on the part of the patient. Hence the ideal drug is to be sought elsewhere, and is found in *Cereus Mexicana*, which acts efficiently in the form of a tincture, in doses of γ -xxx \mathfrak{M} . Under its influence the strength and regularity of the contractions is increased without corresponding rise of blood-pressure such as to necessitate any consumption of the reserve energies of the heart.

In conclusion, two conditions of minor importance remain to be noted. The one common and comparatively insignificant, the other rare but important. The first is a symptom complex generally termed stage-fright, but is better known in the athletic world as "the needle." Clinically it is evidenced by an aspect rather pale and drawn, a loss of the normally elastic gait of the well-trained, loss of appetite, repeated attacks of yawning, frequent passage of large quantities of pale and odourless urine and, in bad cases, diarrhoea. The sufferer will complain of an epigastric sinking and a sensation of paresis in his limbs. This group of symptoms is of course the common accompaniment of a good many crises in daily life, its importance in connection with training lies in the fact that it may seriously interfere on occasion with the racing efficiency of a crew, especially at the start of a race. While generally not evident until the morning of, or only an hour or two before, a race, it may sometimes attack a novice two or three days before. In the latter case the persistence of the symptoms is very apt to induce staleness, or at all events a condition clinically indistinguishable from that phenomenon, and consequently calls for treatment. This consists in the administration of potassium bromide in doses of not more than five grains at bedtime and repeated in the morning if necessary. The effect of such doses is to produce composure without any depressant effect on the heart. The great caution to be observed is that these cases do not require stimulant tonics, in spite of the popular advice to "buck up," and strychnine, of all drugs, must be rigidly avoided.

The second condition is arterio-sclerosis, which

in the man of athletic age is fortunately very rare. When established it should constitute a bar to all training, and I would go so far as to add that if either hereditary or acquired syphilis be found in a candidate he should be warned against any exercise that tends to raise his blood-pressure. It is true that no one has yet established the fact that training between the ages of twenty and thirty has led to premature atheroma, but in the light of our physiological knowledge of the etiology of atheroma it is a reasonable inference that makes us fear the effects of strain upon arteries already touched by a disease which has so marked an effect of its own in the same direction.

One caution I may give with advantage. It has been recently recognized that there exist conditions of arterial spasm so that the radial may be felt one day distinctly thickened and cord-like, while the next day—or even a few hours later—it is perfectly normal. The great distinction between this and the genuine complaint is that in the latter there is nearly always accompanying tortuosity of the vessel. If in addition to noting this point care is taken to examine the artery at two or three different times, mistakes should not easily arise

D. P.

THE NAUHEIM METHODS

The methods of treating diseases of the heart and blood-vessels known as the "Nauheim" treatment have been employed in England for some twenty years, and have attained a well-established and recognized position in clinical medicine, yet their use is not so widespread as it should be, considering the ease with which the treatment can be given and the great benefits that are derived from it in many forms of cardiac and circulatory disease, more especially in those cases where the usual treatment by drugs, rest and diet fails to produce any lasting or satisfactory result.

The bathing springs at Nauheim are slightly ferruginous, highly carbonated, saline waters, varying in heat from 86° F. to 94° F. It is a mistake, however, to suppose that a Nauheim bath must, of necessity, be a carbonated bath, as simple warm saline baths are also used; indeed, in a large number of cases of cardiac and circulatory diseases, the administration of carbonated baths, especially at the commencement of the treatment, is not only useless but markedly injurious, and sometimes decidedly dangerous. The indiscriminate use of the carbonated baths in England has caused much disappointment, both to patients and medical men, and has at times brought a wholly undeserved discredit upon the treatment, the cause of failure to produce good results being

entirely due to ignorance on the part of the administrator, and not to the treatment.

The baths of Nauheim may be divided into five chief classes—

1. *The Brine Bath.* The brine for these baths is supplied by the water of the springs after it has been freed from calcium and iron salts and CO_2 .

2. *The Thermal Bath.* When the water is exposed in open tanks a large proportion of the natural CO_2 is given off, whilst iron and calcium salts, held in solution, are precipitated, forming a brownish-yellow fluid called "Thermal brine." It is this that is used in preparing the thermal baths.

3. *The Thermal Sprudel Bath.* The water for these baths is stored in closed tanks and therefore loses little of its natural CO_2 .

4. *The Sprudel Bath.* The water for these baths is brought from the spring to the bath through pipes without coming in contact with the outer air, and is therefore fully charged with CO_2 .

5. *The Sprudel Strom Bath.* A "stream" bath can be made of any of the latter three kinds of baths by means of a process by which a constant flow is kept up through the bath. Any of the various kinds of baths can be strengthened, as required, by the addition of the mother-lye which is extracted at the salt works; so that during a course a carefully graduated sequence of baths can be given.

The radioactivity of the bath waters is so small that it may be disregarded as a therapeutic agent. The baths are given above in the order in which they are generally administered in cardiac complaints, but in many cases only numbers one and two are employed.

A properly prescribed Nauheim bath stimulates the cutaneous nerves and dilates the capillaries, thereby producing a slower and more vigorous heart's action and an increased metabolism. A dilated heart, under these conditions, has less resistance to overcome, and therefore regains contractility and tonicity, and is progressively more able to carry on a satisfactory circulation. The improved circulation thus set up reacts upon the heart itself, and its muscular walls, being better nourished, regain strength, consequently any dilatation that is present soon disappears.

The effect produced by a single bath upon a suitable case is a temporary decrease in the cardiac dullness; some observers ascribe this to an overlapping of the lungs due to deeper breathing; this cannot, however, be the case, as the cardiac area will gradually and progressively diminish during a course and ultimately regain its normal dimensions. Whatever theories are held as to the action of the baths, the fact remains that many cases which have had to

live a life of invalidism for months, and sometimes years, are restored to health and enjoyment of life by a course of Nauheim baths. The effect of these baths upon arterial tension varies according to the form of bath that is given; as a practical guiding-rule one may say that the arterial tension is lowered for a time by the warmer and weaker baths, and temporarily raised by the cooler and stronger baths. It is for this reason that effervescing baths given at the beginning of the treatment to patients with weak, dilated, flabby, ill-acting hearts are decidedly harmful, not to say dangerous, as such cases have not the necessary recuperative power to withstand the temporary rise in blood pressure.

The culminating effect of a course of baths is undoubtedly the restoration of balance between the force of the heart's stroke and the resistance to be overcome, so that in patients who, at the beginning of the treatment, have a markedly high arterial tension, a decided lowering of this tension will be the result of a course of baths, provided the vessels are not very advanced in degeneration and retain sufficient elasticity to dilate when the toxic poison causing spasmodic contraction is eliminated. In a patient, on the other hand, with a markedly low arterial tension and a heart weakened by anæmia or debility, that tension will be gradually raised by the improving condition of the cardiac muscles, and a more satisfactory circulation will be established.

The selection of cases for treatment is of the greatest importance, and the very fact that the kind and degree of cases that will receive benefit from the treatment is large, may lead to it being given where unsuitable; it may be laid down as a definite rule that it is not suitable for cases in which defective compensation is in an advanced stage.

In the following classes of case the Nauheim treatment is especially useful—

1. **Cardiac Dilatation with Weak Muscular Walls,** the sequela of influenza, typhoid, malaria, acute or subacute rheumatism, anæmia, or any wasting and debilitating illness. In these cases symptoms of palpitation, cardiac pain, anæmia, dyspnoea on exertion and general weakness are often permanently cured.

2. **Valvular Disease accompanied by Cardiac Dilatation and Muscular Weakness.**—The valvular defect cannot, of course, be cured, but the strengthening of the cardiac walls and diminution in the dilatation help very greatly to improve the circulation and assist compensation, especially in cases of mitral regurgitation. In cases of valvular disease where *great* hypertrophy is present, with its accompanying powerful contraction of the left ventricle, producing an uncomfortable sensation of pulsation, I have not found the Nauheim treatment satisfactory.

3. Cardiac Dilatation secondary to High Arterial Tension and commencing Arterial Degeneration in Middle-aged People.—This condition is often the result of a gouty or rheumatic diathesis and, if untreated, will steadily progress. If the arterial degeneration is not too advanced the blood pressure will drop 30 or 40 mm. Hg. during a course of treatment, so that in a case starting with a systolic blood pressure of 180 mm. Hg. the tension will steadily drop during treatment till, at the end of the course, it is about 135–140 mm. Hg., and this lowered tension may be retained for a lengthy period if a careful dietary and habit of life are adhered to. The cardiac dilatation with its accompanying painful and dangerous symptoms will disappear and the patient be able to lead a normal life and take a satisfactory amount of exercise without suffering from cardiac pain or dyspnoea. The effect of a course of baths in this class of case will probably last a year or eighteen months, when it is advisable to take a second course, the high tension and resultant dilatation, due to faulty metabolism, being likely to return.

In cases where there is marked arterial degeneration accompanied by some fibrosis of the kidneys, cardiac dilatation can usually be cured and its symptoms relieved for a time, but the arterial tension is practically unaltered. As in these cases the vessels have lost their elasticity, they must be treated with great care and only the weaker and warmer baths be given, but provided this precaution is taken there is no danger, and troublesome symptoms can be greatly relieved. I have treated a number of these cases, in which the systolic blood pressure was well over 200 mm. Hg. and the urine contained a heavy cloud of albumin, with highly satisfactory results, among which a marked diminution in the albuminuria was one of the evidences of the improved condition.

4. Cardiac Weakness and Irritability produced by the excessive use of Tobacco or Alcohol.—It is necessary that the patient should give up the habit that caused the disease; if this is not done no treatment will have any lasting beneficial effect. The Nauheim methods will greatly accelerate the cure of a "tobacco heart," but the patient should be made to understand definitely that it does not make him immune from tobacco poisoning.

5. Nervous Affections of the Heart.—Among these may be classed such cases as neurasthenia, nervous exhaustion, cardiac breakdown from worry and overwork, and all that large class of cardiac affections in which tachycardia, cardiac pain, restlessness, malnutrition and insomnia are present, but no definite valvular lesion can be discovered, and no marked dilatation, but where a rapid, feeble and unstable action of the heart indicates the presence of a weakened

muscular wall. The partial rest cure, necessary for a course of Nauheim baths, is undoubtedly a powerful factor for good in these cases, but I have often experienced the fact that a rest cure, without the aid of a course of baths to improve metabolism and strengthen and quiet the heart's action, is of little or no value.

6. Graves's Disease.—In many cases of Graves's disease the symptoms can be markedly relieved and the cure hastened by the combination of a course of baths with other methods of treatment.

7. Obesity.—The heart, in these cases, is generally somewhat dilated in addition to being hampered by a layer of fat. An improvement in the cardiac condition leading to a more healthy circulation and metabolism will not only greatly benefit the patient's general condition, but will gradually induce the growth of healthy tissue instead of a superabundance of fat, and bring about a material and lasting decrease in the weight. Such cases as these will lose from one to two stone in weight during a period of two or three months following a course of baths and, instead of being weakened by the process, will feel stronger and be more able to take exercise, and thereby keep the weight from again rising.

The Nauheim methods as applied in England consist in the administration of a course of mineral baths artificially prepared so as to resemble, in all active ingredients, the baths of Nauheim. In conjunction with these baths a course of "Schott" exercises is sometimes given, the details of which will be considered later. It is not possible to give an account of the preparation of the baths that can be rigidly adhered to in every case, but a careful observation of the pulse and general condition of the individual patient before and after a bath will enable any one who is willing to give time and take trouble with the treatment, so to regulate the strength, temperature and duration of the baths that the best results may be obtained.

A suitable bath will produce a slowing and strengthening of the pulse, an improved colour and a general feeling of comfort, though in some cases the pulse does not markedly slow down till some time after the bath.

The first bath should contain six to seven pounds of salt, and seven to eight ounces of calcium chloride, and should be of a temperature varying from 97° F. to 95° F., according to the case and the time of the year. Rather warmer baths are necessary in the winter than in the summer. The patient should remain immersed for from three to four minutes and, after carefully drying, should go to bed for an hour.

The baths should be given for two consecutive days, with a day's interval, during the first week, and for three consecutive days, with a day's

interval, during the following weeks, if this does not overtire the patient. The bath should be strengthened by one pound of salt and one ounce of calcium chloride, and lengthened by one minute every second bath. Where the reaction is good and the patient not debilitated, half an effervescing CO_2 bath may be added at about the twelfth bath, and this may be gradually raised to a whole CO_2 bath if the result is satisfactory. It is sometimes advisable to weaken and shorten the bath slightly on beginning the CO_2 . A full course of baths consists of twenty-four or twenty-five, five baths being given weekly. A sheet may be fixed over the bath after the patient is immersed, so that the medical man can watch the effect on the pulse. If the pulse is increased in frequency or becomes intermittent, or the patient complains of any disagreeable sensation, the bath is probably too strong, too lengthy or too cool, or the patient has had as many baths as are advisable. Slight rigors will often follow the baths, especially in nervous cases, but these soon pass off and, unless the patient feels cold and has a bad pulse at the time, they may be disregarded. A feeling of tightness of the chest on first getting into the bath is quite common.

In combination with the bath treatment, massage and various forms of medical exercises are used, *i. e.* the Zander, the Jurain and the Schott. The last-named are the best adapted for cardiac cases, as they are given by an operator who is able to watch the effect upon the pulse, respirations and skin, and is thereby able to regulate them exactly for each individual, whereas no form of mechanical exercises, however skilfully planned, can be so exactly graduated.

The Schott exercises are best given on the days when no bath is taken; there should be an interval of a few minutes between each exercise and the operator should carefully watch their effect upon the pulse. If properly given the exercises will increase the volume and decrease the rapidity of the pulse, though their action is slower and less powerful than that of the baths. Some patients who have not sufficient recuperative power to start the baths will often be so improved by a fortnight or three weeks' course of exercises that they will then be able to take the baths with benefit. The patient should breathe regularly during the exercises, not holding the breath as some are inclined to do, and should lie down for half an hour after the administration. The exercises are so planned that they include every muscle in the body, thereby causing a dilatation of all the muscle vessels and a consequent decrease of the resistance to the heart's action; if, however, they are pushed so as to quicken the pulse their object is defeated. A description

of these exercises, to be of any use for practical purposes, requires a number of somewhat elaborate illustrations which it is not possible to include in this article.

Though the Nauheim methods have been used in England almost exclusively for the treatment of diseases of the heart and circulation, they are applied at Nauheim, with great benefit, to several other forms of chronic disease in which an improved circulation and increased metabolism produce relief of symptoms and tend to arrest further degenerative changes. The chief among these are: chronic muscular rheumatism, chronic articular rheumatism, arthritis deformans, corpulency, diabetes, gout, scrofula, rachitis, anæmia and chlorosis, chronic catarrhal conditions of the digestive and respiratory organs, and some chronic nervous diseases.

There are six drinking springs at Nauheim, two are of the carbonated saline variety, three acidulated ferruginous springs, and the sixth is a weak acidulated water. The drinking waters are used in various forms of digestive and pulmonary affections, but as it is the object of this article to deal with the Nauheim methods with especial reference to the treatment of cardiac and circulatory diseases, it is not necessary to enter into any more detailed description of the drinking waters. For use in pulmonary complaints, such as chronic bronchitis, etc., there is a building in which inhalations of pulverized salts and other medical preparations are given.

The official season at Nauheim is from April 16th to October 15th.

L. T. T.

ELECTRO-THERAPEUTICS

Various forms of electricity have been recognized and employed as therapeutic agents for many years, but the exploitation of the suggestive factor in some of the more sensational forms of electrical application by charlatans brought this powerful agency into temporary disrepute. Fortunately the day has passed when people look askance at a medical man who employs a battery or other electrical machine in his practice, and at last the profession seems to have grasped the fact that, although it has been misused, electricity is in reality an agency that will well repay scientific study.

In the space at our disposal we cannot do more than indicate the scope of the subject and the various types of current that are in common use, and we have purposely laid stress on those forms of treatment which may be employed by the practitioner without an expensive outfit, rather than on those involving the high-frequency and static currents, which can only be effectively applied by means of costly and cumbersome apparatus.

The **Constant or Galvanic Current** is derived from batteries of dry cells, from accumulators, or from the town's mains, the first of these being the best for ordinary work. In using the current from the mains a resistance board must be interposed to reduce the voltage to such limits as are applicable in medicine, *i. e.* from 0 up to 50 or 60 volts. Some method of gradually increasing the current so that the patient does not receive shocks is also necessary, but this presents no great difficulty. Without elaborate apparatus it is possible for a physician to do good work in general and local electrization, besides having the whole field of ionic medication at his service.

Various modifications of the constant current are in general use. The simplest is the interrupted continuous current, the interruptions being made either by hand or by an instrument designed for the purpose. The effect of this is to give a series of shocks of a more or less painful character which are useful for producing contractions in wasted muscles. A better form of this current, and one that is not painful, is produced by sliding the resistance, either by hand or mechanically, so that the strength of the current is gradually increased and diminished in intensity. The employment of this current will be found very useful in the treatment of paralysis and various other conditions in which stimulation of muscles is required.

The **Sinusoidal or Alternating Current** is produced by a motor transformer, and this is perhaps the most useful variation of the constant current for stimulating purposes. The type of curve produced by these current is:—

~~~~~ The rate at which the alternations of the current occur is regulated by the speed of the motor, and the best results are obtained by the more slowly rather than by the more rapidly changing currents.

The **Faradic Current** has been replaced to a great extent by the sinusoidal, but for certain purposes it is of value. A special coil is required, and it should be noted that some of the coils that are sold for medical work are almost useless, as they are altogether too small; the currents that are given out from them are not only too feeble to be effective, but also very painful to the patient. Even with fairly large coils, however, the faradic current is much more painful in proportion to the quantity of current passing through the patient than any of the other forms.

**Methods of Application.**—All these forms of current may be applied locally, by means of suitable electrodes, or generally, the patient being placed in a bath of some kind. The full bath has fallen out of use, as it is impossible to estimate what proportion of the current passes through the patient, and it has been replaced by the four-cell bath of Dr. Schnee, which has

found universal favour. Separate vessels are supplied for each of the extremities, and in each of these baths a carbon electrode is placed. The current can be passed in any direction through the patient as desired and can be measured exactly.

A word of warning must be given. If the town's mains are utilized for supplying current to baths or instruments, the greatest care must be taken that no water pipes, gas taps, electric fittings or other metal work connected with the earth are within reach, as very severe and even fatal shocks may be received by patients touching such objects when they are in the bath or holding one of the instruments.

*Electrodes* are the applicators through which the current reaches the patient. Various types are in general use, the most common being made of metal covered with layers of lint or chamois leather. The most important point is that there should be good contact with the skin, but care must be taken that no part of the exposed metal touches the patient, otherwise a burn will be produced by the excessive amount of electrolysis that will take place at this point. In our own work we use pieces of copper gauze of suitable sizes and cover them with two or three layers of gamgee tissue.

In all cases the circuit through the patient must be completed, and for this purpose a large "indifferent" electrode is placed on some convenient part of the body. It is most important that this indifferent electrode should be of sufficient size when big currents are used or a burn will result. A burning sensation will precede the actual formation of a burn, and this must be borne in mind when patients speak of any pain during an application.

**Principles of Ionic Medication.**—When two wires from a galvanic battery, or from any other source of constant (unidirectional) current, are placed in water, electrolysis takes place and the water is separated into its elementary constituents, the hydrogen being given off from the wire connected with the negative pole, the oxygen from that connected with the positive pole. If common salt or any other soluble salt is dissolved in the water, it also is split up into its component molecules, the basic radical (the sodium) being given off at the positive pole while the acid radical (the chlorine) is liberated from the negative terminal. If the copper wires are placed one above and one below a pile of damped sheets of blotting-paper and the current is allowed to flow through them, it is found that copper can be detected in the blotting-paper near the positive and penetrating many layers of it towards the negative pole, but that no copper has passed into the blotting-paper near the other wire; and in the same way the copper could be made to penetrate into the body



from a copper electrode placed in contact with the skin. For practical purposes, however, it is not usual to employ the metal directly in contact with the surface but to interpose some layers of lint soaked in a two to four per cent. solution of one of the salts of the metal we wish to use, and to place behind it an electrode made of the same metal connected with the positive pole. In exactly the same manner we can drive in acid radicals, such as the salicylates, by connecting with the negative pole a pad soaked in a solution of the salt. The circuit is completed by means of a large indifferent pad electrode placed in some convenient situation or by immersing a limb in a bath containing an ordinary carbon electrode.

This method is not limited to the treatment of small areas. A knee can be enveloped in a large pad from which the ions may be driven into the joint, or the drug may be forced through a larger area by immersing the legs or arms in baths in which the drugs are dissolved.

The following table shows the drugs most commonly used, and the electrode which must be employed—

| $\div$<br><i>Driven in from the<br/>Positive Pole.</i>                                     | $-$<br><i>Driven in from the<br/>Negative Pole.</i> |
|--------------------------------------------------------------------------------------------|-----------------------------------------------------|
| Sodium . . . . .                                                                           | Chloride                                            |
| Potassium . . . . .                                                                        | Iodide                                              |
| Lithium . . . . .                                                                          | Sulphate                                            |
| Sodium . . . . .                                                                           | Salicylate                                          |
| Zinc . . . . .                                                                             | Sulphate                                            |
| Magnesium . . . . .                                                                        | Sulphate                                            |
| Cocaine . . . . .                                                                          | Hydrochloride                                       |
| Copper . . . . .                                                                           | Sulphate                                            |
| etc. . . . .                                                                               | etc.                                                |
| <i>i.e. The ions of all<br/>metals and basic<br/>radicals, such as<br/>NH<sub>4</sub>.</i> | <i>i.e. all acid radicals.</i>                      |

For ordinary ionic medication a battery that is capable of giving forty volts is amply sufficient. The quantity of current used varies with the size of the area under treatment and the individual susceptibility of the patient. For small areas it is found that patients will not tolerate more than a few milliamperes. The minimum current that will be of value is about three milliamperes per square centimetre for twelve minutes; in the treatment of large surfaces, such as a knee joint, forty or fifty milliamperes are easily tolerated by the majority of patients, and in exceptional cases as much as 120 ma. may be given.

Twenty minutes is an average dose, but naturally the length of time needed for each application varies.

In ionic medication the greater the current borne by the patient, the deeper will the ions

penetrate; hence in some cases it is better to give one big dose, with an anæsthetic, than multiple doses of comparatively small intensity at frequent intervals.

**The Static Current** is a form of electricity that is much used in America and requires elaborate and expensive apparatus. It has not found favour in England, partly no doubt on account of the technical difficulty in producing these currents in a damp climate. The feature of this form of electricity is that the pressure (voltage) is exceedingly high, but the quantity of current (amperage) is low. The instruments produce an absolutely unidirectional current that may be used for actuating an X-ray tube, and, in fact, this form of generator was in common use for this purpose in America at one time. The voltage is so high that sparks of six or eight inches may be produced, but the quantity of current is so small (about one milli-ampere) that no ill-effects are experienced by receiving a shock of such apparent magnitude.

**Chief Methods of Use.** When the machine is charged and the current cannot spark across a gap it diffuses itself in the air in a brush discharge that gives a crackling sound and electrifies all objects in its neighbourhood. By connecting the patient to one pole and placing him on an insulated stool beneath an electrode connected with the other pole, the patient is "electrified," and sparks may be drawn from him by any person standing on the floor.

This form of treatment is said to have a very soothing effect and has been used in sleeplessness with some success.

The static current is also used by some workers for direct sparking, but the high-frequency current is better for this purpose.

**The High-frequency Current**, commonly called "H.F.," is also a current of great potential and is capable of producing big sparks. These are most sensational in appearance but quite harmless, owing to the small quantity of current that is passing and the extraordinarily rapid oscillations that occur. The very high frequency of these oscillations (running into millions per second) is believed to be the reason of the harmlessness of the powerful shocks this type of apparatus is capable of giving. This form of current is much used and is a potent remedy for many conditions associated with debility; it has become the stock-in-trade of the charlatan, and has therefore fallen into ill-deserved neglect among medical men. The chief methods of use are (1) Condensation, (2) Sparking, (3) Thermic effects (diathermy).

1. *Condensation* is carried out by placing the patient on a couch that is covered with metal, from which he is separated by a mattress. He holds a metal handle that is connected with the top of the instrument, and when the apparatus

is working sparks can be drawn from him. The patient experiences no definite sensations, but the treatment has a soothing effect and a general feeling of well-being is produced. This treatment is of service in various ill-defined conditions that may be classed under debility, and it has a pronounced action in lowering the blood pressure—causing a general fall of blood pressure.

2. *Sparking* may be applied directly by means of a metal point, but is more usually applied through vacuum electrodes made of glass; the current from the machine flows into the electrode and induces a current on the outer surface which sparks on to the skin when the electrode is brought near. The method of sparking with vacuum electrodes has been used for various forms of skin disease, such as chronic eczema and psoriasis, with fairly good results, but the X-rays and other forms of treatment have replaced it in this field, while CO<sub>2</sub> has taken its place in dealing with naevi.

The direct sparking by means of a metal point is called fulguration, and powerful sparking from H.F. machines has been used in the treatment of inoperable cancers with a certain amount of success, especially when combined with operative procedure as extensive as the nature of the disease permits.

This method has also been applied to port-wine marks, but although there is a certain amount of improvement it is hardly commensurate with the time and patience necessary in carrying out the treatment.

3. *Diathermy*. By means of certain modifications in the most recent and powerful H.F. machines it is possible to produce very marked thermic effects. The current may be applied to any part of the body and the temperature raised by several degrees, in fact the albumin can easily be coagulated. The treatment has been applied to various joint affections and other conditions, but as yet the experience of this new therapeutic procedure is limited in this country. This current may also be used locally for surgical purposes, and it is probable that it will supersede the knife for the removal of vascular tissues because, as the instrument passes through, it seals the vessels with blood coagulated by the heat and prevents all bleeding.

Success or failure in the treatment of disease by electrical methods depends in many cases on the technique employed and the efficiency of the apparatus, but the personal equation cannot be overlooked, and no physician is likely to be successful unless he can inspire his patient with confidence both in himself and in the method he employs. Failure will dog the steps of the man who makes half-hearted excursions into electro-therapeutics, whereas the physician who possesses the implicit confidence of his

patient, and who understands and believes in the methods he employs, will command success.

**Electrical Diagnosis (*Muscle Testing*).**—By applying an electrical shock to the motor point of a muscle (approximately where the nerve of supply enters) a sharp brisk contraction should occur. In certain diseases these electrical reactions of muscles are altered and furnish evidence of considerable value in diagnosis. Simple increase or decrease of the contractions resulting from the application of a certain current appears to stand in direct relationship to the increase and decrease of the ordinary reflexes. These quantitative changes are therefore of little diagnostic value, and it is rather in the appreciation of the qualitative changes that assistance in diagnosis may be obtained. The motor points of the muscles must be known, and are best learned by self-experiment. Before testing the defective limb it is wise to try the reactions of the sound limb; this not only gives the patient confidence, but also yields some information as to the strength of current that should produce a contraction—a factor that varies very greatly. Two forms of current are used for the purpose, the galvanic and some form of rapidly interrupted current, such as the faradic, and in health there should be a ready response to both.

*The reaction of degeneration (R.D.).* Failure of the muscle to respond to faradism and only a "sluggish" response to galvanism are the chief indications of R.D., and of these two the nature of the contraction (its slow, lazy, lingering character) is by far the more important. R.D. does not come on at once; it takes perhaps a week to develop, and persists until either complete atrophy of the muscle has taken place (when no reaction of any sort can be obtained) or recovery occurs. The latter event is heralded by decreasing sluggishness in the contraction, but the response of the muscle to faradism does not occur until about the time that voluntary control over the muscle is re-established. When R.D. is suspected it is often found that it is possible to obtain a better contraction of the muscle by stimulating the junction of the muscle and the tendons (longitudinal reaction), and if this fact is definitely established the diagnosis of R.D. is certain, even though the sluggishness of the contraction to ordinary stimulation is not marked.

The presence of R.D. does not necessarily indicate a hopeless outlook, as recovery may take place, but it indicates conclusively that there is interference with the lower neuron, and that the disease or injury is one that affects the axis cylinder somewhere between the anterior horn cell and the nerve-ending in the muscle.

Partial R.D. (*i. e.* when contraction to galvanism is somewhat sluggish and faradism still causes slight contractions) is generally



held to indicate that the cutting off of the nerve supply is only partial, and that recovery will result, but it is doubtful if this is always a correct interpretation of the sign.

**Electro-Therapeutics.**—The list of diseases in which electro-therapeutics may be employed with some hope of success is a long one, and as a reasonable classification cannot be formulated it is arranged in alphabetical order. In general, electrical methods are called for only when other treatment has failed, but considering the class of cases in which the treatment is employed the results are very satisfactory. We deprecate the placing of electrical treatment in the hands of assistants, and maintain that the best results will not necessarily be obtained by the use of the most perfect apparatus. The physician who will take the trouble and time to treat his own patients will find that he succeeds where his lay assistant failed.

We have not included in our list those diseases in which our own experience has been unsuccessful, unless the writings on the subject are of such a character as to justify their inclusion.

**Amenorrhoea.**—This symptom of debility is sometimes cured by the administration of one or other of the forms of general electrization. Our own preference is for the use of the galvanic and sinusoidal currents through the four-cells bath, although good results are obtained by means of the H.F. condensation couch.

**Anæmia (Chlorosis).**—In most cases this trouble is amenable to ordinary medical treatment, but when this fails it is often found that general electrification is of much service. Treatment either by means of the four-cell bath, using the galvanic and sinusoidal current, or by condensation with H.F., is of considerable value, and probably acts through the improvement in the general circulation.

**Anæsthesia (Local).**—May be induced by ionizing cocaine from the positive pole of the battery, using a solution of two per cent. of cocaine hydrochloride on a pad.

**Arterio-Sclerosis.**—The high blood pressure found in this disease is influenced by H.F. currents. The condensation couch is employed, and a marked fall of the blood pressure may be looked for as the result of even a single treatment. There is a very large increase in the waste products in the urine, and cases of granular kidney are said to derive much benefit.

**Carbuncle.**—A zinc needle, connected with the positive pole of the source of supply, passed into the centre of the tumour is a most effective form of treatment. The relief of pain that follows the treatment is said to be most marked, while a continuation of the application brings about a cure of the condition in a reasonably speedy manner.

**Carcinoma** in various regions has been treated

by means of zinc ionization with a certain degree of success. Zinc needles are run into the redundant parts and large currents are passed through them, producing sloughing followed by a fairly healthy ulcer. The ulcerated surfaces are treated through pads of lint soaked in a four per cent. solution of zinc sulphate (positive pole), with the result that the ulcer becomes cleaner and may even heal. In treating large surfaces it is advisable to use an anæsthetic, as this enables the operator to employ much more drastic treatment.

**Cardio-Vascular Conditions.**—The effect of the H.F. couch treatment on abnormal blood pressure is peculiar. When the tension is high the treatment lowers it, when it is too low the sphygmomanometer shows an increased blood pressure. In other words, the tendency of this treatment is to restore the blood pressure to the normal. It appears to act both on the tone of the blood-vessels and also on the heart, the latter being directly stimulated. There is a definite increase in metabolism as the result of the treatment, but it is not known whether this is due to the circulatory changes or not.

**Chilblains.**—Our experience of the treatment of chilblains is satisfactory. The four-cell bath of Dr. Schnee is employed, and when half a dozen baths are given in the autumn it is quite common for patients to pass through the whole winter without trouble. Many of these patients volunteer the statement than they do not seem to feel the cold in the same way that they did before they had the baths. We employ both the galvanic and sinusoidal currents, and treat the patients, for half an hour two or three times a week. The treatment has a marked influence on the general health and well-being of the patients, who all appear to improve in this respect.

**Chorea.**—In 1849 Golding Bird reported thirty out of thirty-seven cases of this disease as cured by sparking of the spine, and the late Sir William Gull reported that nineteen out of twenty-five cases yielded to general electrization by the static machine. In spite of these testimonies the electrical methods of treating this disease are apparently neglected at the present time.

**Constipation and Atonic Conditions of the Digestive Tract.**—Various forms of treatment have been devised for the relief of these conditions, and there is no doubt that much benefit may be derived from applications of electricity. The most suitable current to employ is the sinusoidal, of very slow periodicity, or some other modification of the galvanic current that will produce regular, strong contractions of the abdominal wall and possibly stimulate the peristalsis of the intestine. It is probable that the good effects that undoubtedly follow from this form of treatment are due more to the tonic

action and strengthening of the abdominal muscles than to direct action on the bowels.

**Corns**, like warts, also yield to ionization, the drug most frequently employed being salicylate of soda (negative pole). (See *Papillomata*.)

**Deafness** due to stiffening of the ligaments of the ossicles has been treated with some success by the ionization of iodine, derived from a solution of potassium iodide (negative pole).

**Debility** from overwork and in convalescence, especially after influenza, is treated by the four-cell bath, using the galvanic and sinusoidal currents. Our experience with overworked business men is very satisfactory. H.F. is also used for this purpose.

**Diabetes**.—Although H.F. condensation influences the output of sugar, the treatment does not appear to be of any real value in the treatment of this disease; but in simple glycosuria, especially when dependent on the patient's state of health, a few applications will generally cause the complete disappearance of the sugar from the urine.

**Dupuytren's Contractions**.—See under *Keloids*.

**Exophthalmic Goitre**.—Faradism of the thyroid is used as a routine practice by some physicians, but we are not convinced of the value of the treatment. The ionization of potassium iodide (negative pole) into the thyroid is said to be of service, but we have had no experience of this method, preferring the use of X-rays, from which very satisfactory results have been obtained.

**Fistula (of the Anus and elsewhere)**.—These may be treated by ionization, the solution of zinc being injected and a zinc wire electrode passed into the opening. Good results have been obtained, and the method, although far from perfect, is rational; it is not likely to have injurious effects, and should be tried in all cases of persistent sinuses when these are not dependent on a sequestrum or other removable cause.

**Gout**.—Gouty arthritis is treated on the same lines as other forms of chronic arthritis, except that lithium sulphate or carbonate is employed, (positive pole), and treatment in this manner generally relieves the pain. When several joints are affected the lithium may be applied by means of the four-cell bath, and after even a short course the lithium can be detected in the urine, while analysis of the water used in the baths will show the presence of urates.

For the general gouty state the H.F. couch is the most effective form of treatment, and an analysis of the urine will demonstrate the increased metabolic changes as evidenced by the urea output. Good results are claimed, but—as in rheumatism—the effect of treatment may at first be the determining cause of an acute attack; when this has subsided, however, there is generally marked improvement.

**Gynæcological Conditions**.—*Vaginitis* is very

successfully treated by ionization of copper. A special electrode is used, and the vagina is ballooned with a saline solution containing two per cent. of zinc sulphate. This addition ensures that the current shall flow through the fluid to the tissues in an even manner throughout, as the body tissues will offer more resistance than this fluid.

*Chronic endometritis* is usually treated by curetting, but it is found that ionization has almost, if not quite, as beneficial an effect upon this troublesome condition as the operative procedure, which is so much dreaded by many patients. If properly applied the ions should reach every part of the endometrium and improvement should commence after the first application. Six to twelve applications are usually necessary, separated by an interval of a week. Vaginal douching before and after treatment is advisable.

*Endometritis* is indirectly influenced by treatment applied to the vagina, but it is better to treat the uterus directly by a special electrode made of copper, insulated up to two inches from the end; this is passed into the uterus and connected with the positive pole. A large indifferent electrode is placed over the lumbar region. The amount of current which patients will tolerate is about eight to twelve milliamperes. The treatment should not be prolonged beyond fifteen minutes at each sitting, and when it is completed no attempt must be made to withdraw the sound until the current has been run in the opposite direction (*i.e.* with the sound as the negative pole) for two or three minutes; this is done to free it from the cervical canal, to which it becomes firmly adherent when the current is being used for treatment. By employing the special apparatus designed by Dr. Sloan of Glasgow the vulva, vagina, cervix and body of the uterus can all be subjected to the ionization at the same time, and in certain cases this is a great advantage; but the introduction of a sound into the uterus should be avoided unless it is necessary, as there are records of cases in which pelvic peritonitis has followed this procedure, not only when ionization has been performed, but also when the sound has been passed for diagnostic purposes.

*Dysmenorrhœa* due to chronic endometritis is also relieved by ionization.

*Menorrhagia* is treated in the same manner. The bleeding is usually stopped after two or three applications, and great benefit follows in many cases after about twelve treatments.

**Hæmorrhoids**.—It is only in cases where the trouble is of comparatively recent date that success can be looked for by electrical treatment. The vacuum electrode actuated by H.F. currents is most successful in slight cases, and as a rule no further treatment is necessary.



**Headache.**—As a rule this trouble is symptomatic and due to toxic or ocular causes; but when overwork, anxiety, or similar influences are responsible, the application of the faradic current through large pads placed at the back and front of the head will be found of considerable service. The faradic coil for this purpose should be of reasonable size, as the currents obtained from the smaller ones are too painful and irritating for this form of treatment.

**Incontinence of Urine in Children** is treated by stimulation of the sphincter by means of a pad placed over the perineum. The interrupted continuous or the faradic current is employed, and is often successful in bringing about a cure.

In the incontinence of adult females the treatment by means of direct stimulation of the sphincter with an olivary bougie in the urethra is attended with marked success. The neutral pad is placed over the lower dorsal and lumbar region. The efficacy of the treatment depends on the production of the desire to micturate, and in some cases one form of current is more effective than others. The faradic, sinusoidal and interrupted continuous are all of service, but in this, as in other forms of treatment, it must not be forgotten that the moral influence of the physician who administers the treatment is a very potent factor in assisting a cure, and for this reason these patients should not be handed over to the care of a nurse for the applications. In patients who are otherwise healthy there is every hope of a successful result, but where there is mental deficiency the treatment is less likely to be of use.

**Insomnia.**—Some cases of insomnia will yield to no known form of treatment, but in a certain proportion of cases the application of the faradic current to the head, as for headache, will be of value. The static form of electric breeze and the H.F. couch are also said to be of value, but our own experience of these methods is not very encouraging.

**Keloids and Dupuytren's Contractions.**—The treatment of these conditions by means of chlorine ions (sodium chloride negative pole) yields satisfactory results. The treatment must be thorough and continuous, and as the palm of the hand is not so sensitive as other parts of the body a current of sixty or eighty milliamperes can be tolerated after a time. One of the other limbs, placed in a bath, is the safest way of completing the circuit when large currents are employed. X-ray treatment is likely to give even better results in keloid.

**Locomotor Ataxia.**—Faradism of the spine is of value in relieving symptoms, and cases of apparent cure are recorded, but we have not ourselves seen improvement produced in this type of nervous disease by means of this or any other form of electrical treatment.

**Lupus Vulgaris.**—There are now many alternatives to scraping in the treatment of this disease. The Finsen light and X-rays are not always available, and the ionic method of treatment offers a very good hope of success. The methods vary slightly with the type of lesion that is to be attacked. Ulcerated surfaces are treated directly with zinc ionization (positive pole, zinc sulphate four per cent.), but when the surface is not broken the parts that require treatment are first painted with potassium hydrate and the overlying cuticle scraped off before the treatment is applied. By this method it is usually possible to remove apple-jelly nodules, but if they are resistant to this form of ionization they may be treated directly by means of a zinc needle (positive pole) inserted into each. The cosmetic result is decidedly good and compares favourably with that produced by Finsen treatment, while it is much better than the average X-ray result in that there is no tendency to the formation of telangiectases.

**Muscular Rheumatism.**—General electrization of various kinds produces advantageous results, especially the four-cell bath through which the galvanic and sinusoidal currents are passed. The local application of the galvanic current to the affected part by means of a pad or roller connected with the anode is, in our experience, more beneficial.

**Nævi.**—Cavernous nævi are now successfully treated by so many physical agencies that electrolysis—by means of one or more platinum needles thrust into the tumour—is falling into disuse, although it is a very successful method. In our own practice we now use carbon dioxide and clear up any small remaining areas by means of electrolysis.

Capillary nævi—port-wine marks—do not yield satisfactorily to treatment. A certain amount of improvement may be obtained by H.F. sparking from a vacuum electrode with the patient under an anæsthetic, or with carbon dioxide snow. By a very tedious process of electrolysis with a fine needle inserted into each of the visible capillaries a certain amelioration may be effected, but as yet there is no really successful method of dealing with these disfigurements.

**Obesity.**—When this trouble is once established, neither H.F. nor any other form of electrical treatment appears to be of any value.

**Papillomata and Warts.**—These prove amenable to the ions of magnesium, zinc or copper. A solution of magnesium sulphate, the most usual drug employed, is driven into the wart from the positive pole. In order to ensure the passage of the current through the warts rather than through the surrounding skin, it is advisable in some cases to prick them with a needle in

several places before applying the pad. When the warts are very numerous the simplest method of applying the drug is to immerse the hand in an arm bath containing a solution of the magnesium sulphate after pricking all the warts. The results of this treatment are most satisfactory.

**Paralysis.**—Direct stimulation of the muscles, by means of the interrupted galvanic and the sinusoidal currents, is of value in keeping up their condition pending the return of nervous control.

**Pruritus of the Anus and Vulva** can almost invariably be relieved by mild sparking with H.F. electrode.

**Rheumatoid Arthritis.**—Ionization is of great service in various forms of arthritis, and is usually applied locally by means of pads soaked in potassium iodide or salicylate of soda (negative pole), but when many joints are affected the four-cell bath is employed. The results of this form of treatment are gratifying, but patience is required, as it is often found that after perhaps half a dozen applications the patient becomes worse for a time, but it is just these cases that derive most benefit in the end.

In all rheumatic conditions the constant current applied through the four-cell bath is beneficial, and the probability is that the improvement in the disease is secondary, depending on the improvement in the cardio-vascular tone and consequent increase of the flow of blood through the affected parts.

**Rhinitis.**—Improvement can be obtained in this troublesome condition by packing lint soaked in two per cent. zinc chloride around the turbinates and ionizing the zinc into the affected region.

**Rodent Ulcer.**—Surgery was formerly the only cure for rodent ulcer, but X-rays, radium, CO<sub>2</sub> and ionization are now available. They are all highly successful in the early cases and there is little to choose in the efficiency of the various methods. Ionization has many advantages, among which must be numbered its simplicity, inexpensiveness, and the absolute precision with which the treatment can be applied. This latter point is of much importance, since it is possible to treat ulcers in such difficult positions as those occurring on the margin of the eyelid and other places where it would not be safe to use any of the other methods at our disposal. The deficiency of all the present modes of treatment is that none of them is of any avail if bone or cartilage is involved, but with this reservation it may be said that the treatment of rodent ulcer is most satisfactory, and it is very seldom that a cure is not effected. Several layers of lint soaked in zinc sulphate (two per cent.) are placed on the

ulcer, and a zinc electrode, connected with the positive pole of the battery, is held in position behind them. The amount of current must not be less than three milliamperes per square centimetre of surface, and the treatment should be continued for at least twenty minutes, when it will be found that the surface of the ulcer is coated with a pearly white substance. The greater the velocity with which the ions are driven into the ulcer the more effective is the treatment likely to be; hence it is important that the patient should tolerate the passage of as much current as possible, since the velocity of the ions depends on this factor.

**Sciatica.**—The treatment of sciatica by the ordinary methods is frequently extremely unsatisfactory, and in a large proportion of these cases the introduction of the salicylate ion has been found of great service. A large pad is soaked in two per cent. sodium salicylate, and placed over the sciatic nerve. It is connected to the negative pole and large currents, up to 200 ma., are passed. We have also obtained very good results by placing the feet in the Schnee foot-baths and connecting the affected limb with the positive pole.

**Sinus.**—See *Fistula*.

**Superfluous Hairs.**—This troublesome condition is treated by the introduction of a platinum needle, connected with the negative pole of the battery, right into each hair follicle. Each follicle requires at least one minute's treatment before destruction is complete, although the hair itself is easily removed after perhaps thirty seconds. The process is not painless, but most patients who are troubled with hypertrichosis are willing to endure the treatment and to attend time after time until the whole growth is removed. The treatment must be thorough to be effective and not more than about a dozen hairs should be removed at a sitting, but even with the most patient care on the part of the operator there will be regrowth of some of the hairs.

**Ulcers.**—Chronic ulcers are treated by the ionization of zinc or copper. Pads of lint soaked in a two or four per cent. solution of the sulphate, and backed by an electrode of the metal, are placed in contact with the ulcer. The effect of ionization is to clean up the surface and to promote healing, and even in dealing with chronic varicose ulcers the method has been used with considerable success.

**Ulcerative Proctitis and Colitis** are treated by ionic medication with very considerable success. The method employed is to inject a two per cent. solution of zinc sulphate per rectum through a special tubular electrode made of zinc and covered with some insulating material. The quantity of the solution injected should not be greater than the patient can comfortably retain



when he is sitting up. A large neutral electrode is placed over the lumbar region and the positive pole is connected to the zinc terminal in the rectum. The current is gradually increased, and, although the patients will in some cases stand large quantities, it is best not to press the treatment beyond thirty milliamperes, as a considerable amount of delayed shock may be produced, accompanied by severe depression lasting for several days. It is better, therefore, to employ smaller currents for longer periods, say half an hour, two or three times a week.

The success of the treatment varies with the accessibility of the disease. It is of course easy to distend the whole colon with the fluid, but there are few patients who can retain such a quantity for the length of time necessary. Naturally, therefore, those cases that involve the descending colon and rectum are most suitable for ionic treatment. Improvement is slow at first, but if the treatment is used persistently for some weeks a good result may be confidently expected unless irritability of the bowel makes it impossible to reach the seat of the disease effectively.

**Urethritis.**—The ionization of copper or zinc is employed in chronic gonorrhoeal ulceration of the urethra, and is applied by means of a special bougie electrode through which a solution of one of the salts of the metal to be used can be injected. The bougie has an olivary point that prevents the solution from passing into the bladder, thus ensuring the distension of the urethra when the fluid is injected. This form of treatment yields good results even in cases of long standing.

**Warts.**—See under *Papillomata*.

W. J. S. B.

A. E. B.

## X-RAY THERAPEUTICS

The diseases which have been treated beneficially by X-rays differ so widely in their pathology and etiology that the subject of X-ray therapeutics is of direct interest to practitioners in almost every branch of medicine and surgery. It is most difficult to cover so large a ground, and it will be impossible in the space at our disposal to do more than give a list of the conditions in which X-ray treatment may be of use, with a few explanatory notes of its action and the methods to be employed.

X-ray treatment is necessarily of a somewhat risky nature, as in most cases small applications are useless and may indeed do more harm than good. A certain amount of risk is, however, justifiable in treating desperate cases, such as Hodgkin's disease or inoperable cancer, but this should involve no real danger to the patient. The whole question of dosage is a very import-

ant matter which requires great experience, and none but competent radiologists should be allowed to have dealings with an agency so potent for evil as X-rays. In no case should the treatment be carried out except under the immediate supervision of a medical man well versed in the technique required. The difficulties of the dosage are increased by the fact that the X-ray tube is a remarkably fickle piece of apparatus and that it is quite impossible to measure the output of the rays by simply noting the amount of current passing through the tube and the length of the exposure. The same tube may give out rays varying both in quantity and quality at different times, and in the first place, therefore, it will be necessary to explain briefly some of the physical properties of the X-rays and the changes which the tubes undergo.

**The X-Ray Tube.**—Without attempting to discuss the purely scientific questions of the nature or the origin of the X-rays, it will suffice to state that their production depends largely upon the degree of the vacuum within the tube. If, on the one hand, the vacuum is too high (*i. e.* the air is too much exhausted), the internal resistance may be so great that little, if any, of the current will be able to pass through the tube, and practically no rays will be emitted. When, on the other hand, the tube contains too much air the internal resistance falls to a very low point, the tube will rapidly become overheated, and the quantity of rays produced will be equally deficient. A tube in the former condition is termed "hard," in the latter "soft," and the qualities of the rays vary in the two cases in a manner which it is essential to understand before considering the effects of X-ray treatment. Stated briefly, these qualities are :—A *hard tube* gives out rays of long wave-length and possessing great power of penetration, but exerting very little action upon the skin. A *soft tube* emits rays of shorter wave-length and less power of penetration beneath the surface of the body, but capable of producing much more readily a severe skin reaction. In other words, a tube which has become too soft will give out rays more likely to burn the skin, but owing to their lack of penetration the action produced will be more superficial.

In most instances the use of a medium tube is required, and great experience is necessary both in judging its working qualities and in the management of its vacuum. The dangers of burning the skin may be diminished to a great extent by the employment of what are known as X-ray *filters*. These consist of layers of felt, leather, or thin sheets of aluminium (half to one millimetre in thickness), which are interposed between the tube and the skin of the patient with the object of cutting off some of the rays of short wave-length which act most powerfully

upon the skin. It has been found that these filters enable us to apply much heavier doses with the production of less skin reaction, and the results of X-ray treatment have much improved in consequence.

**Dosage.**—When treating a new patient who is about to undergo a long course of the X-rays, it is necessary to watch the dosage very carefully until some idea is formed as to the amount the skin will stand. The individual susceptibility to the action of the rays varies to a great extent, and cases are occasionally met with in which comparatively small applications set up a marked skin reaction. In all cases the operator must be able to estimate the dosage correctly; as a rule he should employ one of the methods of measuring the output of the rays, such as a Sabouraud pastille.

**Physiological Action of the X-Rays.**—The action of the rays is purely local, and only those tissues directly in their path are affected. It is therefore possible to treat various parts of the body in turn without the danger of any fresh dose adding to the local reaction already produced in other regions.

The rays cause absolutely no sensation of any kind at the time of application, no matter how heavy the dose may be. A mild dose will probably produce no visible reaction in the skin. A somewhat longer exposure may set up a slight erythema in the course of a few days, but at the most this gives rise to a little itching and is very transient. If a succession of such doses be given at intervals of a week or less, the skin reaction will pass on to a stage of bronzing and desquamation, the appearance of the skin being similar to that caused by exposure to the sun. A skin reaction approaching this in degree is commonly seen in the treatment of cancer and other conditions where the dosage must necessarily be as heavy as is consistent with safety, but with care and experience it need cause no anxiety.

After a dangerously big application of the rays no change is visible for some days, the incubation period varying from two or three days to about three weeks. The first evidence of reaction is erythema, usually very irritating, followed rapidly by the formation of vesicles, which coalesce in severe cases; in the course of another few days ulceration takes place, with deep destruction of the tissues. These ulcers, or X-ray burns, are extremely painful and intractable, the edges showing very little tendency to heal.

Much the same effects may result from a succession of doses, no single one of which may be harmful in itself, and it is exceedingly important to grasp the fact that the action of the rays is both delayed and cumulative. It is therefore necessary to allow for the latent

action that may have already been set up by previous applications.

The rays act powerfully upon all the epithelial structures of the skin, a big dose or a long course of treatment causing atrophy of the sweat-glands and hair-follicles, and a permanent condition of alopecia may result.

**Action upon the Deeper Tissues.**—The only tissues affected to any extent beneath the skin are the glandular structures, lymphatics and white blood corpuscles. The rays appear to exert a strong selective action upon all actively-growing tissues, including cells of an embryonic type. The foetus and the young infant are therefore easily affected to a dangerous extent by the rays, though there is no risk in a moderate exposure for purposes of radiography or treatment. The rays may also produce sterility in both sexes, the testes being more rapidly acted upon owing to their exposed position. The action of the rays upon the blood-forming tissues is also very marked, and X-ray treatment is, therefore, very useful in certain diseases of the blood associated with splenic enlargement.

In every case the effect of a small dose is to increase rather than to check the activity of the cells, and in the X-ray treatment of some diseases the symptoms may be actually aggravated by insufficient dosage.

The X-rays, like all other remedies that have produced striking results, have been tried in a great variety of diseases without avail, but the list of ailments in which their application has proved beneficial is now a long one, and in many cases X-ray treatment is the most successful method at our disposal. Our selection from this list is based chiefly upon our personal experience of the results obtainable; we have also included other diseases which we have not treated whenever the published records have seemed sufficiently encouraging to justify a brief reference.

### Diseases of the Skin

The X-rays have a powerful action upon all the structures of the skin, and their therapeutic effect is of great value in a large number of cutaneous diseases. In some cases, as, for instance, in treating ringworm, the dose must be a heavy one, but as a rule the best results are obtained by means of a series of smaller applications.

**Acne.**—The rays have been tried repeatedly in this disease, and some successful cases have been reported. In many cases, however, very little benefit is obtained, and our own results have certainly not been very encouraging. We consider this method of treatment altogether too risky to be applied to the skin of the face. Small doses at short intervals are recommended.



**Eczema.**—Treatment with a comparatively soft tube gives very excellent results in chronic eczema, no filter being used. In some cases the effect of a single dose is very striking, especially when the disease affects the hands. The pustular type, in which there is a mixed infection, responds particularly well to the rays. It is interesting to note that a dose upon one patch may have a distinct curative action upon others situated at a distance that have not been treated, apparently owing to the absorption of antitoxins that have been produced by the local action of the rays.

**Hyperidrosis.**—Full doses of the rays not only lead to epilation, which will be permanent if the dose is sufficiently heavy, but also cause atrophy of the sweat-glands. In cases of excessive sweating of the axilla, or elsewhere, great relief from the discomfort and inconvenience may be derived from full doses, applied without a filter, and repeated in about three weeks. From three to six such doses are as a rule necessary. Greater care is required in treating the hands, and the dosage must be measured very carefully.

**Hypertrichosis.**—Radiologists are not unfrequently asked to undertake the removal of superfluous hairs from the face by means of the X-rays, but in view of the fact that it is necessary to apply a dose heavy enough to produce a distinct reaction, repeated at intervals for an indefinite period, the practice must be regarded as far too dangerous to be recommended. Several cases of very severe and distressing burns have been recorded; in other cases telangiectases, atrophy, or pigmentation, often more unsightly than the original condition, have followed. Removal of hairs from other parts of the body is attended by less risk, as the skin is not so susceptible as that of the face.

**Keloid.**—The X-ray treatment of keloid is nearly always successful, and in our experience the effect has been most beneficial. The following is the most favourable case we have seen—

Girl, aged nine, scalded nineteen months previously by the upsetting of a pan of boiling water down outer side of thigh and knee. Pain very severe and contraction of scars about knee made walking almost an impossibility. After fourth dose of X-rays pain had quite disappeared, and after eight applications the scars had become so soft and elastic that further treatment was deemed unnecessary.

Operation scars, *e. g.* after amputation of the breast, also soften rapidly under X-ray treatment.

**Lupus Vulgaris.**—The advantages of the X-rays over the Finsen light in the treatment of lupus lie in the shorter duration of each application, the larger area treated at a single sitting, and the more rapid effect produced upon the

disease. The Finsen light, however, gives a more perfect cosmetic result and is more effectual in destroying the apple-jelly nodules, upon which the rays exert less action. The best results are probably obtained by a combination of different forms of treatment, namely, X-rays, carbon dioxide snow, ionization, and possibly curetting in some cases.

**Moles.**—These should as a rule be treated by means of ionization with magnesium sulphate rather than the X-rays, but in some cases the latter are very useful. In the X-ray treatment of hairy moles the first effect produced is a complete epilation, further doses causing a shrinkage of the growth. Ionization, electrolysis, or the use of carbon dioxide snow, may be employed to remove the last traces of the mole. Some form of treatment is strongly indicated for moles which are beginning to show signs of activity in middle life, and in such cases it is essential that the treatment adopted be really effectual, as mere tampering with the growth is likely to lead to increased activity.

**Parasitic Diseases of the Hair (Tinea Tonsurans, Favus and Sycosis).**—An absolutely certain cure may be relied upon in these diseases as a result of X-ray treatment. This is in no way due to any action of the rays upon the organisms which cause the disease, but solely to the complete epilation which the rays produce. The question of dosage is a somewhat delicate matter, as it is necessary to give a single application just heavy enough to bring this about, but not sufficient to cause a permanent alopecia. A full "Sabouraud" dose is usually given without a filter to all the infected parts and this should suffice to produce a complete epilation in the course of two to four weeks, the healthy as well as the diseased hairs being removed. The process of removal should be assisted by friction with a rough towel night and morning and mercurial ointment applied until epilation is completed. The patches which have been properly treated will be rendered quite bald, and the disease should be entirely eradicated, provided the whole of the infected areas have been treated. The interval which elapses before the hairs begin to grow afresh varies from about four weeks to several months, and if the dosage has been correctly measured there should be no loss in either the quantity or the quality of the hair; we have even known the patient to state that the new hair was improved in both respects.

There is a certain amount of risk of permanent alopecia attached to this method of treatment, although we ourselves have never seen any ill effects. The dangers to the brain, about which so much has been written in the lay press, are utterly devoid of foundation.

**Pruritis.**—In many cases the rays have a

very striking curative effect upon pruritus, both of the anus and the vulva. We have known a single unfiltered dose to relieve the itching in a very troublesome case of pruritus vulvæ, the application being repeated every two or three months.

**Psoriasis.**—Patches of psoriasis often react very rapidly to X-ray treatment, the best results being produced by a succession of small doses. The disease is apt, however, to recur, and the treatment may then be repeated. As in the case of chronic eczema, a markedly beneficial effect is sometimes seen upon patches situated at a distance from those which have been treated.

**Ulcers.**—Nearly all forms of chronic ulceration are benefited by X-ray treatment, a few doses causing the ulcer to clean up. A clean granulating surface is left and healing is promoted.

#### Diseases of the Nervous System

The rays have been tried in many of the diseases of the *central nervous system*, such as locomotor ataxia, syringomyelia, disseminated sclerosis and myelitis of the spinal cord. In some cases a certain amount of temporary relief of the symptoms has been recorded, but in no case has a cure been claimed, so far as we know.

In **Neuritis**, on the other hand, we have seen very remarkable results follow from the applications of a few doses upon the affected nerve, even a single dose over the sciatic notch producing unmistakable relief in a case of sciatica. Cases of facial neuralgia and migraine have also been successfully treated. Less benefit is to be expected when the pain is due to pressure upon the nerve trunk, but we have seen good results from applications to the spine in pain caused by secondary malignant growths.

#### Diseases of the Glands, Lymphatics and Blood

**Exophthalmic Goitre.**—In every case that we have seen there has been a very distinct improvement in the symptoms as a result of X-ray treatment. The nervous symptoms rapidly diminish, the pulse-rate falls, the palpitations decrease or disappear altogether, and as a rule the exophthalmos and goitre become less prominent. The doses should be applied once a week for some months, care being taken that the thyroid gland does not become too greatly atrophied, lest symptoms of myxœdema be produced. On the other hand, if the X-ray doses be too small the gland may be stimulated and the symptoms of the disease actually aggravated.

In **Goitre** the rays appear to be quite useless.

**Hodgkin's Disease.**—The results of energetic X-ray treatment of this disease are very remarkable, and our own experience leads us to believe that it is the only form of treatment that holds out any hope of a permanent cure. The effect

of the rays upon the enlarged glands in acute cases is very rapid, a single heavy dose often being sufficient to cause a large mass of glands to disappear in the course of a few days. In severe cases the glands enlarge as rapidly as they subside, and a very long and patient course of treatment is required; as many as 500 applications, extending over two or three years, may be necessary before the disease gets really under control. When the enlargement of the mediastinal glands gives rise to dyspnoea, these must be attacked both from the front and the back with a comparatively hard tube, the skin being of course protected by an aluminium filter. In less severe cases, especially when only one or two sets of glands are involved, the enlargement is less liable to recur, and after a few months' treatment an occasional dose will suffice to keep the disease well in hand.

**Leukæmia.**—Like other forms of splenic anæmia, leukæmia improves rapidly under X-ray treatment. The filtered rays should be applied to the spleen two or three times a week. The general condition usually improves very steadily as the spleen diminishes in size and the blood-count shows a decrease in the number of white corpuscles. Relapses occur if the treatment is entirely suspended, but occasional doses should keep the white corpuscles down to 30,000 or 40,000.

**Malaria.**—A few cases of malaria treated by X-rays have been reported and the results are very encouraging.

**Prostatic Enlargement.**—Several writers have published accounts of cases of prostatic enlargement in which a course of X-rays applied to the perineum has brought about a diminution in the size of the gland, with consequent improvement in the power of micturition. A moderately hard tube is required and the rays should be filtered through aluminium.

**Tuberculous Adenitis.**—The results of X-ray treatment, not only in early stages of tuberculous glands, but also when sinuses remain after operation or the bursting of abscesses, are often very good. The glands tend to shrink and sinuses rapidly become more healthy and tend to heal. The improvement is not due to the direct action of the rays upon the tubercle bacilli, but upon the tubercles. The advantage of X-ray treatment over operative measures lies in the absence of scarring, but it cannot be recommended as an alternative to operation except as a tentative method of treatment in early cases, or where sinuses already exist.

#### Malignant Growths

To a certain extent the hopes that were founded upon the X-ray treatment of cancer and other malignant growths have been disappointed. Nevertheless there can be no doubt



as to the powerful action of the rays upon all such tumours, or of the benefit which follows heavy dosage in practically every case. Small applications are quite useless, and a reasonable amount of risk is justified in view of the desperate character of the disease.

X-ray treatment is perhaps of the greatest value in carcinoma of the female breast. The growth, especially in early recurrent cases, is comparatively superficial, and thus more easily attacked by the rays. It will be convenient, therefore, to discuss the treatment of cancer of this region in some detail first, and to consider other malignant growths afterwards.

The cases of carcinoma of the breast which are submitted to X-ray treatment may be classified into three groups:—(1) hopelessly inoperable cases, (2) those in which the prognosis is more favourable, and (3) cases in which the rays are applied as a prophylactic measure after operation.

Of the *hopelessly inoperable cases* the majority are recurrent forms, but a few cases of primary tumour are met with in which the patient has neglected to seek advice until the growth has become too advanced to admit of removal. As a rule these primary growths do very well under X-ray treatment unless they are of the more rapidly-growing types. We have known them to remain under treatment for three or four years, the growth being kept in check, becoming softer and less defined, and without any evidence of metastatic deposits. The rays possess a marked power of preventing these growths from breaking down and of rendering more healthy and clean any ulcers or fungating masses that may already exist.

Recurrent growths also may be kept in check for four or five years, or even longer, provided the cancer is not of the most malignant type. Ulcers again tend to heal up or are kept clean, thus giving great relief from the distress caused by offensive smells and septic absorption, a fact which alone makes this form of treatment well worth application. Many of these cases also remain practically free from pain until death is brought about by metastatic deposits. When this occurs it is common to find that the external growth is no larger, and in many cases even less, than it was when treatment was commenced.

The cases which we have described as *more favourable* are those in which the growth is in an early stage, but in which an operation is not performed either because the patient refuses her consent or because her age or general condition contra-indicate operative treatment. Of the primary cases that fall under this category, all those that we have seen have done well. The growth may often be kept in check for several years, or even reduced in size. Recurrent

nodules, if treated early enough, also react well to the rays and may completely disappear. Some of these cases seem to have been definitely cured, but there is undoubtedly always a danger of further recurrence; they should therefore be watched very closely and occasional doses applied at regular intervals.

*Prophylactic treatment* after amputation of the breast, or removal of recurrent nodules, is in our opinion of the greatest value. The doses should be commenced immediately the wound is healed and continued for several months at gradually increasing intervals.

Carcinoma in other regions of the body is treated in much the same manner. When, however, the tumour is situated more deeply, *e.g.* in the stomach, there is much greater difficulty in dosing it sufficiently without causing damage to the skin. In such cases the maximum action upon the growth is obtained by means of a comparatively hard tube and the employment of an aluminium filter which will cut off the rays of least penetrating power. In spite of the difficulty of adequately dosing deep-seated cancers, we have seen very marked relief from pain by the application of big doses to a carcinoma of the pylorus.

**Epithelioma** seems to be less amenable to X-ray treatment than carcinoma. We have treated a number of cases of recurrent epithelioma of the tongue, with glandular infection in the neck; temporary improvement was noted in many of these cases, but in one case only did the glands completely disappear under treatment. This patient is still under observation after a period of three years, and so far there has been no further recurrence.

**Rodent Ulcer.**—The X-rays have been used very largely and with very good effect in the treatment of rodent ulcer. We have seen many excellent results in our own practice, but since the introduction of other methods, such as zinc ionization and carbon dioxide snow, we have not used the rays to the same extent. Any one of these methods of treatment should bring about a perfect cure in almost every case, unless the disease has involved the bone or cartilage.

**Sarcoma** responds more readily than carcinoma to the rays, but shows a tendency to metastasis at a very early stage in the most malignant forms of the disease. The X-rays have, however, produced some very wonderful results, and we have seen some cases of apparent cure; one of these was a case of sarcoma of the upper jaw and two were abdominal growths. Sarcomata of the bones, especially the myeloid growths, are also said to have been cured by X-ray treatment.

**Paget's Disease of the Nipple.**—Regular applications of the rays rapidly effect an improvement in the eczematous condition of the nipple in

Paget's disease, and the dangers of carcinoma of the breast are probably diminished by the treatment. A cure cannot be guaranteed in advanced cases, however.

W. J. S. B.

A. E. B.

### THE INTENSIVE IRRADIATION AND STATIC WAVE TREATMENT

The treatment of painful joints and muscular areas by means of intensive irradiation is best secured by means of one of the so-called therapeutic lamps of the incandescent type. It must be clearly understood that lamps of small candle power are useless for the purposes of administering intensive irradiation in ordinary practice. It is quite true that in the case of small joints and very circumscribed areas a small candle-power lamp can effect certain conditions of alleviation, but, as Snow has well put it, their effects upon general metabolism and other purposes of administration to large areas are not practical, as they consume too much of the time not only of the patient, but also of the physician. The best instrument for treatment with intensive irradiation is a 500-candle power incandescent lamp with special peculiarity in the character of the reflection. Instead of a parabolic reflector with one focal point there is a corrugated reflector and conical side reflectors, which project lines in parallel and crossing lines of radiation having two parallel fields of greatest brilliancy and intensity. This arrangement permits the operator to move the lamp about in such a manner that these two fairly large fields of intense radiation can be tolerated as they cannot be when retained in one position directly over the regions of tenderness or inflammatory involvement. At the same time the whole surface receives a liberal radiation of light and heat. The effects upon simple inflammation, unaccompanied by infection, is to induce general tissue relaxation, with relief of pressure and pain by increasing local metabolism and elimination, to relieve the tissues of the irritating products of defective metabolism present in conditions associated with myalgias and similar conditions, and in conditions of mild traumatism treated promptly after injury, to remove early stasis.

The intensive irradiation treatment, when supplemented with the static wave current, furnishes the practitioner with an efficient means of dealing with a large number of cases of local inflammation and painful effusion.

The static wave current has been well described as an agent which is capable of increasing the physiological resisting power of the part to which it is applied. It restores the metabolic equilibrium, which is disturbed in all conditions

characterized by increased venous and decreased arterial pressure. Passive congestions are removed by improving the physiological "tone" of the affected region. Pain is relieved because nutrition is rectified and toxic material turned into the proper excretory channels. Health has been defined as a condition characterized by perfect equilibrium of arterial and venous blood pressure. Disturbance of this equilibrium results in locally increased arterial pressure or locally augmented venous pressure, both conditions resulting in disturbed nutrition of the nerves, whose cry for proper nutriment is called pain. The wave current, in restoring the physiological tone of the affected area, tends to re-establish the normal equipoise of the two forms of pressure, and in this way counteracts stasis and relieves pain.

The method of applying the static wave current and its various physiological effects are described exceedingly well by Potts, who, quoting Snow, says that the patient, on an insulated platform, must be connected to the side of the static machine that is not grounded. The electrodes should be of pliable metal and the treatment should be commenced with the prime conductors practically closed. On drawing the prime conductors apart the wave current will become apparent and as wide a spark should be used as can be easily tolerated by the patient. The physiological effects are divided into constitutional and local effects. The constitutional effects are:—Marked lowering of arterial tension; lessened frequency of the heart's action, with increased volume of pulse; increased oxidation and metabolic activity, marked by body warmth; deepened inspiration; increased production of  $\text{CO}_2$ ; increased elimination of solids, with marked functional activity of the organs of secretion and excretion, and marked diminution of nervous irritability, with a sense of drowsiness. Patients receiving local treatment daily gain body weight, become less anæmic, and improve generally in health. The local effects are:—A sense of vibration, marked over muscles, when there is little underlying fat, by rhythmical contractions. Physiological tetanus is produced when voltage and alternations relative to muscle are applied. Sedation of pain and nervous irritability is produced by prolonged and gradually increased dosage as toleration permits. The wave current is an antispasmodic, muscular spasm being often overcome by prolonged administration of sufficient voltage to fatigue the muscle. Glands beneath the electrode are stimulated to active secretion. Local congestion and hyperæmia are relieved, and Potts ends the quotation with the statement that metabolism is most active beneath the electrode.

The late Sir Frederick C. Wallis, surgeon to



Charing Cross Hospital, writing on the author's work in the *British Medical Journal*, says that "The immediate effect of this treatment with regard to the alleviation of pain is interesting. I have seen a patient who after a fractured clavicle suffered intense pain, so much so that he was scarcely able to move his arm at all and was quite unable to sleep. After about five minutes of the wave current, which had been preceded by treating the affected area with intensive irradiation, the patient was able to extend the arm shoulder high without any pain at all. A certain amount of stiffness returned after some hours, but a distinct improvement remained, still further increased after each application."

It must be borne in mind that intensive irradiation must precede the application of the wave current, and an explanation of the reason for this is supplied by Snow, who says that when applied after wave-current treatment intensive irradiation relaxes again the tissues rendered tonic at the site of the lesion, where accumulative infiltration causing pain by pressure has been forced out by the contraction induced in the tissues by the wave current. The futility of expecting to cure pain by simply relieving it is so well put by the same author that his views are here given verbatim. "Pain is relieved by the application of radiant light and heat energy in regions of local inflammation on account of the induced relaxation of the tissues, the increased elasticity induced relieving the pressure upon the nerve filaments, which is undoubtedly due largely to the effect of the radiant heat, as the same effects are derived to a less degree by applications of convective heat. This relief of pain should not delude any one into expecting to effect the cure of an inflammatory process in which stasis is once established, for the effect is transitory, not curative."

In that large class of case loosely styled sciatica the unfortunate patient can often be afforded permanent relief from his pain and disability by means of an intelligent application of intensive irradiation and the static wave current. An interesting case illustrating in a remarkable degree the utility of this treatment was sent up to me from the country with an urgent message from the doctor to cure the man as quickly as possible, because he had been a very long time out of work and was in danger of losing his employment. The patient was thirty-one years of age and had never suffered from any illness till four years before he came to me for treatment, when he was attacked with pains shooting down the right thigh and leg. For some time he could just manage to get through his work, but in April 1909 he was forced to keep in bed. The doctor in whose charge this patient was wrote to me that while

in the recumbent position the patient was fairly free from pain, but he was quite unable to stand or sit. Drugs failed utterly to give any relief and frequent injections of morphia became ineffectual. The patient was then removed to a large general hospital in London and was treated there for six weeks. Whilst in that institution no pains were spared to cure the patient, and amongst the measures adopted was the injection of alcohol. The patient returned home with his health slightly improved but still unable to work in consequence of pain and disability. After the application of intensive irradiation and wave current during five days all pain had disappeared and no disability remained. The man returned immediately to full work and his doctor reports that since then he has not missed an hour's work. His employment as engineer forces him to endure all kinds of weather, but he complains of nothing now except slight attacks of stiffness in very bad weather.

The permanent nature of the cure of sciatica effected by the use of intensive irradiation and wave current is exemplified in a case of a gardener sent up from Sunningdale by a doctor who regarded the case as hopeless, the man having been ineffectually treated by drugs, baths, hot air, electricity, massage and spa treatment. This man was fortunate in being employed by a generous lady who paid for his expenses in London, and in ten days' time this patient was restored to full working power and has now for over four years followed his occupation without any recurrence of his trouble.

It is not to be understood that all cases of sciatica are relieved in this satisfactory manner, but the cases quoted indicate sufficiently that in intensive irradiation and static wave treatment there is a possibility of doing far more for patients than has hitherto been considered safe to promise.

The relief of painful conditions following injuries is a subject of great interest in connection with this new treatment. A lady whose shoulder had been injured by a fall suffered for years from increasing stiffness of the joint, accompanied with great pain. She was seen by many able practitioners, but permanent relief seemed difficult to attain. After two applications of intensive irradiation and wave current the stiffness and pain disappeared, the use of the arm was completely recovered and now, over two years having passed, the lady states that the limb is quite sound and well.

In cases where serious and extensive injuries have been received, as in motor or railway accidents, the resulting stiffness and pain after all possible surgical measures have been utilized can in favourable instances be relieved by

patient and oft-repeated applications. The following case illustrates the happy results that may follow a long course of treatment in such a patient. In consequence of a motor accident the patient, a lady aged thirty-five, was thrown from her car a distance of about ten yards on to her head. She received most skilful treatment from distinguished surgeons, and under their care she made what can be truly described as a marvellous recovery from severe injuries to her cervical vertebræ. The unfortunate lady, however, was left in a condition of great pain and disability, her head being sunk into her shoulders and pressed forward, whilst movement in both her arms was accomplished with great effort and pain. It would be tedious to detail the slow improvement that followed intensive irradiation and wave-current treatment, but the conditions in the end did improve and the amelioration remained permanent, for quite twelve months after the cessation of the applications the lady travelled some hundreds of miles to London and sent the following note, which she had written herself, into my consulting room:—"Dear Doctor, Just spare me five minutes. I am in town for a few days and want to show you how completely you have 'turned my head.'"

In acute conditions the success of intensive irradiation and wave-current treatment is as gratifying to the patient as it is to the operator, as is shown by the following account of a case sent to me by a London surgeon. The patient was a gentleman engaged in athletic pursuits and was obliged to play off a certain important tie within a day of the time he first consulted me; he had fallen down and sprained his right wrist, the swelling resulting therefrom being very great and the accompanying pain almost unbearable. He had passed a sleepless night, and the question was whether he should retire from the contest. I suggested that he should defer his definite announcement to retire until a few hours had elapsed and I was able to afford the patient almost instant relief from his pain and succeeded in reducing the swelling by a considerable amount. The following evening I received two letters, one the patient had written to me in which he said: "I not only won my match this afternoon, but never experienced at any time during the one hour and thirty-five minutes' strenuous play the slightest inconvenience." The surgeon who sent me the case forwarded me a letter he had received from the patient, saying: "Your nominee was so successful that I was not conscious at any one moment of the slightest inconvenience during the match."

Neuritis is an affection which affords the practitioner a number of difficult cases, and though it is not possible to claim success in all

the cases submitted to me for treatment, still in the great majority the most gratifying results have accrued if sufficient time and opportunity have been afforded. In several cases of brachial neuritis the administration of the treatment has secured sedation of pain at once and the removal of the disability in the movements of the arms in the course of a few days.

A favourable prognosis can almost be assured the patient in cases of football knee, golf elbow, tennis arm, rider's sprain, and such-like conditions.

The brawny condition of the neck so often seen in patients liable to carbuncle is peculiarly susceptible to treatment by intensive irradiation and wave current, and it is remarkable how pain disappears and stiffness is eradicated, especially in those instances where chronicity of the condition is a marked feature of the case.

In certain disorders of menstruation, especially dysmenorrhœa associated with local congestion of a simple inflammatory character, success can be obtained by means of the static wave current applied in the case of young girls by means of a rectal electrode during the intermenstrual period. In whatever way the wave current is administered the effect in a great number of cases is so beneficial that this means of securing relief in a distressing condition will probably be much used in future.

In the compilation of the above remarks the author must acknowledge his indebtedness to the labours of Snow, whose work in this branch of therapeutics has done so much to raise it from the mire of quackery and empiricism.

L. E. C.

## RADIUM-THERAPY

Radium is a metal, all of the salts of which give off rays in proportion to the amount of metallic radium they contain. Most of the rays are not due to the original radium salt, but to a gas (the emanation) it gives off and the subsequent products into which this gas is transformed. Therefore, to retain the largest amount of the emanation and its products, it is necessary to seal up the radium in some way, and this is done by enclosing it in a metal or glass tube or by covering it with a special varnish.

The rays given off are of three kinds,  $\alpha$ ,  $\beta$  and  $\gamma$ . The  $\alpha$  rays are minute particles, the size of atoms, carrying a positive charge of electricity, and they can pass through only very thin layers of metal (about  $\frac{1}{20}$  mm. aluminium is the thickest). The  $\beta$  rays are much smaller particles and carry a negative electrical charge; their size is about  $\frac{1}{8000}$  that of an atom of hydrogen: it takes 4 to 8 mm. of lead to absorb the most penetrating, but they consist of rays



of very widely differing penetration. The  $\gamma$  rays are, in all probability, not particles, but ether vibrations, of a similar nature to X-rays, with, however, much greater power of penetration; in fact they will pass with ease through an inch of lead, and the most penetrating of them will not be suppressed by one or two feet.

Thus it will be seen that, by placing between the radium and the patient a sheet or filter of metal, it will be possible to prevent the less penetrating rays from reaching him, and to use either the  $\gamma$  rays only or a mixture of  $\gamma$  and penetrating  $\beta$  rays, the proportion of which will vary according to the thickness of the screen and the nature of the metal employed. This is known as filtration, and was first used by Wickham, but systematically and scientifically studied by Dominici. The metals which stop the largest amount of  $\beta$  rays for a given thickness are platinum and lead.

*The rays are given out in all directions*, so that if the radium apparatus is buried in the tissues all the rays from it are used, while if it is employed externally less than half the total rays are used. This point is often forgotten with flat applicators, through the back of which just as many penetrating rays escape as through the front.

When dealing with radium enclosed in tubes the *intensity of the rays*, like that of light, the source of which is virtually a point, *varies inversely as the square of the distance*; for instance, a surface ten inches from the radium will receive only a hundredth part ( $\frac{1}{100}$ ) of the rays which would reach it at one inch, as it is ten times the distance away. This law only partly applies when the radium is covered with varnish and spread over a flat applicator. This fact is very important, because, even when using rays of extremely high penetrating power, the skin receives a full dose long before the deeper parts, and if a full dose were given to deep structures the skin would receive a large overdose.

Another point needing consideration is the setting up of secondary rays when the radium rays strike a metallic or other fairly dense substance. These rays have little penetrative power, and their therapeutic value is as yet unknown.

It follows, from what has been said, that if the emanation from radium be collected it will give off all the rays that radium would. The disadvantage of using it for applications through filters, however, is that it varies in strength from day to day according to a definite law, and this variation renders a calculation of the dose very difficult. Another disadvantage is that if the emanation is removed from the radium more than once a month, only a small proportion of the total radioactivity can be removed every day. With the small quantities

of radium available, this is a very serious drawback.

Emanation may also be used for internal administration, and here it has a very great advantage as, though the radium is not used up, all its effects are obtained. It may be indirectly used in another way, viz. by injecting an insoluble radium salt into the tissues: then the emanation is continuously given off into the blood-stream.

#### A.—The Internal Administration of Radium

1. The *swallowing of a radium salt* has no advantage over the administration of the emanation in the same way. A portion will no doubt be precipitated in the tissues and continue to give off emanation, but its amount is uncertain and a large proportion is lost, so that the method would be a costly and wasteful one and measurement of the dose difficult.

2. The *swallowing or inhalation of the emanation*. If an insoluble salt of radium is placed in contact with water for some days part of the emanation is dissolved, and its amount becomes constant if a definite fraction of the water is drawn off every day and replaced by fresh. The removal of a portion of the liquid must be accomplished with as little disturbance as possible, for shaking causes the emanation to pass out of solution.

For inhalation, air or oxygen is bubbled through a solution of a radium salt or passed over a dry radium compound. In giving a radium bath it has been proved that the effects are due practically entirely to inhalation of the emanation, though it is apparently possible for a small amount to be absorbed by the skin.

The action of the emanation is due chiefly to its transformation products (radium A, B, C, E and F), and may be said, briefly, to consist of an increase in the activity of all the body ferments. When it is remembered how many vital reactions are due to ferment action, the widespread changes wrought by this treatment will be perceived. The solubility of uric acid salts in the plasma is increased by the emanation; it also increases peristaltic action and causes diuresis; further, it is said to act as a powerful nerve sedative and as a hypnotic. Augmentation of tissue interchange results from increased activity of the autolytic ferments.

Its chief uses will, therefore, be in cases of disorders of metabolism, especially gout. Armstrong has used it extensively in this country, and has obtained satisfactory results in gout, rheumatoid arthritis, neuritis, diabetes, Bright's disease, high blood-pressure, and neurasthenia.

Dissolved in a solution of gelatine which is allowed to set, it is also used for certain skin diseases and has proved of value, though insufficient attention has been given to the

method: it was introduced by the late Dr. Radcliffe Crocker.

3. *Injection of an insoluble radium salt* into the tissues acts generally by the emanation it liberates into the blood and locally by the rays it gives off, especially if it contains radium products from the transformation of the emanation entangled in it.

It has been used with success for the treatment of rheumatoid arthritis, being injected into the joint or the periarticular tissues. It has also been used in this way for malignant tumours, but without the success which has attended the use of filtered rays for this complaint.

4. *Iontophoresis from a soluble radium salt.*—This means the driving into the tissues of radium ions by means of a galvanic current, the radium salt, of course, being on the positive pole. The radium ions have been shown to penetrate the tissues readily and may cause quite different effects from the injection of a radium salt. Small quantities ionized cause no harm to healthy tissues, and Harel claims good results in malignant disease.

#### B.—Treatment by Radium Rays

1. *a Rays.*—The value of the  $\alpha$  rays has not been determined, though, by the use of polonium (radium F), which gives off these rays only, it could easily be done. In the administrations mentioned above these rays are used in conjunction with the others, but the part they play is not sufficiently known. Applied externally they probably have no effect, as they would be filtered off by the outer layers of the epidermis.

2.  *$\beta$  Rays.*— $\beta$  rays are used to a greater or less extent in practically all applications of radium. Even when using a filter of platinum  $2\frac{1}{2}$  mm. thick some  $\beta$  rays still escape. These rays are, however, of very varying degrees of penetration, a filter of aluminium  $\frac{1}{2}$  mm. thick cutting off a quite considerable proportion, while some of the rays still pass through 4 mm. of lead. The  $\beta$  rays cannot be used without the  $\gamma$ , although, if only a thin filter of aluminium is used, the proportion of the latter is so small that their therapeutic action is not manifest. By increasing the thickness and density of the filter the proportion of the  $\gamma$  rays is gradually increased. The less penetrating of the  $\beta$  rays, however, have a much more irritating effect than those of medium or high penetrative power, and therefore, for most applications, at any rate a thin filter is advisable.

Certain cells, especially the endothelial cells of blood-vessels, are more sensitive to these rays than others; the endothelium exposed to the rays swells up and may do so to such an extent as to occlude the lumen of the vessel. Another evidence of the damage done to the endothelium

is intravascular clotting. Cells of certain growths and, to a less extent, cells of glands are also damaged much more than epithelial and connective tissue cells, though this selective action is much less marked than with the  $\gamma$  rays. In larger doses they act on the other tissues. This selective action in different cells must be due, of course, to some inherent property of the cells themselves or their surroundings.

It will be readily understood from what has been said upon the selective action of the  $\beta$  rays on endothelium, how radium acts on *nævi*. The vessels of the *nævus* get blocked by endothelial swelling and intravascular clotting and are in this way obliterated; the fibrous tissue, formed in consequence of this, contracts and still further destroys the *nævus*. The treatment of *nævi* by radium has to a large extent been replaced by freezing them with carbon dioxide snow, a method which is more rapid and cheaper, though painful.

Another method of treating *nævi* with radium is to use an extremely weak preparation, such as a pitchblende plaster, which is continuously worn for some months.

The  $\beta$  rays are also extremely useful for treating rodent ulcer, though here it is advisable to filter them through about  $\frac{1}{2}$  mm. of platinum and to use large quantities of radium. It is the method which produces the least scarring and the most certain results, whilst failures are exceedingly rare.

$\beta$  rays are also extremely useful for the treatment of keloid, and here they may be used either with or without a filter. Slight filtration will always be desirable to prevent too great a resulting inflammation.

The other uses of  $\beta$  rays are in eczema, certain other skin diseases, leucoplakia, pruritus ani and vulvæ, and in these cases they are generally best employed in flat plaques with a filtration of about  $\frac{1}{2}$  mm. of aluminium, except for leucoplakia, which requires thicker filters. The value of  $\beta$  rays in malignant neoplasms appears to be not very great, unless the action of the extremely penetrating variety differs very much from that of the moderately penetrating.

3.  *$\gamma$  Rays.*—The action of the pure  $\gamma$  rays can only be studied after filtration through at least 8 mm. of lead, and up to the present this has not been done in healthy tissues. Filtration through 2 or 3 mm. of lead still leaves some  $\beta$  rays, and the experiments done hitherto have not excluded these. The rays filtered through  $2\frac{1}{2}$  mm. of platinum, however, which only lets through a small proportion of  $\beta$  rays, the action being probably due almost entirely to  $\gamma$  rays, we have found extremely useful in various forms of malignant disease. Growths the size of a large coco-nut have been caused to disappear and amelioration has been obtained in a large



proportion of cases. The columnar-celled carcinomata, the glandular carcinomata and localised sarcomata react most readily, though good results have also been obtained with epithelioma.

For this class of case it is necessary to use the radium in tubes surrounded by thick filters, to use large quantities and to apply for a long time. We regard 50 mg. of radium bromide to be an irreducible minimum for this class of case and more often at least 100 or 200 mg. will be required. We have used as much as a gram in some cases. These rays have also been used with success in the treatment of simple growths such as warts, villous tumour of the bladder, and certain others: they have further proved useful in the treatment of certain local tuberculous cases, and finally have been successfully applied to the spine in syringomyelia.

#### APPARATUS USED

It will be seen that treatment by radium is no easy matter and cannot be applied by rule



FIG. 1.—Radium Tubes.

of thumb. It is necessary to have experience of what class of case to treat and familiarity with the apparatus and the various ways of applying it. We use the apparatus illustrated in Fig. 1, which is the smallest and most compact we have been able to devise: the figures are drawn to scale, and the tube they represent contains £1,600 worth of radium carbonate. It consists of an inner platinum tube  $\frac{1}{2}$  mm. thick, sealed with gold solder, containing an insoluble radium salt. The stopper is long and has two threads cut upon it, with an intermediate space where the stopper is

pierced with a pinhole to obtain some leverage for screwing on the rest of the apparatus. Screens of platinum,  $\frac{1}{2}$ , 1 or 2 mm. thick, screw into the lower thread, while the upper one takes a cap or a long flexible silver rod. One sheath leaves the inner tube bare in half its diameter.

Fig. 2 shows the apparatus ready for use and also the arrangement of the tube and screens.

The radium then forms the end of the rod for oesophageal applications, or is a compact little

box for insertion into the substance of a tumour or for other purposes. The rubber tube with the blind end is to cut off secondary radiations

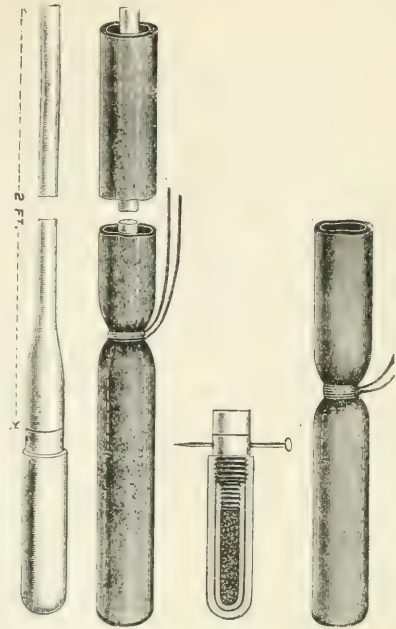


FIG. 2.—Radium Tubes and Screens.

formed in the platinum, which have little penetrating power and whose action is not yet known.

N. S. F.

#### TREATMENT BY MEANS OF CARBONIC ACID SNOW

This is a handy and convenient means of turning the reaction that follows frostbite to good account. Other agents have been and are used in the practice of cryotherapy, as this method is termed, but they have almost entirely given place to solid carbon dioxide, which has many advantages not possessed by others. The greatest of these advantages is probably its solid form, although it is not so hard but that it can be cut or moulded to any size or shape that may be desired. A small or large quantity may be prepared for use in a few minutes, and its temperature remains constant, so that the dosage and subsequent reaction are under complete control. The application is attended with so little pain that no anæsthetic, local or general, is ever necessary. Reaction is certain and efficient, so much so that it is safe to consider failure to secure a good result to be almost always due to its use in unsuitable cases or to faulty technique.

The temperature of solid carbon dioxide is  $-79^{\circ}$  C., which is low enough for most cases,

there being only very few instances where the lower temperature of liquid air gives better results owing to its more energetic action. It may be mentioned that the temperature of the latter agent is about  $-200^{\circ}\text{C}$ .

*Preparation.* There are several appliances on the market for this purpose which are quite satisfactory, and details can be obtained from almost any of the firms supplying medical and surgical instruments. The first essential is a cylinder of the compressed and liquefied gas, and owing to its extensive use in the aerated water industry such cylinders are easily obtained and are quite inexpensive. With such a cylinder the snow may be prepared by the use of a few simple appliances. The cylinder is first mounted so as to be inclined a little from the horizontal, with the valve at the lowest point. It is essential to success that the liquid inside cover the inner face of the valve, the outlet of which should point downwards. If we now tie over the mouth of the valve a porous receptacle, such as a small bag of wash-leather, or a rolled-up towel making a hollow cylinder, and then slowly open the valve, a quantity of soft snow will soon be collected. The valve is then firmly shut and the bag removed. The snow is now pushed into a short length of metal tubing that has been finished smooth on its inner surface and then packed down firmly with a loosely fitting rammer of hard wood. If a specially hard crayon is desired this may be hammered down with a mallet, but in most cases this is not necessary.

No matter how firmly it is packed into the tube it very rapidly frees itself, owing to evaporation, and on this account it must be used soon after preparation. It does not evaporate so rapidly as to be inconvenient; in fact a crayon an inch thick and at least of the same length will take quite the greater part of an hour to return to the gaseous state if left uncovered in an ordinary room.

After being pushed out of the metal tube used for moulding, the crayon is wrapped in a turn or two of lint, and then it is ready for use. If it has not been compressed very hard it may now be cut to any size or shape that fits the part about to be treated, provided it has been made sufficiently large in the first instance; the metal tube in which it has been moulded may be of any size and of any section, such as round, square, hexagonal, etc. The latter are useful in treating large areas, as the different points of application may be made to fit into each other.

If it is desired to take the crayon to the patient's house, it should be made much larger than actually required, and wrapped up in a mass of cotton-wool, by which means it will keep for several hours; it may be kept much longer if put into a Dewar's vacuum flask, the

mouth of which must be plugged with cotton-wool—not corked.

*Application.* To the onlooker the technique attending this procedure is a very simple one, but it will soon be found that to get uniformly good results a certain amount of experience and skill is necessary. Briefly stated, the crayon is held in a piece of lint to protect the operator's hand, and, having been correctly shaped for the case in hand, it is firmly pressed against the part for a period of from ten to sixty seconds, or longer in special circumstances. In some instances five or seven seconds may be sufficient. The depth and extent of the subsequent reaction are determined by the degree of pressure employed and the time it is kept up. A very light pressure for five seconds will give a very mild and superficial reaction; heavy pressure for sixty seconds will be followed by a very deep and intense one, and by experience we may produce almost any degree of reaction between these two extremes.

*Effects of Application.* As the crayon is removed the depression made by it remains and the depressed part is white and hard like a piece of china. The normal contour is restored in a period that varies from two to three times that of the application itself, and the surface will be found covered with the moisture of condensation. Reaction sets in almost immediately, and in a few minutes the part is firmer to the touch and has commenced to swell. A wheal is quickly formed, which is soon followed by a blister if the application has been as long as ten seconds, or perhaps less in some instances. The blister, when formed, should be relieved with a sterile needle and some antiseptic ointment applied. Small areas are best sealed over with cyanide gauze and collodion, but with large ones there is frequently much exudation for some days, necessitating a change of dressing at intervals, and for these the ointment of boracic acid spread on lint and applied with a bandage answers very well; but any mildly antiseptic ointment of a soothing character and used in this way is equally suitable.

For the success of the operation it is essential that anything in the way of septic contamination be most carefully avoided. Fortunately in most of the cases that come for this treatment the surface is intact and normally aseptic; it must be our aim to keep them in this condition, and the above simple directions, if properly carried out, will be sufficient. Naturally the surface should be clean to commence with, and in the case of a broken surface, such as an ulcer, it should be dressed with a moist boracic compress for at least twenty-four hours before the application is made. Sterilization of an unbroken surface preliminary to an application of solid carbon dioxide is a needless refinement,



and the use of iodine, formalin and other more or less irritating antiseptics for this purpose tends to complicate the reaction.

After from four to seven days a crust forms and no further dressings are required; this crust should be left severely alone and allowed to come off of its own accord. Speaking generally, there is no sloughing or necrosis after an application that has been properly made and subsequently cared for. There are few exceptions to this rule, and they will be mentioned in their proper place.

While in most cases a sufficiently intense reaction can be obtained by a single application, there are some instances where an even more severe effect may be useful. This can be obtained by making a second application a few minutes after the tissues have thawed out from the first one. This intensifies the reaction very materially, and it may be rendered even more intense if the second one is made about twenty-four hours later. Necrosis frequently follows this procedure, and it is useful in treating prominent fleshy moles, which are usually very resistant. After the separation of the crust, if one has formed, and the part has healed up, the surface is still redder than normal—the remains of the plastic inflammation that was set up—but this disappears more or less rapidly, and the resulting scar, if it can be so called, is very gratifying. It is soft, smooth and elastic, and more like normal skin than that following any other procedure for the treatment of the same condition.

*Indications.* The diseases that are most suitable for this mode of treatment are those of the skin and the more superficial and easily accessible parts. It is particularly useful in the treatment of *nævi*, and probably quite three-fourths of those that present themselves in an ordinary out-patient department can be satisfactorily dealt with in this way, and the majority of these with a single application. Owing to the few seconds required to apply it, and to the fact that no anæsthetic is ever necessary, the saving in time and suffering is tremendous, and the results are uniformly better.

**Capillary Nævi.**—An application of forty seconds with firm pressure to every part will be successful in nearly all cases. Owing to the nature of the tissue making up these growths a superficial slough forms in most of them, but this is no disadvantage, since the growth must be replaced by a scar of some kind, and that following the use of solid carbon dioxide is superior to any other.

**Cavernous Nævi** are not so favourable for any kind of treatment, but a very large proportion of them can be dealt with successfully by this means. The pressure must be very firm—enough temporarily to arrest the circulation—and where possible it should be in the direction

of an underlying bone, also it must be long enough to allow the freezing to penetrate to a sufficient depth.

**Port-Wine Marks** are the most difficult form of vascular growth to deal with, and it must be confessed that this method has not helped as much as was hoped. These are made up of an overgrowth of normal tissue elements, and as such they are most difficult to destroy. At the same time we have seen many cases that have been greatly improved—probably more than could have been done by any other means—and on this account it is worthy of full consideration. As, however, the results are rather disappointing at times, it should not be undertaken by those whose experience in such matters is more or less limited.

The results obtained in the treatment of **Pigmented Patches** are not very uniform. Many of these do quite well after a single application, but it sometimes happens that, for no apparent reason, further applications are necessary before success is attained. The applications should be made with a light degree of pressure for from ten to fifteen seconds.

**Moles** are usually difficult to remove, since they, like the port-wine stain, are made up of normal tissue elements. If very prominent, much time is saved if a second application is made immediately after the part has thawed out from the first one. This intensifies the reaction very materially. After about two weeks the process may be gone through again if necessary. With care an excellent result can be obtained in practically every case.

The hairy pigmented mole should not be treated by this method—at least not at first. Here it will be found best first to remove all the hairs by electrolysis, in the course of which we should not be too gentle, and the shank of the needle should not be insulated in any way. By this means we destroy much of the tissue making up the growth, and it frequently happens that after the epilation is complete the mole has so far improved that little or nothing more is required. But if further treatment is advisable, it is at this stage that the carbon dioxide, used as above stated, comes into complete the cure.

The **Common Wart** is a form of growth that is very satisfactorily dealt with by this freezing process. If properly carried out a single application is all that is necessary. The crayon should be trimmed to the size of the wart and then applied to it until the wart and a narrow zone of the healthy tissue around is frozen white. Owing to the poorly conducting properties of the growth no rule can be given as to the time of the exposure. It may be anything from one minute to five minutes, but if done in this way the result is almost certain to be successful.

In the treatment of **Rodent Ulcer** solid carbon dioxide has achieved one of its most signal successes. Experience has shown that any uncomplicated case of this condition, that is, one of moderate size and with no involvement of bone or cartilage, can be cured with a single application, the time of healing taking from fourteen to twenty-one days. The surface of the ulcer must be first cleaned up, using a sharp spoon if necessary; the slight bleeding that follows is arrested in a few minutes with slight pressure. The crayon is made of the same shape as the ulcer but a little larger, so as slightly to overlap the edges. Firm pressure is used and kept up for from forty to sixty seconds. There is some oozing for a few hours, and in a day or two a thin slough separates. The surface will then have all the appearances of a healthy healing ulcer, and behaves as such. The dressing of boracic ointment is all that is required, and should be changed at least twice daily for the first few days.

It is unnecessary to give details of treatment for all the conditions that have been improved or cured by this method; they will suggest themselves as the occasion arises. Good results have been obtained in lupus vulgaris, lupus erythematosus, urethral caruncle, trachoma, and obstinate patches of eczema, and doubtless many others will be found. The point to bear in mind is that the method gives us a certain, safe and almost painless method of setting up a healthy inflammatory reaction that is quite localised and otherwise under our control; this reaction can be used to remove adventitious growths or be superimposed upon an unhealthy reaction, and so bring the latter to an end.

R. M.

#### PHYSICAL EXERCISES IN THEIR RELATION TO MEDICINE

The present generation has seen many changes in medicine and surgery, and not the least striking is the change in the relation between these two domains of the healing art. In almost every direction the surgeon has entered more and more upon what not long ago used to be considered the exclusive territory of the physician; and this not so as to diminish in any way the physician's importance, but to bring about a valuable co-operation between the two.

Side by side with this change, or perhaps rather as part of it, may be noticed a very much greater tendency to rely upon various physical means of curing and preventing disease instead of merely prescribing drugs. Amongst the physical therapeutics no method of treatment has received wider favour and more universal application than that of *Exercises*,

either employed alone or, as is very often the case, in combination with *massage*.

Physical exercises in this connection obviously do not include all forms of bodily movement in man's daily occupation for work or pleasure, but only exercises carried out purposely for their beneficial effect upon the performer, whether it be in order to further the natural development of a healthy body or in order to counteract any tendency to misdevelopment, or in order to remedy any pathological condition.

Such a remedy of nature for maintaining and regaining health can obviously not be a new invention, and ever since Greek and Roman times and even earlier it is on record that the value of physical exercises has been more or less recognized. Still it was not until about a century ago that any thorough and successful attempt was made to work out a regular system of gymnastic exercises, classified entirely according to their effect upon the human organism, and with the various movements arranged in a strictly progressive order in each class.

The credit of thus being the originator of rational physical exercises belongs to the Swede, P. H. Ling (1776-1839).

The gymnastic system which Ling and his immediate followers elaborated was very comprehensive; and subsequent originators of similar general systems or of plans for treating certain definite complaints by exercises have in most instances obviously received their inspiration from this source. With this fact serving as a justification the subject of physical exercises will here be treated from the point of view of the Swedish system, with merely passing references to, and comparisons with, other systems of exercises.

Ling divided his gymnastics into:—(1) educational, (2) military, (3) medical and (4) æsthetic; of which the third group only will here be dealt with.

*Medical gymnastics* are classified as—

(a) *Active*, where the patient himself carries out all the work.

(b) *Passive*, where the patient performs no voluntary movements, but these are simply carried out with, or on, any part of his body by another person or some mechanical agency. Amongst these passive movements Ling included all the various manipulations entering into *massage*, although this title and the French names for the different manipulations date from a later period. They were adopted by Dr. Mezger and his school about 1860.

(c) *Duplicated*, the movements being so-called because in them the patient carries out a voluntary movement, but with the assistance or resistance, as the case may be, of another person or of some mechanical contrivance.



In dealing with the therapeutic application of physical exercises the first and most natural question will be: "For what disorders are they to be used?" Unfortunately no precise answer can be given to this question. On the one hand no intelligent claim can be made for them to be a certain cure for any sort of complaint, and on the other hand their range of usefulness is extremely wide under suitable circumstances. For in addition to the actual disease from which a patient is suffering it depends upon many other factors of his condition, mode of living and circumstances generally, whether he is likely to benefit by this treatment or not. Certain conditions form distinct contra-indications, others warnings to extreme caution, and such will be referred to in their places; but at the same time there are many instances where a patient can be benefited by a course of exercises, although the real disease from which he is suffering can be in no way influenced by them.

To attempt to give anything like a complete list of the pathological conditions that might with advantage be treated with physical exercises would therefore be useless—and useless in a double sense, for it would be neither possible nor profitable. Only a few typical disorders, where the value of this treatment is well established, will be picked out and the appropriate exercises for each indicated. To avoid too much repetition the exercises introduced more than once will be given at the end of the article. A suitable sequence and number of exercises to be given under any particular circumstances will be suggested in dealing with various disorders. In that connection merely the name or nature of an exercise will be indicated, and for detailed description reference will be made (by number) to the appended list. Many of the movements will there be illustrated, but generally only by the very simplest skeleton diagrams. These do not claim to be artistic or ornamental, but their very simplicity makes them expressive; and they are easy to execute so that any medical man can reproduce them in giving directions to his patients.

Amongst *surgical diseases* none will be more prominently thought of in connection with this treatment than *spinal curvatures*; and it will therefore be appropriate to begin by considering the application of exercises for such deformities. The etiology, mechanism and pathology of the various conditions falling under this heading will be fully dealt with under *Scoliosis* in the surgical section of this encyclopædia, so that it will be necessary here to refer to them only so far as to make clear how the various curves are affected by physical exercises.

It is obviously the musculo-ligamentous curvatures that are most likely to be benefited, and this all the more readily the earlier they are

discovered and come under treatment. Osseous curvatures are naturally less amenable to treatment, whether the deformity is due to past disease or is of such long standing that the vertebræ themselves have materially altered their shape and perhaps even become fused. Still, a great deal can be done even in these cases to improve the patient's condition by increasing the mobility of his chest and of the spine in the parts where this still is possible, and by strengthening his spinal muscles so as to enable him better to put up with what remains of his deformity.

With regard to their direction spinal curvatures are naturally divided into the antero-posterior and the lateral curvatures; and it is according to this difference in shape that any mechanical method of treatment will have to be adapted. The exercises consequently will here be classified accordingly.

The guiding principle in the treatment is to try to render more active and efficient the muscles on the convexity of any curve and to stretch and restore to their normal length the over-acting and contracted muscles of the concave side. At the same time the spinal column itself should be subjected to the correcting influence not merely of this altered muscular action, but also of the more mechanical effect produced by such positions and movements being chosen as will enable the weight of the body to help in extending the spine. This effect can often be further increased by manual pressure being applied to the height of the convexity of a curve during an exercise, but it has then to be remembered (with regard to the lateral curves) that the pressure should be

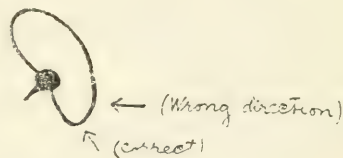


FIG. 1.

applied in the right direction, from behind forwards as well as from the side, so as to meet the rotation of the spine as well as the lateral deviation. There is otherwise a great risk of increasing the already abnormally acute angle of the ribs on the convex side (see Fig. 1).

In all cases of spinal curvatures great attention ought to be paid to the development of the chest; and breathing exercises should therefore always form an important item in their treatment. Especially under the first heading here mentioned they will be found to constitute a very large proportion of the treatment.

In addition to the list of exercises here enumerated as suitable for each particular

form of curve, there will also be suggested under each heading one or more complete programmes of exercises to be performed by a patient of the class under consideration. These ought to be carried out once or twice a day; the number of times is indicated that each movement should be done, and after every two or three of the exercises before passing to the next there ought to be a pause of a minute or two according to the patient's condition. The whole performance will in that way be found to occupy a time of fifteen to thirty minutes; and it ought in most cases, at least at first, to be followed by a rest of from a quarter to one hour's duration. Such a régime needs obviously to be kept up for weeks even under the most favourable circumstances. On the other hand it is well not to go on beyond about three months without a break, for fear of making the whole routine stale and consequently less effective. After a few weeks' interval it can again be resumed with advantage, and may require, with occasional expert supervision and with some variations and increase of the exercises, to be repeated time after time for some years, something like the different terms of school work, until a patient's figure has developed and set in the most favourable way that is possible in his particular case.

*Exercises suitable for any case of Spinal Curvature.*

1. *Lying flat on the back, lifting both arms forwards and upwards, lowering them outwards and downwards (6-8 times)* . . . No. 1.
2. *Standing, arms by the sides, twisting both arms outwards (6-12 times)* . . . No. 2.
3. *Standing, hands supported, bending the head backwards (4-6 times)* . . . No. 7.
4. *Hanging by the hands, parting and closing the legs (2-6 times; repeat)* . . . No. 8.
5. *Suspension by halter* . . . No. 9.
6. *Standing, heels together, raising on tiptoe and bending the knees (6-8 times)* . . . No. 10.
7. *Standing, back supported, bending forwards and downwards, and raising up again (2-4 times; repeat)* . . . No. 12.
8. *Lying on the face, raising the upper part of the body (2-4 times)* . . . No. 13.
9. *Lying flat on the back, arms extended upwards, drawing up both knees (4-8 times)* . . . No. 16a.
10. *Sitting astride, arms bent, twisting the body (2-6 times each side)* . . . No. 19.
11. *Sitting, feet fixed, hands on hips, bringing the body round in circles (2-6 times)* . . . No. 22.

*Suggested Programmes of Exercises, in progressive order, for any form of curve.*

1. *Lying, lifting both arms* . . . No. 1.
2. *Lying, drawing up both knees* . . . No. 16a.

3. *Hanging, parting and closing the legs* . . . No. 8.
4. *Lying on the face, raising the body* . . . No. 13.
5. *Sitting astride, twisting the body* . . . No. 19.
6. *Standing, back supported, bending forwards and downwards* . . . No. 12.

*B*

1. *Lying, lifting both arms* . . . No. 1.
2. *Standing, back supported, bending forwards and downwards* . . . No. 12.
3. *Suspension* . . . No. 9.
4. *Sitting, arms extended upwards, leaning forwards* . . . No. 14.
5. *Lying, drawing up both knees* . . . No. 16a.
6. *Sitting, circling with the body* . . . No. 22.
7. *Standing, heel raising and knee bending* . . . No. 10.
8. *Hanging, parting and closing the legs* . . . No. 8.
9. *Standing, bending the head backwards* . . . No. 7.

*For Kyphosis.*

1. *Standing, hands supported, bending the head backwards (4-6 times)* . . . No. 7.
2. *Lying flat on the back, lifting both arms forwards and upwards, lowering them outwards and downwards (6-8 times)* . . . No. 1.
3. *Hanging, with the back against a wall, a small cushion placed behind the shoulders, parting and closing the legs (2-6 times; repeat)* . . . Compare No. 8.
4. *Standing, back supported, arms extended forwards, parting and closing the arms (6-8 times)* . . . No. 3.
5. *Standing in a doorway, with one hand on each post, the chest being pushed forwards (4-6 times)* . . . No. 4.
6. *Sitting, arms extended upwards, leaning the body forwards (4-8 times)* . . . No. 14.

*Programme for Kyphosis.*

1. *Standing, the chest being pushed forwards* . . . No. 4.
2. *Sitting, bending the body forwards and raising up again* . . . No. 11.
3. *Lying, drawing up both knees* . . . No. 16a.
4. *Hanging, with cushion* . . . No. 8.
5. *Sitting, arms extended upwards, leaning forwards* . . . No. 14.
6. *Sitting astride, twisting the body* . . . No. 19.
7. *Standing, twisting both arms outwards* . . . No. 2.

*For Lordosis.*

1. *Lying flat on the back, arms extended upwards, drawing up both knees (4-8 times)* . . . No. 16a.
2. *Standing, back supported, bending forwards* . . .



and downwards and *raising up again* (2-4 times ; repeat) . . . . . No. 12.

3. *Sitting* on a low seat, arms extended upwards, *leaning the body forwards* (4-8 times) . . . . . Compare No. 14.

4. *Sitting*, on the floor, *bending the body forwards* and touching the toes (4-6 times) . . . . . No. 18.

#### *Programme for Lordosis.*

1. Standing, back supported, bending forwards and downwards . . . . . No. 12.

2. Standing, twisting both arms outwards . . . . . No. 2.

3. Sitting on the floor, bending forwards . . . . . No. 18.

4. Lying, drawing up both knees . . . . . No. 16a.

5. Sitting, arms extended upwards, leaning forwards . . . . . No. 14.

6. Sitting, circling with the body . . . . . No. 22.

7. Sitting, expanding the chest with help of the arms . . . . . No. 5.

#### *For Single Right Convex Curve.*

1. *Sitting* astride, the left hand behind the neck, *bending the body* to the right side (6-10 times) . . . . . No. 21.

2. *Sitting*, the body leaning forward, *extending the left arm* upwards (3-6 times) . . . . . No. 15.

3. *Lying* on the left side, *raising the upper part* of the body towards the right side (3-6 times) . . . . . No. 23.



FIG. 2.—Right Convex Curve.

#### *Programme for Right Convex Curve.*

1. Lying, lifting both arms . . . . . No. 1.

2. Hanging, parting and closing the legs . . . . . No. 8.

3. Sitting, bending the body to the right . . . . . No. 21.

4. Sitting, extending the left arm upwards . . . . . No. 15.

5. Standing, heel raising and knee bending . . . . . No. 10.

6. Lying on the left side, raising the body . . . . . No. 23.

7. Standing, twisting both arms outwards . . . . . No. 2.

#### *For Left Convex Lumbar Curve.*

1. *Hanging* by the hands, bringing both legs over to the left (2-6 times ; repeat) . . . . . Compare No. 8.

2. *Standing* on the left leg only, on a stool, *extending the right leg* downwards (6-8 times) . . . . . No. 24.

3. *Lying* flat on the face, both legs being passively brought over to the left side (4-6 times) . . . . . No. 26.

#### *Programme for Left Convex Lumbar Curve.*

1. Standing back supported, parting and closing the arms . . . . . No. 3.

2. Hanging, bringing both legs over to the left . . . . . No. 8.

3. Lying on the face, raising the body . . . . . No. 13.

4. Standing, on a chair, extending right leg downwards . . . . . No. 24.

5. Sitting astride, twisting the body . . . . . No. 19.

6. Standing, back supported, bending forwards and downwards . . . . . No. 12.

#### *For Double Curvature.*

(Right Convex Dorsal, Left Convex Lumbar).

1. *Hanging*, left hand higher, bringing both legs over to the left (3-6 times ; repeat) . . . . . Compare No. 8.

2. *Sitting* on the left side only, the body leaning forward, *extending the right leg* backwards, and the left arm upwards (3-4 times) . . . . . No. 25.

3. *Lying*, face downwards, the upper part of the body being passively brought over to the right side (4-6 times) . . . . . No. 27.



FIG. 3.—Double Curvature.

#### *Programme for Double Curvature.*

1. Lying, lifting both arms . . . . . No. 1.

2. Lying, drawing up both knees . . . . . No. 16a.

3. Suspension . . . . . No. 9.

4. Lying on the face, raising the body . . . . . No. 13.

5. Lying, the body being brought over to the right . . . . . No. 27.
6. Standing, heel raising and knee bending . . . . . No. 10.
7. Sitting, leaning forward, extending right leg backwards, left arm upwards . . . . . No. 25.
8. Standing, back supported, bending forwards and downwards . . . . . No. 12.

In arranging the exercises for any case of spinal curvature one object always to be kept in view is that the effect of each particular movement should be localised to the right section of the spine. To that end such positions must be chosen and such support given to the patient during the various exercises as will give the most favourable opportunity of action to any desired group of muscles. This is not always an easy matter, and it may therefore be worth while drawing attention to a new piece of apparatus devised by Oldevig of Dresden for this purpose. In order to support and fix various parts of the spine he uses straps of a special kind of firm woollen texture in different widths (4 to 8 in.) and lengths (4 to 6 ft.) according to requirements. These are provided with strong leather handles at the ends, and by means of them two or three operators at the same time secure the patient and assist or resist his own efforts at straightening his spine. Very favourable results are claimed from the exercises carried out in this way; and it is a much more rational way of treating spinal curvatures than the so-called *crawling method* invented a few years ago by Prof. Klapp of Bonn. The patient is here made to crawl about the floor on his hands and knees in various ways; this will certainly induce mobility of the spine, but the movement is not localised with sufficient precision.

With regard to *deformities of the extremities* exercises constitute a well-recognized part in the treatment of many such conditions in order to restore the strength of weakened groups of muscles and to stretch contracted ones, besides being a *conditio sine qua non* for the growth and development of the affected limb, and for the functional adaptation of its various parts. Still, in most of these cases the exercises form such an integral part of the massage and other manipulations used, and their nature is generally simple and obvious, when once their object is clearly realized. It will therefore not be necessary to go into any detailed description here, except with regard to some common deformities of the feet where a few suggestions might possibly be helpful. These conditions are *pes planus* and *pes valgus*; and the reason why these deformities deserve specially to be mentioned is not only their very common occurrence, but also the fact that the right kind

of exercises are here so very essential. The exercises may in themselves be a sufficient remedy in many cases, in others they may need to be supplemented by some supports or specially devised boots, or preceded by redression under anæsthetic and two or three weeks' use of plaster of Paris splints, or possibly even by more drastic surgical interference, but in none ought they to be entirely omitted.

A suitable and easily learnt performance for such cases is the following—

Standing (with feet parallel about three inches apart).

(a) Raising on tiptoe and bringing the heels together; then sinking down on the heels while parting them as before (6–12 times).

It is very essential that the heels, and not the internal malleoli, should be approximated when at the height of the tiptoe position; otherwise it is quite possible to perform this exercise without effecting any correction in the shape of the feet.

(b) Raising the inner side of the feet, while at the same time bending the toes (6–12 times).

The action of the flexors, in addition to that of the tibialis anterior and posterior, increases markedly the corrective effect of this exercise by producing for the time being a more distinct plantar arch.

(c) Marching on tiptoe forwards and backwards, with the feet kept in the position obtained in (a).

(d) Marching with the feet supinated, kept in the position obtained in (b).

(e) Raising on tiptoe as described in (a), and bending the knees. (Ex. No. 10).

A great variety of *injuries*, such as *contusions*, *strains*, *sprains* and *dislocations*, will naturally come under treatment by physical exercises, but here again the movements are so closely bound up with the massage that ought to be given in these cases that in most instances they need not be described here. It may, however, be worth while going into some detail with regard to the treatment from this point of view of what is generally termed *internal derangement of the knee joint*.

For the differential diagnosis of the various conditions (displaced cartilage, loose body, synovial fringes, etc.), included under this somewhat vague heading, reference must be made to another article of this publication, as also for the general lines of treatment by operation or otherwise. In practically all these cases it is, however, likely that at some time or other exercises will be indicated. They may be all-sufficing in a great number of instances, where the actual lesion is of a less severe nature, but where the soft structures of the joint have got into a relaxed and weakened condition by repeated attacks of synovitis, and where the



extensor muscles of the thigh have wasted partly by disuse and partly by a reflex disturbance of their trophic nerves from the injury to the joint. In other cases the patient ought to be given the benefit of the doubt and a thorough course of exercises (aided, if requisite, by massage and electricity) ought to be tried before operative measures are resorted to. Should an operation after all prove necessary, the time and exertion spent must not be looked upon as wasted, for it may be taken that the improved condition of the limb thus brought about will give a more favourable opportunity for the operation, and it will tend materially to shorten the time afterwards, until full function and strength can be regained. Lastly in those cases where it is evident from the first that nothing but an open operation holds out any hope of cure, an after-treatment by exercises will in most instances be indicated. An omission of this precaution is a frequent cause of a patient failing to derive the full benefit of such an operation.

The treatment might with advantage be commenced while the patient is still in bed, as soon as the synovitis shows signs of subsiding. After a day or two of massage, *passive movements* of the affected limb may be started very cautiously. Their effect is a purely mechanical one, facilitating the venous and lymphatic flow, and at the same time preventing or breaking down adhesions. They should at first consist of circumduction, flexion and extension of ankle and hip joints without any disturbance of the damaged knee.

With regard to this joint itself, gentle flexion and extension only is permissible, with rigorous exclusion of any rotation of the leg which might tend to re-tear the coronary ligaments and other attachments that are in process of being restored in a case where a semilunar cartilage has been but slightly wrenched.

The *active movements* are of still greater importance, for, in addition to the mechanical action upon the joint, we have here the physiological trophic effect of impulses again passing through the motor nerves, an advantage which cannot be fully replaced by anything else. These movements should be started in the same order as the passive ones: quite early in ankle and hip, and but little later in the knee joint, and here again strictly in the antero-posterior direction only. Very small amount of work should, naturally, be given at first, but it need then not cause any alarm if a slight temporary increase or return of the effusion in the joint should occur.

Another point of importance at a later stage is that the active movements should for some time be done without the body weight being supported by the injured limb.

They should therefore consist of such exercises as—

1. *Standing* (on the sound leg), *bringing the other leg*, with the knee kept straight—

- (a) forwards and backwards (6–12 times);
- (b) from side to side (6–12 times).

2. *Sitting* (with the leg hanging down), *extending and flexing the leg* (4–6 times).

3. *Standing* (on the sound leg), bending up the other knee, extending the leg forwards and then bringing the whole leg backwards with the knee kept straight (6–12 times).

To increase the effect of these various exercises they might be done with resistance, either manual or mechanical.

Among other exercises with mechanical appliances used for the purpose now in view none is better than—

4. *Sculling practice* on a sliding seat, or what represents this.

5. *Bicycling* forms another valuable method of restoring the strength of the extensor muscles; but it is safer to start on a stationary machine if possible.

Later on during the treatment, when there is no longer any objection to the body weight being borne by the affected joint, a simple and effective exercise is—

6. *Raising on tiptoe and bending the knees* until finally squatting down. (Compare No. 10.)

*Fractures* form another large and important group of injuries the treatment of which is in the way of being revolutionized by the introduction of the ideas of early massage and movement so ably put forth by Prof. Lucas Championnière. Still, the mild and carefully regulated amount of mobilization practised in a case of recent fracture can hardly come under the heading of physical exercises, and is thus outside the scope of this article.

It is rather in the cases that have not been so treated from the beginning, and in which consequently much impairment of movement in joints and wasting of muscles may have taken place, that regular and persevering exercises are needed to restore function. The same applies to a great number of *surgical operations* leading to a somewhat similar state of affairs, and where consequently a thorough after-treatment with well-planned exercises is required.

The essential points in arranging such exercises are obviously to extend the range of movement in affected joints to their normal limits, or as far as any possibly altered anatomical conditions will admit, and at the same time to restore the strength of the muscles governing the joint and especially those that ought to perform the movement that is for the time being defective. Much that has already been said in connection with exercises for deranged knee

and deformed feet will apply here and can easily be modified and made to suit different conditions and different parts of the body.

It ought here to be pointed out that such results of accidents or injuries are with greater advantage perhaps than any other pathological conditions treated by the aid of mechanical appliances, as will be more fully referred to later.

Amongst the more purely *medical diseases* that lend themselves for treatment by physical exercises we will first consider disorders of the *digestive organs*.

The complaint of this kind that is most often and most successfully treated by means of exercises is no doubt *chronic constipation*.

The object here to aim at is the development of the abdominal muscles, for at the same time the unstriped muscular tissue in the walls of the intestines will get into a better state of nutrition, thus increasing in strength and becoming capable of a more powerful peristaltic action. The secreting glands too will benefit by the improved circulation and thereby be rendered more active.

It might be worth while to enumerate a few of the more simple and effective movements that are to be recommended for this purpose, and also to give a complete set of exercises that might be prescribed for such a case, if of fair physical development and strength.

#### *Exercises to counteract Chronic Constipation.*

##### 1. *Lying flat on the back.*

- (a) *Drawing up both knees* (4-8 times).
- (b) *Lifting both legs* (3-6 times).
- (c) *Drawing up the knees and throwing them over from side to side* (2-4 times each side; repeat) . No. 16.

##### 2. *Sitting astride, arms bent, twisting the body* (2-6 times each side) . . . . No. 19.

##### 3. *Sitting, feet fixed, hands on hips, leaning the body backwards, raising up and bending forwards* (3-6 times each way) . . . . No. 17.

##### 4. *Sitting, feet fixed, hands on hips, bringing the body round in circles* (2-6 times) . . . . No. 22.

##### 5. *Standing, feet parted, lifting both arms outwards and upwards, bending the body forwards and downwards, raising up again and lowering the arms* (3-6 times) . . . . No. 6.

In treating chronic constipation, or for the matter of that any given condition, it is, however, well to give not only movements of one particular kind, but also to introduce some movements of a more general effect amongst the specific ones. As a suitable programme of exercises to be carried out by patients of this class the following might be suggested—

#### *Suggested programme of Exercises suitable for a case of Constipation.*

1. Standing, lifting both arms outwards and upwards, bending the body downwards . No. 6.
2. Sitting, circling with the body . No. 22.
3. Standing, bending the head backwards . No. 7.
4. (Abdominal massage).
5. Sitting, bending the body backwards and forwards . . . . . No. 17.
6. Standing, heel raising and knee bending . No. 10.
7. Standing, back supported, bending forwards and downwards . . . . . No. 12.
8. Lying, drawing up the knees and throwing them over to the side . . . . . No. 16c.
9. Lying, lifting both arms . . . . . No. 1.

It is obvious that chronic constipation is not the only disorder of the alimentary system that might be favourably influenced by exercises of this kind. Many dyspeptic conditions of stomach and intestines will benefit in a marked degree by a similar régime; and it stands to reason that the powerful agency afforded us by suitable exercises in counteracting an atonic condition of the abdominal muscles and of the muscular layers in the intestines might also be usefully employed in dealing directly with the more or less marked *enteroptosis*, which so often co-exists with and underlies the various disorders above mentioned.

The question of ptosis of the abdominal viscera naturally leads on to the consideration of a similar state of affairs in the *pelvic cavity*; and here a great field opens where the value of judiciously planned exercises begins to be more and more recognized.

They are certainly of great value in combating a good many of the troubles that result from slack abdominal musculature and weakness of the pelvic floor; and carrying this idea one step further there has recently been a tendency for the obstetrician as well as the gynaecologist to make use of this form of exercise for their patients. After parturition much can be done in this way to facilitate drainage, assist the involution of the uterus, restore the tone and strength of the supports of the uterus and of the abdominal wall, and thus ultimately to "improve the figure," a consideration that always counts for a good deal with the patients themselves.

In addition to localised exercises for such patients, it is obvious that they are likely to benefit from some more general movements as well. Deep breathing, for instance, will be of value to them not only by expanding the lungs and facilitating the general circulation, but the variation in pressure within the abdominal and pelvic cavities thus brought about will directly benefit the enclosed organs. Further, some



special exercises with the lower extremities are exceedingly useful in minimizing the wasting of the muscles and the loss of strength which often is such an unpleasant feature on getting up after a lying-in period. And another aspect of the question is that if the undesirable effects of the inactivity are thus counteracted, there will be less objection to keeping a patient in bed after parturition for a time sufficient to ensure the mental and physical rest which is so essential to many of these cases.

The exercises must, of course, at first be only of the very simplest and easiest nature, such as the first two or three mentioned below, and they ought to be preceded by gentle massage of the extremities and abdomen and later of the back. In this cautious way a start may be made after the first forty-eight hours in a normal case, and the performance should then be carried out twice a day with gradual addition of some of the exercises mentioned later in the list.

*Exercises suitable during the Lying-in Period.*

1. *Lying*, circumducting, flexing and extending each foot (8-10 times).

2. *Lying*, flexing and extending each knee (3-6 times).

3. *Lying*, twisting both arms outwards, with deep breathing (4-6 times) . . . No. 2.

4. *Lying*, feet crossed, contracting the abdominal muscles (1-3 minutes) . . . No. 28.

5. *Lying*, knees flexed and feet resting on the bed, *parting and closing the knees* (3-4 times) . . . No. 29.

6. *Lying*, feet crossed, *drawing up the pelvis* in the vertical direction (6-8 times) . . . No. 30.

7. *Lying*, knees flexed and feet resting on the bed—

(a) *Raising the sacral region* from the bed (3-6 times).

(b) *Parting the knees* while raising as before; *closing* them while lowering (3-6 times).

(c) Position as in (a), *contracting* the sphincters (repeatedly, for 10-30 seconds).

(d) Position as in (a), *parting and closing the knees* with resistance (3-4 times; repeat) . . . No. 31.

It is of course impossible to lay down any hard and fast rules as to how rapid the progression from the one to the other of these exercises can be made or new ones added to the daily work, but it would be well during the first two or three days (in addition to the massage mentioned before) to be content with—

\*1. *Lying*, circumducting, flexing and extending each foot.

\*2. *Lying*, flexing and extending each knee.

\* Exercises 1 and 2 might soon be done by the patient herself, and later with resistance.

3. *Lying*, twisting both arms outwards with breathing . . . . . No. 2.

After a week the patient ought, if all goes well, to be able to carry out something like the following programme—

1. *Lying*, twisting both arms outwards . . . . . No. 2.

2. *Lying*, flexing and extending each knee.

3. *Lying*, feet crossed, contracting the abdominal muscles . . . . . No. 28.

4. *Lying*, raising up to a gradually increasing angle with assistance; pressing the body back again with resistance (3-4 times).

5. *Lying*, knees flexed and feet resting on the bed, throwing the legs over from side to side (3-4 times each way) . . . Compare No. 16c.

6. *Lying*, parting and closing the arms (3-6 times) . . . . . Compare No. 3.

After another week, when the patient begins to be up and can perform some of the exercises in a sitting posture, the following ones ought to be possible—

1. *Lying*, lifting both arms . . . . . No. 1.

2. *Lying*, drawing up both knees . . . No. 16a.

3. *Lying*, knees flexed and feet resting, raising the sacrum . . . . . No. 31a.

(Later: parting and closing the knees, while in above position . . . No. 31d.

4. Rest for 2-5 minutes.

5. Sitting, feet fixed, twisting the body, . . . . . Compare No. 19.

6. Sitting, feet fixed, bending the body backwards and forwards . . . . . No. 17.

7. Sitting, twisting both arms outwards . . . . . No. 2.

8. *Lying*, drawing up the pelvis . . . No. 30.

9. *Lying*, lifting both arms . . . . . No. 1.

As will be seen, the chief position here used is one that closely corresponds to the so-called Trendelenburg position used in pelvic operations in order to let the viscera by their own weight fall away from the floor of the abdomen and of the pelvis. The act of voluntarily assuming and maintaining such a position involves in itself a considerable effort of the extensors of the lumbar spine and of the hip joints; and it is obvious that in addition to the mechanical effect of the position, this action of such large groups of skeletal muscles with the consequent divergence towards them of the blood stream cannot be without its influence on the neighbouring internal organs. With regard to the movements carried out, these aim evidently at bringing into use all the muscles that surround and support the viscera, and also those that move the hip joints; and it may be taken that of these latter muscles the activity of the flexors and adductors tends to draw the

blood towards the pelvis, whereas the extensors and abductors have a depleting effect. These varying groups of muscles should therefore be called into activity alternately in order to cause a more lively circulation through the pelvic structures, when the object is to improve the nutrition of their muscular tissue.

On the other hand it may under certain circumstances be desirable to give a preponderant use to either the one or other of them, if the object is to produce or relieve a state of pelvic congestion. According to this principle it is possible to devise exercises that have a very marked influence on the catamenial flow, and thus to treat with success conditions of dysmenorrhœa, amenorrhœa and menorrhagia.

Turning our attention to the *thoracic cavity*, it has incidentally been pointed out already in dealing with spinal curvatures, how important it is to pay attention to the proper development of the chest, and obviously a great variety of disorders more directly affecting the *lungs* can be favourably influenced by physical exercises.

*Pulmonary tuberculosis* will probably be the disorder that most readily comes to one's mind in this connection; and that breathing exercises are of the greatest value as a prophylactic measure against this disease and even as a curative one in very early stages is well recognized. So well recognized, in fact, that no self-respecting originator of any system of physical culture can afford to omit from his own biography that he started life as a consumptive. It might, however, in view of this fact, be well to put in a word of caution as to how important it is to select carefully the cases, as well as the nature and severity of the exercises in this condition, lest a hæmorrhage should be brought on, or an otherwise safely encapsuled tuberculous focus should be stirred up and the disease rendered active again.

*(The idea of employing general exercise in the form of carefully graduated outdoor work for tuberculous patients as a means of combating their own disease has recently been receiving great attention, and will be fully dealt with in another article of this work.)*

Another danger from injudicious breathing exercises, even to previously healthy lungs, is that of inducing emphysema. It is a very real danger when, for instance, powerful abdominal movements are being performed with the chest inflated and glottis closed, as is such a startling feature in the so-called "health exercises" of one leader of physical culture fashion here in London.

It is a golden rule in all gymnastic exercises that they must not interfere with the natural free and easy breathing, but on the contrary they should whenever possible be adapted to the rate of breathing and made to facilitate

not only inspiration, but also expiration. Any *existing condition of emphysema* can in this way be distinctly benefited by suitable exercises. Thus the patient's expirations might be effectively assisted (passively as far as he himself is concerned) by pressure being applied to the lower part of the thorax at this phase of the respiration, preferably if this pressure is accompanied by a shaking or vibrating movement. The compression of the thoracic wall will then mechanically help to expel the air, whereas the vibration will act in a reflex way on the lung tissue and tend to induce more efficient contractions of its relaxed muscular fibres. Such pressure might be applied by some other person placing his hands over the lower ribs on both sides, or it might be produced by some mechanical contrivance.

Of more active breathing exercises one would under these circumstances choose such as involve movements of the trunk, for instance bending forwards, and generally those involving a contraction of the abdominal muscles, rather than exercises that expand the chest. This latter object (expanding the chest) is achieved by straightening the thoracic spine and by various movements of the arms and head that bring into use the extraordinary inspiratory muscles connecting them with the thorax. The bending to one side in the upper part of the spinal column has obviously the effect of raising and spreading apart the ribs of the opposite side of the thorax and thus allowing one lung to expand.

These deep inspiratory exercises are of immense importance in developing a phthinoid chest and in their effect upon chronic inflammatory conditions of the air-passages; and in certain unilateral lung conditions, such as residual pleural effusions or the adhesions remaining after them, long standing empyema with collapse of lung and consequent alterations in the shape of the thorax, regulated breathing exercises are most indispensable, as it is possible by them to influence different parts of the chest and lungs according to the requirements of the case.

A consecutive list of breathing exercises will here be given, irrespective of the particular purpose for which they are to be used; but in addition, suggestions will be made for complete programmes of exercises suitable for some of the various conditions referred to above.

#### *Some Typical Respiratory Exercises.*

1. *Lying flat on the back, practising deep breathing* (12-50 times).
2. *Sitting, expanding the chest by help of the arms* (6-8 times) . . . . . No. 5.
3. *Standing, twisting both arms outwards* (6-12 times) . . . . . No. 2.
4. *Sitting, feet parted, hands on hips, bending*



the body forwards and raising it up with straightening of the spine (2-4 times; repeat) No. 11.

5. Lying flat on the back, lifting both arms forwards and upwards, lowering them outwards and downwards (6-8 times) . . . No. 1.

6. Sitting astride, arms bent, twisting the body (2-6 times each side) . . . No. 19.

7. Sitting astride, arms hanging down, bending the body sideways (3-6 times each side) . . . No. 20.

8. Standing, back supported, bending forwards and downwards and raising up again (2-4 times; repeat) . . . No. 12.

9. Lying flat on the back, arms by the sides, drawing up both knees (4-8 times) . . . Compare No. 16a.

10. Standing, back supported, arms extended forwards, parting and closing the arms (6-8 times) . . . No. 3.

*Suggested Programme of Exercises in order to develop a Phthinoid Chest.*

1. Standing, back supported, parting and closing the arms . . . No. 3.

2. Standing, hands placed behind the neck, heel raising and knee bending. Compare No. 10.

3. Sitting astride, twisting the body . . . No. 19.

4. Sitting, bending the body forwards and raising up again . . . No. 11.

5. Standing, the chest being pushed forwards . . . No. 4.

6. Sitting, bending the body sideways . . . No. 20.

7. Sitting, expanding the chest by help of the arms . . . No. 5.

*Programme for Emphysema.*

1. Lying, twisting both arms outwards with breathing . . . Compare No. 2.

2. Lying, arms by the sides, drawing up both knees . . . Compare No. 16a.

3. Sitting, astride, hands on hips, twisting the body (rapidly) . . . Compare No. 19.

4. Sitting, bending the body forwards and raising up again . . . No. 11.

5. Standing, heel raising and knee bending . . . No. 10.

6. Sitting, circling with the body . . . No. 22.

7. Standing, back supported, bending forwards and downwards . . . No. 12.

*Programme for Left-sided Pleural Adhesions or Collapse of Left Lung.*

1. Sitting, expanding the chest with help of the arms . . . No. 5.

2. Lying, drawing up both knees . . . No. 16a.

3. Sitting, left hand behind neck, bending to the right with deep inspiration. . . . Compare No. 21.

4. Standing, back supported, parting and closing the arms . . . No. 3.

5. Sitting, bending the body forwards and raising up again (this to be done also with the body twisted to the right side).

Compare No. 11.

6. Lying on the left side, raising the body . . . No. 23.

7. Sitting, circling with the body . . . No. 22.

8. Lying, lifting both arms forwards and upwards . . . No. 1.

One lung condition, where breathing exercises are of very great value, still remains to be mentioned, and that is the *cardiac asthma* produced by engorgement of the lesser circulatory system. This leads naturally on to the consideration of physical exercises as a means of treating *heart diseases*. Many such conditions can be benefited in a very marked manner by judicious exercises, as is now well known and universally recognized. This form of treatment is in England generally associated with the name of Dr. Schott of Nauheim. Much credit is certainly due to the brothers Schott for elaborating this system of resisted exercises and combining them with baths in the saline waters, highly charged with carbonic acid gas, which are to be obtained at Nauheim, or which can be artificially imitated. This idea has been taken up by many advocates in this and other countries under the name of the Nauheim Treatment, and is fully dealt with in a special article of this work.

It is, however, not altogether new, for in Sweden, cases of heart disease have regularly been treated by exercises in combination with massage, at least since the middle of last century; and the value of the method, used independently of any baths, is well established. It is therefore to be regretted that space does not here permit any consideration of this very important application of physical exercises.

A great many disorders of the *nervous system* are with more or less success treated by means of physical exercises, the object being to re-educate paretic and spastic muscles once more to obey the impulse of the will, or to develop the power of neighbouring muscles to make up for the defective ones, or to prevent, as far as possible, the mechanical hindrance to function caused by atrophy and contractures.

Amongst the various diseases of this class that have thus been treated might be mentioned: the after-effects of hæmorrhages in the brain or cord, chronic myelitis, acute or chronic poliomyelitis, disseminated sclerosis, tabes dorsalis, amyotrophic lateral sclerosis, progressive muscular atrophy, toxic paralysis, occupation neurosis, clonic torticollis, chorea, paralysis agitans, etc.

In addition to exercises great importance in all these cases must be attached to massage, sedative or stimulating according to circum-

stances, and to mechanical stimulation of affected nerves. *Tabes dorsalis* is perhaps the most typical of these conditions that can be chosen for explaining how exercises (alone or supplemented as above suggested) can be used in their treatment. Much can there be done by persevering systematic training in the way of restoring the nervous control and the lost muscular sense and co-ordination.

In the same way as Dr. Schott of Nauheim has taken up the mechanical treatment of heart diseases, so has another German medical man, Dr. Frenkel of Freihof, Heiden, taken up the idea of treating locomotor ataxy with exercises. With true Teutonic thoroughness he has systematized a very complete and undoubtedly valuable method of dealing with this disease.

He classifies the exercises into those performed in:—(1) lying position, (2) sitting, (3) standing, (4) walking, and (5) exercises for the upper extremities; and they consist in placing the limbs in certain positions or moving them along certain directions either in a definite fixed order, or according to command, and this partly with the aid of sight, and partly with the eyes shut. Thus, with very simple means, a series of movements is provided, carefully graduated so as to demand more and more precision and co-ordination in their execution; and persevering practice in this way will, sometimes in a remarkable degree, improve the patient's power and control over his movements.

The same holds good in a great many of the nerve diseases enumerated above: few are curable, in most of them a more or less temporary improvement only is possible, in some it can merely be a question of somewhat retarding the downgrade slide of the patient. And yet even this small gain, with its psychological effect on the patient, is worth considering in these conditions, where the professional interest in the case is unfortunately often apt to cease with the making of the diagnosis.

#### List of the Exercises referred to in the Text

1. *Lying* (flat on the back with the arms and the palms of the hands pressed to the sides), *lifting both arms* forwards and upwards, while breathing in, and bringing them back again outwards and downwards to the sides while breathing out (6–8 times, slowly, in time with deep breathing) (Fig. 4).

2. *Standing* (with the arms hanging down by the sides), *twisting both arms* outwards with deep breathing (6–12 times).

If this is done energetically with the upper arms still kept in contact with the body, it will be plainly felt that the shoulder-blades are drawn back and the chest expanded. The exercise can be done quite as well in a sitting or lying position and will be so used

under various circumstances referred to in the text.

3. *Standing* (with the arms extended forwards

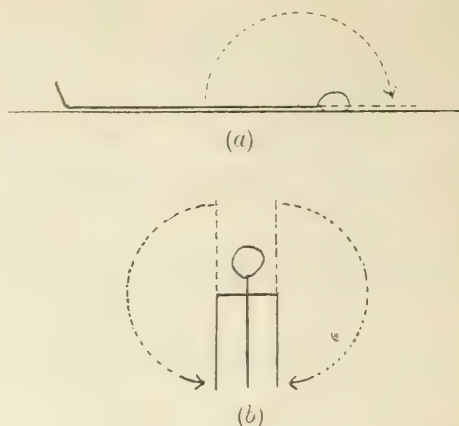


FIG. 4.

and the palms facing each other), *bringing both arms out* to the sides, while breathing in, then bringing them forwards again while breathing out (6–10 times).

To increase the effect of this exercise some other person might offer resistance when the arms are parted, and then bring them forwards again, the patient resisting.

To facilitate a correct position during this performance the patient may stand with his back supported, for instance against a door-post.

4. *Standing* (in a narrow door opening, two to three feet wide, with one hand and forearm placed on each post), *another person pushing the chest forwards*, with one hand placed between the shoulders, the other on the abdomen to prevent bending in the lower part of the back (4–6 times).

5. *Sitting*, *expanding the chest by raising the upper arms and shoulders and pulling them backwards and downwards* (6–8 times, with deep breathing).

6. *Standing* (the feet astride, two foot lengths; the arms hanging by the sides).

- (a) *Lifting both arms* outwards and upwards (inspiration).
- (b) *Bending the body* forwards and downwards (expiration).
- (c) *Raising up again* with arms extended upwards (inspiration).
- (d) *Lowering the arms* outwards and downwards (expiration) (3–6 times).

7. *Standing* (with the hands supported), *bending the head* slowly backwards and raising it up again by drawing in the chin (4–6 times).

The movement should take place not merely



between the atlas and occiput, but throughout the whole of the cervical spine, and no bending backwards must occur in the lower part of the back.

8. *Hanging* (from a bar, trapeze or similar support), *parting and closing the legs* with the knees kept straight (2-6 times; repeat).

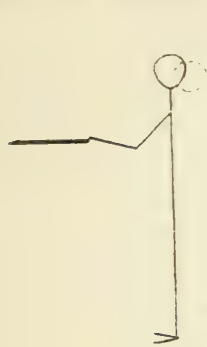


FIG. 5.

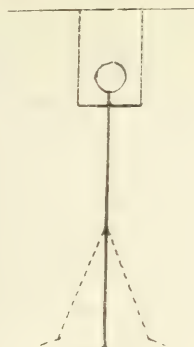


FIG. 6.

Under certain circumstances both legs might be brought over to one side; and also one hand be placed higher than the other.

9. *Suspension* by means of a halter supporting the patient's chin and neck.

The method is to attach the halter, by means of a rope and pulleys, to a fixed point above the patient, and then to let him take hold of the running end of the rope above his head, and by means of this hoist himself up as high as he can when standing on tiptoe. If there is a marked difference in the level of the scapulæ, the hand of the side where the scapula is lower must always be made to grip higher up on the rope. The patient should now try, without paying out the rope, to lower his heels again towards the ground as far as possible.

10. *Standing* (with the heels together), *raising on tiptoe and bending the knees* until the thighs form right angles with the legs, at the same time



FIG. 7.

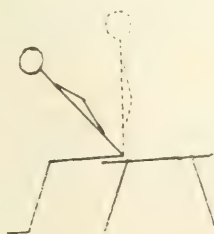


FIG. 8.

pressing the knees out to the sides; afterwards straightening the legs and sinking down on the heels again (6-8 times).

11. *Sitting* (feet parted; hands placed on the hip crests with fingers forwards and thumbs backwards), *bending the body forwards* and then *raising it up again* while fully straightening the spine with help of the arms (2-4 times; repeat).

12. *Standing* (with the back resting against a door-post, the feet parted and placed some few inches forward from the post), *bending the body forwards* and downwards with the head and arms drooping down; then *raising it up* gradually, so that each vertebra of the spine in turn from below upwards may, if possible, touch the door-post (2-4 times; repeat).

This exercise will bring the spinal muscles into more active use, and will increase the mobility between the various vertebræ. It will thus tend to straighten slighter degrees of lateral curvatures. When properly performed, its principal effect is, however, to correct antero-posterior curves; lordosis is corrected by the hamstring and glutei muscles being made to tilt the pelvis backwards, the lumbar spinous processes thus being brought to touch the support; and kyphosis is corrected by the straightening of the upper part of the spine. In this latter part of the movement care has, however, to be taken that the lordosis is not allowed to recur.

13. *Lying* (flat on the face with the arms and



FIG. 9.

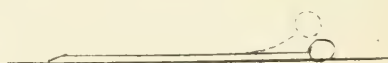


FIG. 10.

the palms pressed to the sides), *raising the upper part of the body* a short distance only, but with the shoulders well drawn back (2-4 times).

14. *Sitting* (facing a wall, some two to three feet distant from it, with the arms extended upwards), *leaning the body forwards* from the hip joints, with the spine kept straight, until the hands touch the wall at the highest possible point (4-8 times).

15. *Sitting* (with the left hand bent up to the shoulder, the right one placed on the hip crest; the feet parted

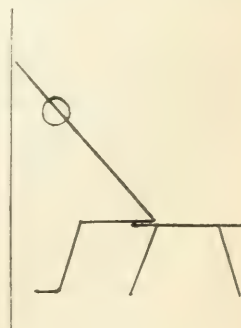


FIG. 11.

and firmly resting on the floor, the body leaning forwards from the hip joints), *extending the left arm upwards* (3-6 times; repeat).

This movement is best done with the help of some one who, standing in front of the patient, can steady his body by placing one hand on the convexity of his curve, and at the same time with the other hand offer some resistance to the extension upwards of the left arm.

16. *Lying* (flat on the back, with the arms

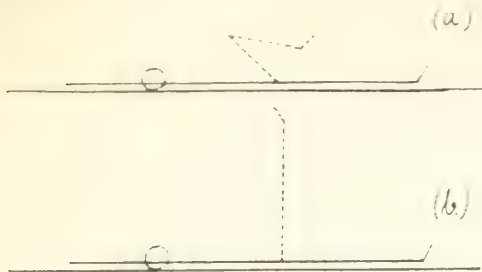


FIG. 12.

extended upwards and the hands grasping some support).

- (a) *Drawing up both knees* and then bringing the legs down to the original position again (4-8 times).
- (b) *Lifting both legs* with the knees kept straight (3-6 times).
- (c) *Drawing up the knees* as explained above (see a), and *throwing the legs over* from side to side (2-4 times each side; repeat).

17. *Sitting* (with the feet fixed, for instance under a chest of drawers, or any other suitable piece of furniture; the hands placed on the hip crests), *leaning the body backwards*, with the spine kept straight and the head in line with the body. *Raising up again* and then *bending the body forwards* as far as possible (3-6 times each way).

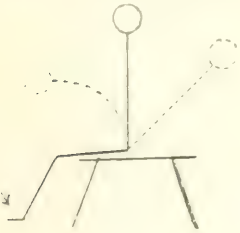


FIG. 13.

18. *Sitting* (on the floor), *bending the body forwards* and touching the toes, without letting

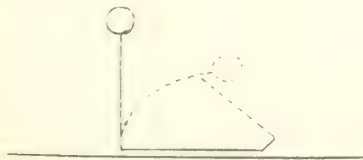


FIG. 14.

the knees bend (3-4 times, maintaining the position five to fifteen seconds).

19. *Sitting* (astride a chair with the hands bent up to the shoulders, the elbows kept close

to the sides and the forearms brought well outwards), *twisting of the body* from side to side (2-6 times each side).

20. *Sitting* (astride; the arms hanging down by the sides), *bending the body* first to one side and then to the other (3-6 times each side).

This should involve a genuine flexion of the thoracic spine and not merely a leaning over of the body from the hip joints.

21. *Sitting* (astride; the left hand behind the neck), *bending the body* to the right side and raising up again (6-10 times).

22. *Sitting* (with the feet fixed; the hands placed on the hip crests), *describing a circle* with the body, bringing it in turn forwards, to the side, backwards, to the other side and forwards again (3-6 times in each direction).

23. *Lying* (on the left side, with the left hand behind the neck and the right arm extended along its own side of the body), *raising the upper part* of the body straight towards the right side (3-6 times).

24. *Standing* (on a chair on the left foot only; hands grasping some support), *lowering the right foot* below the level of the chair with both legs kept straight (6-8 times).

25. *Sitting* (on the buttock and thigh of the side where the hip is lowered (the left)), *extending the other (right) leg* backwards as far as possible. *Leaning the body forwards* in line with the rear leg. *Extending the arm* of the side where the scapula is lowered (left) upwards in line with the body, and the *other arm* (right) downwards

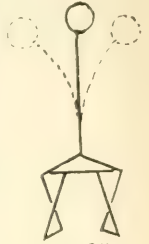


FIG. 15.

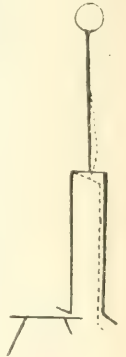


FIG. 16.

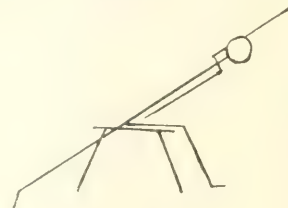


FIG. 17.

and backwards. (Maintain this position fifteen to fifty seconds; 3-4 times).

26. *Lying* (flat on the face), *both legs being grasped and brought over* to the left side by an operator, who at the same time steadies the body by placing his left hand on the height of the convexity, thus localising the movement to the desired part of the spine (4-6 times).



27. *Lying* (on the face with the legs fixed and the upper part of the body slightly raised actively; the arms extended upwards outside the couch and grasping round the waist of an assistant), *the body being brought over to the right by the assistant, who at the same time applies pressure on the height of the thoracic convexity. Another assistant in the meantime exerts opposing pressure on the lumbar convexity, so as to localise the movement to the upper curve* (4–6 times).

28. *Lying* (with the legs straight and either foot placed on the top of the other), *practising voluntary contractions of the abdominal muscles* (repeatedly for 1–3 minutes).

29. *Lying* (with the knees flexed, the soles of the feet resting on the bed), *the knees being drawn apart by an operator, under moderate resistance by the patient, and then actively closed against resistance* (3–4 times, each way).

30. *Lying* (with legs straight and either foot placed on the top of the other), *drawing up the pelvis in the vertical direction by a voluntary contraction of the abdominal muscles and flexion in the lumbar spine so as to press this against the bed* (6–8 times; an inspiration to precede the exercise each time, and a deep expiration to be made, while the movement is being performed).

31. *Lying* (with the knees flexed, the soles of



FIG. 18.

the feet resting on the bed; hands placed on the hip crests).

- (a) *Raising the sacral region* so as to rest merely on the upper part of the back and on the feet (3–6 times).
- (b) *Parting the knees* while raising the body as before and *closing them* while lowering down again (3–6 times).

- (c) (Patient lying in the position obtained in a).

*Practising voluntary contractions of the sphincters* (as if to prevent the escape of flatus), (repeatedly for ten to thirty seconds).

- (d) (Patient lying in the position obtained in a).

*Parting and closing the knees*, another person offering resistance to the movement each way (3–4 times; repeat).

### *Mechano-Therapeutic Appliances.*

The idea of using mechanical appliances for administering various duplicated and passive movements has long been thought of, but only crude attempts had been made in this direction until Dr. Gustaf Zander, who is still living in Stockholm, turned his inventive genius to the solving of this question. Some forty years ago he first started his long continued experiments on this subject, and by persevering effort he has devised a most complete and perfect set of machines, by help of which practically all the exercises and movements used in medical gymnastics can be performed, not only such simple resisted and assisted exercises as have been dealt with in the present article, but also the most complicated duplicated movements that otherwise require the assistance of two or three persons. Moreover a great number of purely passive movements and most of the manipulations used in massage are also imitated in a very ingenious way. It is obvious that a very elaborate and intricate plant is necessary for these manifold purposes; and for many of the machines some motive power is required, electricity being used nowadays as being the most convenient.

The appliances might broadly be divided into four different classes—

1. For active exercises.
2. For passive exercises.
3. For massage.
4. For orthopædic treatment of scoliosis.

1. The active exercises are in this connection practically synonymous with duplicated exercises, as in the “free” movements, which the patient performs entirely by his own effort, no appliances are called for. Zander subdivides the exercises of the first group into (a) those where the machine offers a resistance to the patient’s movement, (b) those where the patient’s movement is assisted and extended by a pendular or rotatory action of the machine, and (c) those where the trunk muscles are more prominently brought into use in order to balance the body.

It is perhaps in the first of these subdivisions that the superiority of the appliances devised by Zander is particularly manifest. In most so-called “Exercisers” the resistance is obtained by the use of elastics or spiral springs, both of which offer a resistance that is rapidly increasing in strength the further the movement is carried, while in other appliances use is made of weights and pulleys, and the resistance is then at least constant. Zander’s principle on the other hand is to use levers that can not only be loaded at will, and the resistance thus gauged, but, what is still more important, by correctly adapting the angles of the levers under various conditions

the strongest effort can be called forth at the phase of the movement, when the interested muscles act at their greatest advantage. The chief factors determining this are partly the angle at which a muscle pulls on a bone, into which it is inserted, and partly the state of its shortening. A muscle exerts its greatest power when it is extended beyond its state of tonic contraction by some outside influence, and its power decreases rapidly as it becomes shortened. It is for this reason that an elastic resistance is so fundamentally unsatisfactory.

The second subdivision (where the patient's own movement is carried on further by the action of a pendulum or fly-wheel), includes probably some of the most valuable of all mechanical appliances used for therapeutic purposes. As has already been stated, there is no more effective way of extending the range of movement of stiffened joints and at the same time of increasing the power of the muscles working them. One great advantage with some justice claimed for all well-planned mechano-therapeutic appliances, is the facility with which the patient's body can be secured in a firm and comfortable position, and the movement thus localised to any desired part of the body. This is obviously a point of much importance in the conditions now under consideration.

To gain the object aimed at in the third subdivision (that of exercising the trunk muscles generally) the patient is placed on a seat which, when the machinery is set in motion, is made to tilt about in various directions. Constantly varying exertions of the spinal and abdominal muscles are thus induced to keep the body in balance and at the same time the mobility is increased in the spinal column, especially in its lumbar part, and the abdominal viscera are thus moved about in a way that might be compared to internal massage.

2. When considering, next, the apparatus for passive movements, the difficulty becomes obvious in drawing an absolute line between the various classes of the apparatus used in mechano-therapeutics.

Thus the pendulum machines, and others described above as set in motion by the patient's own effort, can easily be used for administering purely passive movements either by some other person working them or by the patient himself doing so by some other part of his body than the one for which the exercise is intended; for instance he might give himself knee flexion and extension by working a handle, or the sound leg might be made to produce the movement required for the other knee. In the same way there is rather a fine distinction between the exercises on the tilting seat referred to above and the very realistic imitation of horse exercise

which Zander includes amongst the passive exercises. This is produced by the patient sitting on a saddle which can be made to move in a way closely resembling that of a horse in canter, trot or gallop, as may be desired.

On the other hand this second class includes apparatus capable of performing the most complicated exercises, where there is no doubt about the patient being passive; but some of these machines are in their turn merging into the next class: machines for massage.

3. The appliances for administering massage fulfil their object in a very creditable way, most of the manipulations used in manual massage being cleverly imitated, such as kneading and stroking the extremities, tapping on the back and even abdominal massage. Still the skilled human hand is naturally much to be preferred for all these purposes.

There is, however, one movement where the mechanical application is more effective, and I refer to *Vibrations*. These can be made far more strong, regular and continuous by machinery than by the hand, however skilled. This particular application has received a great deal of attention during the last few years, and a great many vibrators of different makes have seen the light. In spite of the objectionable way in which some of them are advertised, there is no doubt that vibration is a very useful form of massage.

4. The last group of Zander's apparatus contains those used for orthopaedic purposes, more especially for the treatment of spinal curvatures.

Various mechanical devices are here introduced in order to correct the curvatures passively and actively; and for their proper working the most accurate measurements of the degree and situation of the curves are necessary. A very ingenious and elaborate apparatus is provided for this purpose, but, in spite of this, errors may easily be made that would seriously detract from the value of the consequent mechanical treatment.

In fact, one of the fundamentally weak points in the whole treatment by means of machinery is that it is uncompromising and unreasoning compared to the exercises administered by intelligent and observant operators, who can judge of the patient's condition and state of health and strength, as this may vary from day to day.

R. T.

## MASSAGE

By massage is meant the scientific manual application of certain movements, namely, stroking (*effleurage*), kneading (*petrissage*), friction, vibration and percussion (*tapotement*) to the human body. It is a passive part of



medical gymnastics. In some cases, such as recent sprains and fractures, it takes the leading place in the treatment; in others, for example curvatures, active exercises do so. As a rule they are used in conjunction with each other. The physiological effects of massage are briefly as follows—

**The Nervous System.**—According to the movements employed the nerves may be either stimulated, so that increased functional activity is promoted in the muscles, vessels and glands governed by them, or they may be soothed, so that pain and nervous irritability are allayed.

**The Blood-Vascular System.**—Stimulation of the vasomotor nerves and direct pressure over the veins accelerates the flow of blood through the system. The amount of blood in the parts under treatment is also increased. Deep manipulations, if the area treated is sufficiently large, cause an increase in the strength and a decrease in the rate of the heart beat. This is due to the fact that the vessels in the tissues under treatment are dilated, consequently resistance is lessened; the back pressure of arterial blood upon the heart is relieved, and it is thus able to contract more fully and to empty its cavities more completely.

**The Lymph-Vascular System.**—Massage accelerates the flow of lymph through the system by centripetal pressure over the vessels and glands. The pressure exercised also promotes absorption, so that waste and poisonous matters are taken into the lymphatic circulation and more rapidly eliminated.

**The Respiratory System.**—Manipulation of the muscles causes increased combustion and consequent formation of carbonic acid gas in the tissues; respiratory activity is thus increased, the movement of inspiration being deeper and that of expiration more complete. Internal or tissue respiration is also increased by massage.

**Digestion.**—Massage aids digestion in the following ways—

1. It stimulates the nerves which control the abdominal viscera, causing increased secretion of digestive juices by the stomach, intestines, liver and pancreas.

2. It promotes peristalsis in stomach and intestines and increases the amount of bile secreted by the liver.

3. It promotes the absorption of digested food substances through improved circulation in the walls of the alimentary canal.

4. It strengthens and develops the muscles of the stomach and intestines.

**Elimination.**—Massage increases oxidation and absorption and improves the circulation. As a result more carbonic acid gas, water and urea are produced, and are carried more quickly to the excretory organs. Its effects upon the skin are to improve its nutrition and activity;

secretory activity in the sweat and sebaceous glands is promoted, while effete matter is forced out of the ducts of these glands.

**The Muscular System.**—Massage improves the nutrition of muscles. More arterial blood is brought to the parts under treatment, while effete matter in the veins and lymphatics is forced onwards. Certain movements produce contractions of the muscles, while others allay nervous irritability and muscle fatigue.

**Bone.**—Massage treatment increases the circulation in the muscles and in the underlying bones, thereby promoting their nutrition and growth.

### Effects of the Different Movements

**Stroking.**—Stroking acts upon the cutaneous nerves, and if applied with sufficient firmness causes dilation of the superficial vessels, so raising the temperature locally. It also increases the glandular activity of the skin. Light stroking excites reflex action, causing muscular contractions and also promoting the functional activity of the internal parts governed by the same nerve centre which supplies the skin. Light centrifugal stroking over a part diminishes its blood supply and has a sedative effect upon the nerves. Firm centripetal stroking aids the return circulation of blood and lymph.

**Kneading.**—Kneading stimulates the nerves, accelerates the venous and lymphatic circulations and brings a larger supply of arterial blood to the parts under treatment. It promotes glandular activity and increases oxidation, absorption and elimination more than perhaps any other movement. It is one of the chief movements for improving the nutrition of muscles and general metabolism. It is also largely used to reduce thickenings in the tissues and to break up inflammatory products.

**Frictions.**—Gentle superficial frictions act upon the skin and superficial vessels and have a decidedly sedative effect. Firm, deep frictions are used to break up inflammatory products and to promote absorption.

**Vibrations.**—Vibrations have a stimulating effect, and by their means remotely situated organs and tissues can be influenced. They cause increased cellular activity and promote the absorption of inflammatory products. They are also used where stronger manipulations cannot be well borne by the patient. Vibrations are much used in neuralgia, neurasthenia, constipation, indigestion and other ailments.

**Percussion.**—Percussive movements are employed when stimulation is desired. Gentle percussion causes contraction of the superficial vessels, while strong applications cause their dilatation and raise the temperature of the part. Prolonged and strong percussion has a benumbing effect.

**Passive Joint Movements.**—Passive joint movements further the circulation and promote mobility. They are employed in paralysis and all cases of general debility to prepare the way for active exercises. They prevent and break down adhesions in cases of sprains, dislocations and fractures.

**Active Movements** are employed in conjunction with massage whenever the patient's condition allows of the exertion entailed. They may be divided into three classes: (1) Free; (2) Resistive; (3) Static.

Respiratory exercises form a very important part of massage treatment in most cases. Deep breathing develops the muscles and mobilizes the joints of the thorax. It fully exercises the lungs and increases their functional activity. It improves the systematic, pulmonary and portal circulations.

Massage treatment is indicated in the following cases—

#### Constitutional Diseases

**Arthritic Gout.**—As a preventive treatment massage and gymnastics are useful when the subject is unable to take active outdoor exercise, and also in chronic and subacute cases. They improve the circulation and promote elimination. They also promote absorption of oedema and prevent gouty thickenings. Massage will frequently arrest or alleviate an acute attack of gout. In these cases it is advisable to manipulate only the parts above the seat of the attack. This relieves the congestion lower down.

**Acute Articular Rheumatism.**—Massage may be ordered when the fever has subsided and the swelling in the joints disappeared. The attention of the masseuse should in these cases be directed to manipulation of the muscles. Massage of the joints should be omitted at first or a relapse may occur.

**Chronic Rheumatoid Arthritis.**—Massage and exercises produce excellent results here. The treatment causes improved circulation in the joints and muscles and increases the elimination of toxic products from the system. The mobility of the joints is improved and muscular development is promoted.

**Diabetes Mellitus.**—Massage, together with passive, and later active, gymnastic exercises, promote the oxidation of carbohydrates; they improve the general and portal circulations. Massage also, by stimulation of the sweat glands, allays irritation due to dryness of the skin.

**Rickets.**—General massage and gymnastics are strongly indicated in the above cases in order to improve the general health. When there is any deformity, special exercises to correct it must be added.

**Anaemia.**—General massage should be ordered,

and particular attention directed to massage of the abdomen, and to respiratory exercises.

**Obesity.**—General, massage and gymnastics are a useful adjunct to diet in the treatment of obesity. They cause increased oxidation, promote absorption of fat and help the muscles to gain tone. In most cases the weight is greatly decreased by the treatment, in some the reduction in the fat is partly counterbalanced by muscular development.

The exercises and massage must be carefully regulated to suit the strength of the patient; if there are symptoms of a weak heart, care must be taken not to tire the patient or to give any exercises which may hinder respiration.

#### Diseases of the Heart and Blood-Vessels

**Heart Disease.**—Massage and exercises facilitate the work of the heart without causing it any strain. It is therefore recommended for valvular and functional diseases, and also for the following diseases of the heart muscle:—dilatation, hypertrophy, fatty infiltration, degeneration and chronic myocarditis.

The venous and capillary circulations are accelerated by the treatment, consequently resistance in the arteries is diminished, more blood flows into the auricles, while the heart at systole is able to contract and to empty its ventricles more completely. There is a longer pause between diastole and systole and the pulse becomes stronger. In bad cases stroking and gentle kneading of the limbs, local heart treatment, mild respiratory exercises and passive circumduction of the feet and hands are indicated. As the patient grows stronger abdominal kneading may be added and vibrations for the back. Passive movements, consisting of flexion and extension of the foot, leg and arm and circumduction of the thighs and arms, may be gradually introduced as the patient can bear them. Later, active resistive movements may be given.

In giving directions the following points should be taken into consideration:—(1) That leg movements can be more easily borne by patients suffering from heart disease than those of the upper extremity. (2) That no movements which hinder respiration should be continued. (Circumduction of the thigh and abdominal kneading may do so, while all exercises in which the arms are raised above the head should be avoided, also those which strongly expand the chest.) (3) That certain movements, namely those known as back tremble shaking or vibration; chest lift shaking; stroking and vibration over the precordial area, and abdominal kneading diminish the pulse rate, while tapotement over the heart tends to increase the pulse rate.

**Thrombosis.**—When the acute stage of this



disease is past, and organization or resolution of the thrombus has occurred about four to six weeks, massage—avoiding the area of the clot—and passive movements may with great advantage be commenced.

**Phlegmasia Dolens.**—Massage, consisting of light effleurage, may be commenced about the seventh week. If the thrombosis has extended to the thigh the area of the thrombus must be avoided. Passive movements, frictions, and kneadings must be postponed until all danger of dislodging the thrombus is past.

**Varicose Veins.**—Massage and respiratory exercises are recommended. The former improves the circulation locally and relieves congestion in the varicose area, while the latter improves the general circulation.

**Hæmorrhoids.**—Massage employed both locally and on the gluteal region, and also breathing exercises, have been proved to give great and long-continued relief in these cases. Abdominal kneadings and exercises helping the portal circulation should be ordered as well if the attack is caused by constipation.

#### Diseases of the Respiratory System

**Chronic Laryngitis.**—Massage of the neck (vibratory movements most useful) improves the circulation, relieves congestion, and promotes the nutrition of the muscles and membranes of the larynx.

**Chronic Bronchitis.**—This is a condition in which massage and exercises prove of great benefit. Chest clapping, and back hacking and clapping promote cellular activity and the interchange of gases and directly influence the disease by loosening the mucus from the mucous membrane of the bronchi. They also facilitate expectoration. Respiratory exercises relieve dyspnoea and oppression.

**Emphysema of the Lungs.**—Massage and gymnastics influence the disease itself and the secondary affections—chronic bronchitis and heart disease—frequently associated with it.

The treatment directly influencing the disease includes respiratory exercises, especially those which help expiration. Other movements are also employed to improve the pulmonary circulation, to loosen mucus, promote expectoration, stimulate the lung tissues and increase the interchange of gases.

**Bronchial Asthma.**—The treatment is on the same lines as that indicated previously in chronic bronchitis and emphysema. But it is only employed in the milder forms of the disease.

**Incipient Phthisis.**—Massage and exercises to improve the general health of the patient are useful. Respiratory movements are very important, but only mild ones should be selected and no forcible chest expansions should be given. This precaution holds good even if gymnastic

treatment is ordered several years after the disease has been arrested. Gentle massage of the chest may be given, omitting any form of tapotement. The treatment is contra-indicated if there is fever or tendency to hæmorrhage.

#### Diseases of the Alimentary System

**Chronic Gastritis (Dilatation of the Stomach), Chronic Enteritis (Constipation).**—Massage, aided by suitable exercises, is a useful adjunct in the treatment of disorders of the digestive system. Its aims are—

1. To stimulate the circulation and glandular activity, causing increased secretion of digestive fluids.
2. To promote peristaltic activity and increase the flow of bile.
3. To promote the absorption of digested food substances.
4. To diminish flatulence and to facilitate the removal of mucus.
5. To strengthen the walls of the stomach and intestines and the abdominal muscles.

General as well as abdominal massage may be ordered and carried out daily. Two hours should be allowed to elapse after a meal before treatment is given.

**Massage after Operation for Appendicitis.**—Gentle massage is of value in preventing the formation of adhesions. It also helps peristalsis and restores tone to the muscles. Massage and exercises, commenced a few days before the patient gets up, do much to relieve the weakness consequent upon this and other similar operations. In these cases the masseuse should avoid any movements or exercises which would tend to stretch the cicatrix.

#### Kidneys and Urinary System

**Chronic Bright's Disease.**—As the treatment for this disease aims at the elimination of effete matter from the system, massage appears to be a rational agent for effecting the end in view. General massage and passive exercises as for heart disease are indicated. Its aims are—

1. To improve the circulation, relieve œdema and facilitate the work of the heart.
2. To stimulate the cutaneous nerves, so that excretory activity in the sweat glands is increased.

**Diseases of the Bladder. (Paresis. Enuresis. Neurosis).**—Massage appears to be used a good deal in Sweden for the above diseases of the bladder, and successful results are claimed in many cases. Exercises taking the blood from the pelvis may also be used and gentle sacral beating.

#### Fractures, Sprains, Dislocations

**Fractures.**—Treatment may begin any time after the bone has been set. Its aims are as follows—

1. The relief of pain. Massage allays muscular spasm. It hastens the removal of extravasated blood and lymph, thereby relieving the pressure upon the nerves and preventing the formation of excessive scar tissue. It also promotes the absorption of excessive callus.

2. Promotion of more rapid union of the bone—a result of improved circulation in the part.

3. The prevention of atrophy and shortening of the muscles and adhesions in neighbouring joints—mainly accomplished by joint movements.

Once a day is sufficiently often to order massage, and at first the treatment should only be given for ten or fifteen minutes. Whether early passive movements may be given to neighbouring joints depends entirely upon the situation of the fracture and how it is put up. They may be commenced with advantage at once if feasible.

In cases of compound fracture or after operation the parts in the neighbourhood of the wound may be manipulated as usual and passive joint movements given.

**Sprains.**—If there are no very acute symptoms, massage and joint movements may be carried out from the first, and may be ordered once or twice daily. Ten minutes' treatment at a time is sufficient for the first two days; afterwards this may be increased by a few minutes every day to twenty minutes or longer if the massage is only given once during the twenty-four hours. In cases of severe sprain massage should not commence until the inflammation in the joint has ceased to increase, and should then be confined to the parts above the injured area, massage of the joint itself and joint movements being postponed until the acute stage has passed.

The results to be obtained are as follows—

1. Improvement of the circulation, leading to early repair of the tissues.

2. The removal of coagulated blood and effusion from the injured parts and the prevention of adhesions and consequent stiffness of the joint.

3. Prevention of atrophy of muscles moving the joint. This is effected chiefly by early joint movements.

Joint movements should be carried out with great caution, their range being limited at first and gradually increased. No movement which would stretch the injured ligaments and muscles should be employed until their repair is well advanced. Where strapping is used in treating a sprain massage can be given over it.

**Dislocations.**—Dislocations may be treated by massage any time after reduction—the sooner the better. Occasionally gentle stroking of the muscles about the seat of injury may be necessary to allay spasm and to facilitate re-

duction. Passive movement of the joint may commence on the third day, and voluntary movements on the eighth day after the injury. This should be very limited in range at first. Massage should be given daily for ten minutes, gradually increasing to twenty minutes or half-an-hour. Caution should be observed at first in carrying out movements in which the weakened muscles are concerned.

### Surgical Diseases

**Acute Traumatic Synovitis of the Knee.**—As long as there is any effusion in the joint elastic pressure is a safer method of treatment than massage. Slight active movements of the toes and ankle are encouraged from the first. When the effusion has subsided massage and passive, followed later by active, movements are indicated. In no case should massage be ordered until the effusion in the knee has ceased to increase, and if applied directly after this it should be limited to stroking of the parts above the injured joint until the fluid has dispersed. The treatment should be ordered daily.

**Myositis.**—Massage in acute cases should consist only of gentle effleurage at first. In chronic cases vigorous massage may be given, with passive, and later active, movements.

**Chronic Cellulitis.**—Massage and exercises prove very effective in reducing the thickenings which mark these cases. Vigorous kneading is indicated and movements to improve the circulation of the part.

### Deformities

**Spinal Curvature.**—The forms of curvature treated by massage and gymnastics are: *kypnosis arcuata*, *lordosis* and *scoliosis*; in these cases gymnastics take the leading part.

The aims of the treatment are—

1. To strengthen the muscles on the convex side of the curve by exercises, so as to improve their antagonizing action, and to stretch the ligaments and muscles on the concave side. In cases of *scoliosis* symmetrical exercises for the back muscles are employed, as well as unilateral ones, in order to train the muscles to work evenly together.

2. To maintain or improve the mobility of the spine and thorax. This is accomplished by active trunk movements and respiratory exercises.

3. To educate the patient in the correct pose of the body when sitting, standing and walking.

Curvatures of the first degree—*i.e.* those which can be completely corrected by voluntary effort or when the patient is in the suspended or recumbent position—can be cured by the treatment.

Curvatures of the second degree—*i.e.* those



which cannot be fully corrected by voluntary effort and in which forced correction is painful—can be arrested and improved.

Curvatures of the third degree—*i.e.* those in which the vertebræ and other bones have altered in shape, so that the curve has become fixed—may in a few cases be very slightly improved, but the treatment here aims at the relief of symptoms, namely, hindered respiration, bad circulation, backache and intercostal neuralgia.

Treatment may have to extend over many months. Its duration depends upon the case, the patient, and the amount of treatment available. It is desirable that the patient should be treated not less than three times during the week, and daily treatment is preferable.

In Potts' disease the treatment is contra-indicated until at least six months have elapsed after the disappearance of all symptoms of active disease. Gentle massage, gentle respiratory and mild strengthening exercises may then be ordered, but all forcible stretchings of the spine should be prohibited.

**Flat-Foot.**—Massage and exercises aim at strengthening and developing the structures which maintain the integrity of the arch of the foot. The whole leg is included in the treatment, and active movements of inversion and plantar flexion are freely given. Massage also relieves the symptoms of pain and tenderness due to inflammation. In the earlier stages and in the less severe forms excellent results are obtained from the treatment.

**Talipes.**—Gymnastic treatment, including massage, may in some cases be sufficient to correct the deformity by stretching contracted muscles and ligaments and by developing the weakened and stretched structures of the opposite side. If operation is necessary the treatment is given afterwards to promote the symmetrical action of the opposing groups of muscles.

**Knock Knee.**—Satisfactory results are obtained by massage and gymnastics when given in the early stages of the deformity, before bony changes have occurred, and also after operation.

**Wry Neck.**—In mild and early cases of spasmodic torticollis massage, combined with exercises, has proved useful. Other forms of this complaint are treated by massage and exercises with good results, all movements being intended to correct the deformity by exercising and stimulating the stretched muscles and stretching those which are contracted.

#### Diseases of the Brain and Spinal Cord

**Paralysis from Cerebral Hæmorrhage.**—Massage may be commenced about three weeks after the hæmorrhage has occurred. The treatment prevents the degeneration of muscles and nerves, and possibly helps to set up bene-

ficial changes in the brain through stimulation of the peripheral nerves.

Passive, and later active, exercises also prevent deformity arising from contracture of antagonizing muscles. Gentle massage should at first be ordered three times a week. Later, passive joint movements should be added. Massage of the unaffected parts, to maintain their nutrition, may be given with advantage as soon as the patient's strength permits. Active movements for the affected extremities should be commenced as soon as any degree of voluntary power returns.

**Infantile Paralysis.**—Massage and passive exercises should be commenced as soon as the acute symptoms have disappeared in order to maintain the nutrition of the affected parts and to prevent deformity. Active exercises are commenced when possible. In order to obtain the best results the treatment should in all cases be continued for a considerable time, and in some until the patient has ceased to grow. If the muscles continue to respond, however feebly, to electrical stimulation good results may be expected, while in more severe forms of the disease atrophy and deformity are arrested by massage and suitable gymnastic treatment.

**Paralysis of Peripheral Origin.**—**Facial paralysis** Paralysis of the sterno-mastoid and trapezius muscles. Paralysis of the deltoid muscle. Erb's paralysis. Radial (musculo-spiral) paralysis. Paralysis of the ulnar nerve.

In all the above cases massage is indicated to maintain the nutrition of the muscles, so that they may be able to respond to the action of the nerves when and if the functional activity of the latter is restored. Passive joint movements are given to promote circulation and to stretch those muscles which, unopposed by those which are paralysed, tend to become shortened. Active movements are encouraged as soon as any degree of voluntary power returns.

**Progressive Muscular Atrophy.**—Massage and gymnastics, aiming at improving the patient's general health and the condition of the wasted muscles, have been employed with good results in these cases. The treatment should be gently carried out at first so as not to tire the patient.

**Chronic Transverse Myelitis. Disseminated Sclerosis.**—General massage is given in the above cases, with the object of improving the nutrition of the nerves and muscles and relieving symptoms of tremor and ataxy.

Soothing movements only should be employed over the spinal region. Exercises to improve the circulation and to promote co-ordination of movement are indicated.

**Locomotor Ataxy.**—Massage and exercises have proved of undoubted value in improving the

co-ordinating powers of patients suffering from locomotor ataxy.

General massage should be ordered, particular attention being directed to the spine.

Active exercises form the most important part of the treatment. At first simple exercises for the hands, arms, feet and legs in the half-lying position may be prescribed. The limbs are exercised singly at first, and later bilateral movements are given. The patient should watch each movement at first and try to make it as definite as possible. As co-ordinating power improves the movements should be carried out with the eyes shut and variations introduced in the exercises to make them more difficult. The patient is trained how to move the limbs and where to place the weight of the body in rising from a seat and in walking and turning to right or left. The treatment also relieves lancinating pains, heaviness in the limbs, numbness and other symptoms.

### Functional Nerve Diseases

**Chorea.**—Treatment by massage and gymnastics is given for chorea in order to allay muscular irritability, improve the tone of the muscles and promote co-ordination of movement. General massage may be ordered during the acute stage, but should then consist mainly of strokings in order to soothe the patient. As a rule it is well to postpone the treatment until the acute stage has passed. Exercises are given to promote co-ordinate movement. All exercises and movements are carried out slowly, and if the heart is weak the masseuse should be warned against giving any exercises which are likely to strain it.

**Paralysis Agitans.**—Massage and gymnastics do a great deal to alleviate the symptoms which mark these cases. To obtain the best results treatment should be carried out twice daily. The massage movements should be of a soothing nature and adapted to suit the differing conditions of the muscle groups. Passive followed by active exercises are given to strengthen the weak and stretch the contracted muscles, thus arresting deformity and helping to control the tremor. In the intervals between each treatment the patient should be directed to practise the correct position of the body and limbs in standing and walking, and also to control the tremor by methodical exercises performed in front of a looking-glass and by remaining still for as long as possible.

**Neurasthenia.**—General massage is prescribed for neurasthenic patients usually as part of the Rest Cure or Weir-Mitchell treatment. It is employed in order to improve the circulation, aid digestion and peristalsis, and promote the nutrition of the nerves and muscles. It should be ordered once, and in some cases twice, daily.

Half-an-hour is sufficient to begin with, and the time should be gradually increased to an hour. The best time for the morning application is from an hour and a half to two hours after the patient's breakfast. The second application may be given late in the afternoon, or between 8 and 10 p.m. if the patient suffers from insomnia. At this later hour it is usually advisable to prohibit abdominal massage, as it sometimes causes restlessness when given at night. Most attention should then be directed to the limbs and back. The massage should be very gentle at first and gradually increased in vigour and duration. Towards the end of the treatment the massage applications may be reduced to three in the week. In these cases it is better, if possible, that the massage should not be carried out by the nurse in charge of the case, as the daily visits of the masseuse cause a pleasant variety which is good for the patient.

**Neuralgia.**—Certain massage movements have a very soothing and satisfactory effect when applied along the course of the affected nerve or nerves. In addition the treatment aims at improving the circulation in the part and removing products of inflammation which may be present. The masseuse should be directed to give gentle massage at first for fear of a supervening neuritis.

**Neuritis.**—During the acute stage, marked by severe pain, it is generally thought that massage should not be ordered. It may, however, be used to prevent the rapid wasting of the muscles which accompanies some forms of neuritis. In these cases gentle strokings, frictions and kneadings may be applied above and about the affected parts, the area of the inflamed nerve being avoided. When the acute stage has passed massage is of the greatest value; all the different movements may then be carried out locally and along the spine over the origin of the affected nerve-trunk. Exercises should follow the massage.

**Sciatica.**—Massage and exercises are employed in certain cases of sciatica with, as a rule, excellent results. The treatment should be commenced as soon as the acute stage has passed.

**Lumbago.**—Massage is indicated here to relieve the pain and rigidity in the lumbar muscles. Later, active exercises involving these muscles may be prescribed.

**Writers' Cramp and Allied Neurosis.**—Daily massage of the whole arm, shoulder and upper part of the spine may be ordered. The manipulations should be very gently carried out at first, and of short duration, so as not to tire the patient. Active exercises for the muscles which antagonize those which are affected are given, as well as passive movements to stretch the latter. Good results are obtained, although improvement is usually very gradual.



**Insomnia.**—Massage for insomnia should be given in the evening, if possible at the patient's usual bedtime. The attention of the masseuse should in these cases be directed chiefly to the back and head of the patient, but massage of the limbs, especially of the legs, is usually necessary to improve defective circulation and to allay nervous restlessness. Should the sleeplessness be caused by indigestion, abdominal massage should be ordered in the morning, as massage of this part may have an exciting effect when given at night.

L. D.

### PHYSICAL EXERCISES

Physical training in the army connotes two distinct ideas, which, however, overlap to a certain extent. The first of these is physical education pure and simple, in other words, instruction in the orderly use of the limbs; the second is the maintenance of the muscular apparatus in a state of general fitness, that is, "in training," as this term is popularly understood. The former of these processes affects most prominently the earlier months of the recruit's military life; the latter persists throughout the whole of his colour service, and though its main primary intention is the maintenance of "condition," it has an important secondary effect in the direction of the higher education of the soldier.

Physical education is carried out, as already stated, during the earlier months of the recruit's military life. It consists in a number of attendances at the gymnasium, varying somewhat in the different arms of the service, intended directly to teach the raw lad the ordered use of his limbs. As in the case of all other education, it is merely a means to an end, a fact that must be prominently kept in mind, since gymnastic instructors are very apt to forget that the gymnasium is merely a school, and that its value depends not merely on the work done in it, but on the extent to which that work fits the pupil for the real exercise of his profession in after-life.

We have therefore, as in all education, to consider, first the raw material, secondly the finished article that it is desired to produce, and thirdly the means by which the former is to be converted into the latter.

The finished article, in other words the made soldier, is practically the same in all armies, the branch of the service being the same, but the raw material differs in different nations. This difference is partly the result of varying national character, and partly that of different methods of recruitment. The effect of the former has not been sufficiently studied, but that of the latter is too striking to be ignored. As is well known, the great armies of the Con-

tinents are recruited by a method of universal liability to service, tempered only by the proportion which the yearly contingent of men available bears to the numbers needed to maintain the fighting strength of the nation at a proper level. In Germany the former is so much in excess of the latter that a certain amount of selection can be made, whereas in France the opposite condition prevails. In our own case and that of the United States of America the army is recruited purely by voluntary enlistment. The results are shown not only by a difference in the nature of the training demanded, but also in the quality of the material that has to be trained. Since the nations of the Continent in all cases draw very heavily, though to a different extent, on the young male population, it is necessary for them to decrease the drain by limiting the length of the training, which in consequence becomes of a more intensive character. In addition this short term of colour service raises the age of enlistment, since it is imperative that the soldiers actually in the ranks at the outbreak of war should be fairly mature. Thus we see that though the liability to service begins at an age as low in some cases as seventeen or eighteen, the contingents are not actually called up until twenty or twenty-one, and in the case of Norway and Denmark not till twenty-two.

As a result the soldier when he commences his course of instruction has already reached the less receptive years of his life, which again necessitates a more rigorous method of training.

On the other hand, with voluntary service it is necessary to take the soldier at a comparatively early age, before, that is, he has settled down in regular employment. If this is not done, the military authorities have to compete in the general adult labour market, and to offer in consequence higher wages. If the man is taken young he is more receptive, but on the other hand, as is acknowledged in the yearly report of the Director-General of the Army Medical Service, he is in consequence physically immature. It is necessary, therefore, to retain him for a longer period with the colours to ensure there always being a certain number of mature soldiers in the ranks. This effect is enhanced in our army by the fact that so large a proportion of its numbers is constantly on service beyond the seas. It is worth remembering, however, that under any voluntary system, unless the State is prepared to raise the pay very considerably, the soldier must be caught young, and therefore before he is mature; as a consequence he must be taken on for a longer period of colour service than is the case where universal liability to service is the rule. This lengthened period of service permits of a more easily graduated system of training, which

therefore need not be nearly so intensive as in the short-service armies, with the further advantage that the recruit is at a more receptive age, both physically and mentally. The above remarks must not be taken as supplying any arguments for or against a voluntary system of enlistment, as compared with the universal liability to service that exists on the Continent. Such a comparison is not only uncalled for, but outside the scope of the present article. It is, however, essential to recognize the effect produced by enlistment on the nature of the raw material that has to be worked up eventually into the finished soldier.

The British recruit is, therefore, in the enormous majority of cases immature, and, since he has not settled down to regular employment, is, especially in the case of the older recruits, apt to be ill-nourished. He is, of course, free from deformity, and in addition sound in wind and limb. His general physical condition may be inferred from the *Report of the Director-General, Army Medical Department*, for 1910, which gives the following measurements as those of the average recruit—

|                                       |           |           |
|---------------------------------------|-----------|-----------|
| Height . . . . .                      | 66.3 in.  | (168 cm.) |
| Chest Measurement (minimum) . . . . . | 33.4 "    | (85 cm.)  |
| Chest Measurement (maximum) . . . . . | 35.8 "    | (91 cm.)  |
| Range of Expansion . . . . .          | 2.6 "     | (6.6 cm.) |
| Weight . . . . .                      | 128.8 lb. | (58 kg.)  |

A good rough rule for the estimation of physical efficiency is that the chest measurement should be about half the height, and the weight in kilogrammes should be equivalent to the height in centimetres in excess of one hundred. In the above case we see that the chest measurement bears a satisfactory relation to the height, whereas the weight (58 kilogrammes) is lower than the height in centimetres minus one hundred ( $168 - 100 = 68$ ). In popular language, then, we may say that the average recruit possesses a good framework, insufficiently covered, though there are, of course, many variations above and below the average.

In an army recruited on a voluntary system the quality of the recruit varies from time to time according to the state of the unskilled labour market, but the variations are not so great as one would *a priori* have expected. The general average remains very much the same, though the standards of height, etc., may from time to time have to be lowered to get the total number of recruits demanded. This affects only the fringes of the mass, so to speak, the great bulk of the men are, and for years have been, very much of the same quality.

Another effect of voluntary enlistment is to increase the number of recruits drawn from towns as compared with those coming from agricultural districts, unemployment being

always more prevalent amongst urban populations. Continental armies, on the other hand, contain a greater percentage of country lads, though in them the increase of townsmen, due to the gradual townward drift of the population, is also exercising an important effect.

The physical and mental differences between these two classes of the population exercise an important influence on the course of instruction that has to be pursued. The town lad is, as a rule, inferior from a physical point of view, since he has been brought up in less healthy surroundings than the country lad, and has had fewer opportunities of exercise in the fresh air. He is as a rule not so well nourished, a defect, however, that a few weeks of barrack life rapidly eliminate. On the other hand, he is both mentally and physically more nimble than the country-bred boy, qualities which, except in extreme cases, do more than merely redress the balance in his favour.

We now come to the second part of the subject, namely the finished article which it is desired to produce from the raw material just described, in other words the made soldier, of whom the type is the infantry private. The ultimate duty which this man has to perform, and for the execution of which his education is intended to fit him, is to kill, with cold steel or with bullet, his national enemies. He has incidentally other duties to perform, such as the custody of government property and warlike stores, appearance on ceremonial occasions, etc., but his real *raison d'être* is as I have just described it, a fact that instructors, more especially drill and gymnastic instructors, are apt to forget. It has to be remembered, too, that this ultimate duty has to be carried out in competition with his opponent, who is similarly instructed, and who possesses identical intentions, and that the thoroughness of his instruction will be treated by the most searching of examinations. Clearly since the correct performance of this duty has such an important personal and national significance its real nature should never be lost sight of at any stage of the educational process. To enable him to perform his duty efficiently the following physical qualifications are necessary—

1. Free movement of all the joints.
  2. Accurate co-ordination of all movements, so that hand and foot and eye may be trusted to work evenly together even in moments of excitement and after fatigue has set in.
  3. Uniform muscular development to a degree distinctly above that of the average man.
- These three items include all the preliminary education of the soldier; on them must be superadded his higher education, viz.—
4. The use of the rifle in shooting.
  5. The use of the bayonet.



6. The knowledge of the best method of surmounting obstacles, such as high fences, walls, ditches, etc., when encumbered by the weight of armament and equipment.

Lastly, he must be so "trained" that he shall be able to—

7. March long distances carrying a dead weight equivalent to about one-third of his body weight without undue disturbance of his physiological economy; and—

8. To cover short distances of, say, fifty to one hundred yards at top speed, even when loaded as above, with the minimum amount of cardiac and respiratory derangement. Here "education" and "training," using this latter word in its strictest sense, overlap.

The preliminary education occupies naturally the opening weeks, or months, of the recruit's life, and once accomplished need not be repeated. This stage corresponds to the learning of the grammar of a foreign language. Once this has been taught, the mere use of the language is sufficient to keep the knowledge up to date. The higher education persists to the latest moment of the soldier's colour service, since here, as in all other branches of knowledge, finality can never be attained. It is not necessary, in fact it is a great mistake, to postpone the commencement of the higher education till the preliminary period has been thoroughly completed. Here, again, just as in teaching a new language it is advisable to accustom the pupil to a colloquial and literary use of the new tongue before the details of the grammar have been thoroughly mastered, so it is wise, in the physical education of the soldier, to commence the higher education before the less interesting preliminary exercises have been completely taught. The beginner is thus enabled to see the object for which he is being educated, and the dry details of preliminary instruction are given a meaning which they would otherwise inevitably lack.

*Preliminary Education.* As already stated, the recruit is in the great majority of cases immature, and in a considerable number badly nourished. Before beginning any severe physical exercise it is above all things necessary to remedy the latter defect, and this takes, as a rule, some weeks. Since, at the same time, the lad is revaccinated immediately after enlistment, it is clear that for the first fortnight no "arm work" can be done. It is, however, quite possible during this period to carry out the first two items of the preliminary education, namely, the suppling of the joints and the co-ordination of movements, and also that part of the further education which consists in marching. I should personally be inclined to make a rule that no recruit should be made to perform any exercise entailing "strain"

for six weeks after enlistment, during which period his weight and physical development generally should be carefully watched. It is impossible to lay down any definite rule, though the correspondence between the height and the weight already referred to may be taken as a rough guide. This demands careful individual attention in the case of each recruit on the part of the medical officer. Experience will be a better guide than any actual measurements; the latter are undoubtedly useful, but too rigid a reliance on them may be misleading. During this period the general "training" of the lad should also be watched. The best method of doing this is to make him run a short distance, say one hundred yards, at a brisk pace. The pulse should be counted immediately before, and again immediately after the run, the difference noted, and the time taken to return to a normal rate recorded. If the training is doing good the actual disturbance will diminish, and the return to normal will be more speedy, as time goes on.

At the conclusion of this preliminary period it will be necessary to go on to the third item of the preliminary education, and at this stage exercises tending to encourage muscular development must be undertaken. These will of course entail, in some cases, a certain amount of strain, and will therefore demand careful watching, especially at first. There is one rule by which the propriety of all such exercises may be tested, and this rule is equally applicable at all stages of the soldier's physical education.

If any exercise, entailing strain, is one which the soldier may conceivably be called on to execute in the performance of his duty in the field, then it is a justifiable exercise, no matter how great the strain. On the other hand, any exercise which entails strain, and which at the same time consists of movements which it is extremely improbable that the soldier will ever need to perform in the execution of his duty in the field, is unjustifiable, no matter how slight the strain. This last rule cuts out a great many exercises in the various manuals which are mere posturing, without any direct educational advantage. It is often urged in support of these exercises that, though they are not directly useful, still they strengthen certain muscles which are concerned in the performance of certain military duties. Thus, for instance, I have heard the exercise called "span-bending" defended on the ground that it strengthens the muscles used in digging, a very important form of military activity. This statement is, in the first place, only partially accurate. The exercise strengthens, it is true, certain of the loin muscles which are used in digging, but it does not strengthen those of the arms or legs, nor does it harden the skin on the palms of the hands, factors which are of equally great

importance. In addition to this fault, however, the argument is essentially based on a fallacy. It cannot be too strongly emphasized that the only way to learn to do a certain exercise is to do it, and the only way to learn to do it well is to go on doing it. A man who actually digs exercises and trains, perforce, all the muscles concerned in that process, and it is only necessary to make the exercise harder, and the lift of the load greater, to attain to the utmost pitch of excellence of which the individual is capable. The performance of any complicated series of movements demands a most careful adjustment and co-ordination of antagonistic groups of muscles, and until this system of co-ordination has been thoroughly established there will always be a certain loss of power. Perfect economy of energy can only be achieved by practice. It cannot be attained by any indirect method of instruction, and the too prolonged practice of such indirectly useful movements will tend, as a matter of fact, to lead to waste of energy.

In this connection reference may be made to a class of exercises much practised in some systems of gymnastics commonly called breathing exercises. In the simplest of these the pupil is merely told to "breathe in" "until the chest is fully expanded," and then to "breathe out" quietly and steadily. The Model Course of Physical Exercises further lays down that this should be done about ten times at least twice daily, and "after it has been thoroughly acquired it can be combined with slow arm movements, which bring into play the auxiliary muscles of respiration." They are prescribed to be taken at "the end of a physical training lesson, in order to prepare for rest, and also to aid in the elimination of the carbonic acid accumulated by the repeated contractions of the muscles during the lesson."

Instruction in any movement, or series of movements, is only necessary when these have either never been performed before or have been improperly performed. The series of movements constituting respiration have presumably been performed by the recruit, on an average, fifteen times a minute since the moment of his birth, and efficiently to this extent at least, that after eighteen to nineteen years of the practice he is still sound in wind and limb. Clearly he must in that time have acquired the art of furnishing the amount of oxygen necessary for the due performance of such acts as his mode of life, very rarely indeed a sedentary one, has demanded of him. It may, indeed, be urged that he has not been in the habit of using his lungs to their fullest capacity, though this again is only true of boys who do not take part in the ordinary games of childhood and youth; and, since the average expansion of

his chest is equivalent to an increase in circumference of two inches, it may be gathered that he has made, in the great majority of cases, a sufficient use of his pulmonary tissue. Even supposing he has not done so the real remedy is not to cause him to go through a series of artificial movements, but to bring into play the normal stimulus to increased respiration, in other words, to increase the partial pressure of carbonic acid in his pulmonary alveoli. This can be done very simply by the practice of graduated "runs" of such length, and at such a pace, as to produce slight breathlessness. In this condition he will perforce expand his lungs to the extent necessary to produce satisfactory aeration, and in fact no hindrance, short of actual constriction of the trachea or compression of the chest walls, will prevent his doing so. There is, then, no reason why the healthy young adult of the human race should be treated in any way differently, in this respect, from the corresponding member of the equine genus. A young hunter is not put through a course of gymnastics in the stable yard to fit him for the extreme strain that will be put on his respiratory apparatus in crossing country. He is taken out, and ridden gradually farther and faster until the desired condition of "training" is produced. Similarly the young soldier does not need to be put through a series of exercises in the gymnasium or the barrack yard to improve his breathing. A smart double on the flat or across country, beginning with short distances and gradually increasing both the pace and the length of the run, is not only more logical, but infinitely more efficacious in producing the desired result. It may be well to refer to the last fallacy contained in the argument adduced in support of these exercises in the model course, namely, the necessity of eliminating carbonic acid that has accumulated in the course of gymnastic work. As already stated, the natural reflex to which deep breathing or hyperpnoea originates from the very partial accumulation of this particular gas in the lungs, and if this be lowered below a certain level cessation of breathing will occur. It is quite possible to produce this condition of apnoea by taking even less than ten deep breaths in succession (the number fixed approximately by the interdepartmental committee) when the conditions of the pulmonary exchange are such as not to necessitate that degree of ventilation, and it is quite possible to carry this process to a dangerous extent. Breathing exercises, such as described, are unnecessary in the healthy, and in the delicate they may have serious ill effects if not most carefully supervised. They have very wisely been omitted from the War Office *Manual of Physical Training* in the present edition.



*The Position of Attention.* One of the most important parts of the preliminary education of the recruit is that which teaches him to assume a correct position of "attention." The best definition of this position is contained in its name. It should be a position in which immediate attention can be paid to any order, and the necessary movement carried out without its being necessary to undo any previous muscular contraction. Clearly the posture must be an erect one, and the feet must be close together. If this latter be not the case the soldier cannot step off smartly and at once on receiving the word of command. It must be a position demanding the minimum of strain for its maintenance, therefore there must be no thrusting forward of the chest in a position of fixed inspiration, no bracing back of the knees, no throwing the weight of the body on the forepart of the foot, as in the older drill books. In our present manual the position is well described, and indeed conforms to the natural erect posture of the well-built healthy young man. A certain amount of muscular strain is inevitable, since the body is constructed of a series of segments, all of which are asymmetrically constructed in the sagittal plane, and each of which has its own special centre of gravity and its own basis of support on the segment immediately below.

In the simplest form we may consider the body as consisting of a dead weight (trunk, head and arms) resting at the hip joint on supports (the legs and feet). The head rests on the trunk with its centre of gravity slightly in front of its base of support (the atlanto-occipital joint), and has a natural tendency to fall forward, which, however, is easily counteracted by the tonic contraction of the muscles at the back of the neck. If the arms are allowed to hang easily from the shoulder their centre of gravity is practically transferred to the trunk, and the combined centre of the "dead weight" is then slightly behind the line joining the two hip joints, the bases of support. The whole of this weight, therefore, tends to fall backward, and this tendency is checked by the psoas and iliacus muscles and the *tensor fasciæ femoris*. Here again, however, the length of the lever concerned is so small (only a quarter of an inch) that these powerful muscles are not seriously involved. Passing down, we find that the supports are themselves jointed at the knee and ankle. The centre of gravity of the body above the knee lies farther forward in the sagittal plane than the point at which that plane is intersected by a line joining the points where the femora bear on the tibiæ. The distance is about half an inch, and the tendency to pitch forward has to be checked by the crucial ligaments, assisted to a slight

degree by the calf muscles. It is important here to note that the *quadriceps extensor* is not concerned in the maintenance of the natural erect posture. In the old position of "attention," in which it was directed that knees should be well braced back, this rule was transgressed. The anterior of the thigh should feel soft and relaxed in the modern position of attention. Since the *quadriceps extensor* is one of the most important "marching" muscles, it is easy to understand how important it is that it should be spared the strain of continuous contraction when the man is standing on parade. The weight of the entire body above the ankle falls well in front of that joint, and it is here that the chief muscular strain is involved. The soleus muscle is in a constant condition of contraction as long as the erect position is maintained. It is increased if the weight is thrown unduly forward, as in the old position of "attention," and not supported evenly between the forepart of the feet and the heels, as in the new regulation.

The preliminary education of the recruit has chiefly to be directed, in the case of the country lad, to the improvement of co-ordination and making the joints pliant. The ordinary lad from a rural district is in the habit of keeping all his joints in a state of semi-flexion, especially those of the lower limbs. The town lad is deficient in muscle, and in his case, after a week or two of barrack messing, much less actual teaching has to be done. In both classes, however, it is necessary to teach the recruit to carry out orders promptly to the word of command, a very important item in the elementary education of the soldier.

The higher education of the soldier consists in teaching him to use his weapons, and to convey himself and them along the road or across country. The use of the rifle is carried out on the range, and therefore is not usually included under the heading of physical education, though as a matter of fact it is so. The use of the bayonet is one of the most highly specialized departments of physical training and its discussion would carry us beyond the scope of this article. The most important of all branches of the higher physical education of the soldier are marching and the surmounting of obstacles. The former is the first in logic and in importance. On the proper knowledge of how to march, carrying a heavy load equivalent to at least one-third of his body weight, the whole value of the infantry soldier depends. An army which cannot march is unfit for all aggressive movements, and is perforce confined to a defensive role, in other words to ultimate defeat. Marching can only be taught on the road. No amount of training in a gymnasium can teach a man how to walk,

much less how to march, which entails a far more severe exertion. Marching in a progressive manner is the only way in which the art of marching can be learnt.

On the other hand, the overcoming of obstacles can, partially at least, be taught in the gymnasium, and the higher education of the soldier inside this building should be directed mainly to this end. The use of the horizontal and parallel bars and other apparatus is of importance only in as far as it assists in this, and practice on these should be carried even to the extreme of vaulting and "pulling up" in full fighting order. What may be termed "ornamental work," even, is justifiable with these pieces of apparatus, since it encourages emulation and is interesting. Care must be taken to avoid injury in the case of the more clumsy, but this must consist more in affording assistance and support, and in careful progressive training, than in absolute exclusion of any particular feat. The conclusion of this part of the course, if indeed it is permissible to predicate finality of a system that can never really come to a real end, must be carried out in the open "across country." The finished infantry soldier should be able, in the Great Duke's words, to "go anywhere and do anything," however rough the ground, even when encumbered with his arms and ammunition, with the minimum of cardiac and respiratory distress possible.

Marching and the overcoming of obstacles do not, however, satisfy all the demands that may be made on the soldier. After all, the ultimate conclusion of his training is "fighting capacity." The chief characteristic of this is personal emulation, since success is dependent on personal superiority over an antagonist. This can be taught best by boxing or single-stick fighting, though the personal element enters also into all games of a competitive nature, such as football, hockey, etc.

I have said nothing so far about any system of physical education. Such systems exist, however, and have a very definite value. At the outset I compared physical education to the learning of a new language, and just as in all new languages a new grammar and a new vocabulary have to be learnt, so also in physical education. Here the vocabulary is represented by muscular contractions, and the grammar by certain set exercises grouping these together in the form of ordered movements. It is to be noted in the first place that the vocabulary is not new, especially in the case of young healthy adult males. It is, however, limited in many cases, and needs to be extended. Neither, again, is the grammar quite new, though here the limitation is more marked than in the previous case. In other words,

the recruit has not as a rule used fully all the muscles of his limbs, and, when using them, the movements which he has made have been rude and ill controlled.

The necessity of a system will depend to a great extent on the use that the recruit has made, prior to enlistment, of ordered movements. In some cases a great deal of teaching is needed, in others it is only necessary to add a few finishing touches.

It is to be noted that all formal systems are of continental origin, for instance, those of France, Sweden and Germany. There is no indigenous British system of physical education, though foreign systems have been widely adopted. The reason of this is important. In Great Britain, as the result to a great extent of our national customs, the practice of games and athletics has been common to all classes, not limited merely to those at the richer or more aristocratic end of the social scale. The physical education of the nation has been carried out on every village green, where the young squire and the village butcher played cricket or football together. The recruit of the eighteenth and early nineteenth century did not need physical education in the sense of having to enlarge his vocabulary of movements, and the grammar was taught him on the drill ground, where he was instructed to arrange the constituent movements in an ordered sequence. Amongst the continental nations this was not the case, and when universal service was introduced, and it became necessary to draw more largely than before on urban populations for recruits, some artificial system of physical education had perforce to be introduced to teach the masses of the population the ordered use of the limbs. In our country the gradual town-ward drift of the population has had, though to a much less extent, a similar effect, but at the same time such a formal system is distinctly opposed to the national genius.

In our army we have adopted the Swedish system, and I think wisely. As a method of teaching the grammar of movement it is excellent if carefully watched, its greatest defect being that a lazy recruit can go through his exercises without any real purposeful muscular contraction. On the other hand, the exercises are free from all danger of inflicting strain, except in a very few cases. As a system, then, I consider the Swedish the most suitable for military purposes, up to a certain point. It must be remembered that man may learn grammar for years and yet not be able to use the language concerned fluently in debate or conversation. In the same manner a man may work for years in the gymnasium and still be helpless as a soldier when it comes to a long



march, a long-range-fire fight, or a desperate bayonet charge. The only system which can help towards the higher education, and give him the nimble use of his muscles, is the British system of games. It is interesting to note that in the continental training manuals games are taught as an actual part of the training, and the tendency in this direction is distinctly growing. It is fortunately unnecessary for us to include in our manual a series of rules for the game of association football, illustrated by appropriate diagrams, showing how the men should be placed in the field, as is done in the last edition of the German manual. The knowledge of games is fortunately sufficiently widespread amongst all classes of the population for such elementary instruction to be unnecessary.

*Conclusions.* The physical education of the British soldier should begin with the simpler movements of the Swedish system, contained in the official manual, supplemented by short and easy marches, and, after a fortnight, say, by short runs, carried to an extent sufficient merely to cause slight dyspnoea. The movements may be made more complicated, all strain being still avoided, and the marches and runs lengthened, until, at the end of six weeks, hard work may be begun. The most important line now to be followed is that which leads to the surmounting of obstacles, in which the preliminary teaching consists in vaulting, pulling up on to the high bar, balance exercises, etc.

The marching should be still continued, some slight, but gradually increasing, weight being placed on the men. Running should now be practised across country, suitable obstacles being chosen. All racing should be strictly avoided. Boxing, single-stick and quarter-staff play can also be commenced, every formal lesson being followed by a few minutes of loose play. Bayonet fighting should come in rather later. The eventual test of proficiency should be the accomplishment of a fair march, in heavy marching order, followed by an attack over moderately rough ground, carried out against natural targets with ball cartridge.

All through the course it should be kept in mind that the soldier is intended to be an athlete, not a gymnast, and, moreover, an athlete whose physical activities should be such as to make him a reliable lethal instrument in the hands of his commander. C. H. M.

## HYDROPATHIC TREATMENT

Although in most of the sanatoria which go under the name of *hydropathics* treatment is by no means restricted to the use of pure hydropathy, but includes the use of

massage and electricity, hydrotherapy alone will be dealt with in this article.

So far as hydrotherapy itself is concerned it is very needful for the medical man employing it to be in some degree conversant with the physical and chemical qualities of water.

Much of the value of water as a therapeutic agent is dependent on its remarkable *flexibility*. It may be applied as a solid or a liquid or in the vaporous state. It may be used cold or hot, up to 120° or even 125° F., as pure spring water or with naturally existent or artificially added mineral constituents. It may be naturally gaseous or aerated to a high degree—artificially—by means of CO<sub>2</sub>. It may be applied merely under ordinary atmospheric pressure or under greatly increased pressure of artificial origin and to such a degree that if delivered through a narrow orifice a blister may be raised on the patient's skin.

No method of treatment is so old-established as that by water, and none is so universally employed either by civilized or barbaric races. The pure hydropathist makes no demand on nature for specially mineralized springs—he has his “plant” wherever a water supply of any magnitude exists, and it is by this universality and ease of application that hydropathy makes special appeal to the medical practitioner, as compared with balneology which may only be employed where specially mineralized springs exist.

Many practising physicians who would be indignant were they termed “hydropaths” are unconsciously so. Where can be found a more efficacious hæmostatic for profuse uterine hæmorrhage than hot water? Are not such remedies as a hot bath in convulsions of childhood, cold sponging in fevers and cold water enemata daily, nay hourly, employed?

Let us now consider as briefly as possible some of the elementary principles governing the application of water as a curative agent.

In man, as in all warm-blooded animals, two factors tend to maintain a constant bodily temperature.

1. Physical regulation, causing greater or less heat loss.
2. Chemical regulation, dependent on metabolic changes lessening or increasing heat production.

The chief seat of physical regulation is the *skin*, which has been well described as the largest gland of the body. For all intents and purposes it consists in a secondary hyperamia following on a cold application, or more accurately on the withdrawal of the cold, known as the *reaction*.

On the occurrence and degree of the reaction depends very largely the therapeutic efficacy of a water application. It may be enhanced in various ways, as, for instance, by the previous

application of heat—to cold—by the use of massage or friction, such as mitten-rubbing, or by the addition of brine or carbonic acid gas to a bath.

When using cold baths, or indeed any bath at all the temperature of which differs markedly from the skin temperature, it is absolutely necessary to bring on an adequate reaction.

Speaking generally, if benefit is being derived the skin of any patient reacts better at the end of a course of baths than at the beginning. It usually acquires the faculty of reacting.

It has been shown by Winternitz that the clothing forms a sort of *thermal zone* around the body, the temperature of which is, normally, about 89.5° F. (32° C.). It follows as a natural consequence that, if any reaction is to take place, the bath or hydropathic application must be some degrees above or below 89.5° F. An application only five degrees above or below will induce a reaction if applied together with friction, or if the water be under pressure, as in a douche.

Plunge a man into cold water at 50° F., and he will shiver, catch his breath and then take deep inspirations. The skin will show pallor and even the phenomenon known as "goose-skin." In a few moments, however, he will feel a very comforting glow of heat, and, in a measure, the degree and rapidity of onset of this glow depends on the bodily health. Sooner or later this is a *sine qua non* if baths are to be taken with benefit, or, indeed, freedom from harm. In some people this reaction occurs over-early, is brief and evanescent in character, being followed by fresh shivering. In such cases only with the help of previously applied heat or the use of friction and massage can baths be safely continued. Generally speaking, in feeble folk the reaction is delayed. We may summarize the principles governing reaction, as laid down by Winternitz, as follows—

The *secondary glow*, or warming of the body, is the surest sign and most marked symptom of reaction, and is recognized specially in alteration of innervation, circulation and metabolism, dependent on the following factors—

1. The absolute amount of heat loss. The colder the application the greater the reaction, in a measure.
2. The more rapid the loss of heat the quicker the onset of the secondary glow.
3. Protracted gradual heat loss is followed by slow and moderate reactive increase of temperature.
4. The quickest and best reactions are obtained by the brief use of cold applications on a patient who is hot.
5. A combination of cold with mechanical stimulus leads to a pronounced reaction.
6. The natural reaction is increased if the

patient works or does exercises of some sort after a bath, while rest will lessen the reaction and make it slower.

7. The internal use of alcoholic or other stimulants promotes reaction, which demonstrates the soundness of the administration of a hot alcoholic drink after a wetting.

8. The reaction will vary in direct proportion to the extent and intensity of the thermic stimulus to the patient's nerves, or to the extent to which his thermogenic centres are excited.

The *chemical effect*, or the action of baths on metabolism.

The lower the temperature of the bath or application, the more vigorously does the heat production in the body or the heat loss proceed. Most of the heat is lost in the first minute of the bath, and the amount then gradually decreases to a constant.

If no reaction takes place the heat loss by radiation, conduction and evaporation continues to increase even after the bath, while the heat production is lessened also.

If there be a proper reaction the loss by radiation and conduction is scarcely noticeable, and that due to evaporation is much larger. Short cold douches and baths increase the energy and fitness of the bather. The heat loss is really small, and there is a marked increase in the metabolic changes of the body due to the movements partly set up by the bath. The heat produced by muscular activity thus counteracts very largely any cooling effect. There is, however, no instrumental or accurate method of estimating the measure of increased metabolism.

Shivering, and the active movements of the muscles involved, must be looked upon as a protective agent against cold. The tonic effect of such cold baths is not only seen in the patient's muscles, but often in the central nervous system, and is evidenced by improved will-power and morale of the patient.

After cold baths albuminuria is met with in some individuals, who are disposed to it, especially in adolescence (cyclic albuminuria).

*Technique of Baths, etc.* Current terms for temperatures commonly employed:—Very hot, or hot as can be borne, 115–125° F. (over 46° C.). Hot, 100–103° F. (37–40° C.). Warm, 90–93° F. (32–34° C.). Tepid, 70–80° F. (21–27° C.). Cool, 59–64° F. (15–18° C.). Cold, 40–50° F. (4.5–10° C.). Very cold, 25–30° F. (–4 to –1° C.).

*The Foot Bath.* The foot bath is one of the most valuable and frequently used simple hydropathic procedures. *Hot* (110–112° F.), it is useful in the early stages of coryza and for any congestive headache. Duration ten to fifteen minutes. *Cold* (40–50° F.), useful in insomnia from poor circulation and cold feet.



The effect enhanced by brisk friction with the hands or rough towel. Duration two to three minutes.

A tub, pail or ordinary wash-hand basin and a few gallons of water are all that is necessary; the depth of the water for the hot bath should be eight to ten inches. By the use of it the pain of an ankle sprain is lessened and the part made more amenable to massage.

*Mustard Foot Bath.* The effect of the hot bath is enhanced if a breakfast-cupful of mustard bran be added and stirred well into the water.

*The Sitz Bath.* A specially constructed and fitted-in sitz bath is preferable but by no means necessary. The ordinary domestic hip bath will suffice in an emergency. The patient sits in the water with his thighs resting against the lower part of the abdomen—knees and legs, etc., warmed by a blanket covering—but it is preferable to have the feet in a foot bath or on a hot water bottle.

A damp cold cloth envelops the patient's head.

The hot bath should commence at 104° F. and gradually be raised in temperature to 115° F. By its means the blood is strongly diverted from the abdominal viscera, the pulse quickened and the blood pressure lowered. Duration fifteen to twenty minutes. The temperature must be maintained by adding hot water gradually.

This bath is useful in delayed and painful menstruation, in most painful abdominal conditions, and relieves spasmodic retention of urine and tenesmus.

*The Cold Sitz Bath* (45–50° F.). A tonic measure specially useful in constipation, along with spouting or pouring of cold water against the abdomen. It is also useful in amenorrhœa, in piles, perimetritis and impotence.

These cold baths must be avoided if there is any cystitis or tendency to it; seminal emissions are often aggravated by them, though they are frequently prescribed to patients so afflicted. A very brief dipping sitz bath (at 50° F.) is very grateful and stimulating in the mornings to women who have been subject to chronic metritis, menorrhagia and metrorrhagia, with secondary anæmia and "slackness," and at the time of the menopause.

A somewhat longer cold bath—three to five minutes, with pouring or sponging of water down the spine—is a very bracing treatment (which should be followed by ten minutes' brisk walk or exercise of some sort).

*The Mustard Sitz Bath.* This is a more powerful derivative than even the hot bath, and is employed with effect in arrested menstruation and some painful pelvic conditions.

*The Half Bath.* The usual shallow household bath is used, about half full of water from

50° to 60° F. in temperature, according to the effect we desire to produce. The patient should sponge the head with cold water or wrap it in a damp towel, and then, entering the bath, sit down so as to be half immersed only. The shoulders are temporarily immersed, but the sitting posture is resumed and an attendant freely douches the upper part of the body.

Again the patient lowers himself to the recumbent position while the chest, abdomen and limbs are briskly rubbed under the water by the attendant's hands or with friction gloves. The bath is now finished and the patient may be wrapped in a warm sheet and dried.

This bath is stimulating, and a good reaction is always encouraged by the friction. As a rule, the warmer the temperature of the water the less the stimulating effect of the bath. The quicker the reaction, the greater the amount of heat abstracted.

This bath is a valuable antipyretic, but where the patient is weak and collapsed should be very brief in duration, while it is often good to precede it by giving the patient a warm stimulating drink.

*Indications.* Cool baths, of from 55° to 60° F., of from three to four minutes' duration, may be used regularly in the morning as a hygienic for people in ordinary health, and, especially when combined with friction, are exceedingly pleasant and refreshing.

In digestive disorders, such as gastric catarrh, irritation or atony and hyperchlorhydria, this bath, combined with hot and cold abdominal douching, is very beneficial. The douching may be done by the patient himself, using an ordinary tin or basin.

In spinal conditions the temperature of the bath should be around 60° F., and if the lesion is an irritative one, such as ataxic paraplegia, chorea gravis or paralysis agitans, the water may be even warmer.

*The Plunge Bath.* The temperature of the water should be from 45 to 50° F.; the duration from one to three minutes. The bath should be only about half full of water, so that the patient may splash and move about freely. Both circulation and respiration are markedly stimulated by this bath. The patient should feel warm and comfortable afterwards from a good brisk reaction. Previous warming in a hot-air or electric-light bath of course promotes this result.

*Indications.* Cool and plunge baths are of service when it is desired to cause general stimulation without lowering of temperature. While the brief exposure to cold water is primarily stimulating, a secondary sedative effect is induced, especially if the patient is not dried but goes back to bed with the skin wet.

*The Full Cold Shallow Bath.* An ordinary

household bath—as in the half bath—is used, some six feet long by three wide. The water is cold, from 36° to 40° F., and a fairly low temperature should be maintained throughout by running in fresh water the whole time. The duration is brief—not more than one minute. Having previously wetted his head, as before mentioned, the patient steps into the bath, completely immerses his body once or twice and then gets out. A brisk reaction is induced, with marked general stimulation. The respirations are much quickened, sometimes to the extent of gasping, and the general and cutaneous circulation is also much stimulated, the skin being reddened.

In robust patients this bath is used as a sequel to a hot pack or vapour bath; if followed by a half bath at 50° F. the procedure is distinctly antipyretic in character. The cool half bath seems tepid to the patient by comparison with the cold full bath. If the patient be debilitated or exhausted this bath is not suitable and may be very harmful.

*The Drip Sheet.* The patient having been previously moistened or wrapped in a damp towel, stands in a warm shallow foot bath. A sheet (two to three yards) folded lengthways, is drawn through cold water (40–50° F.) and wrapped about him in the following manner:—The attendant, approaching the patient from the front, unfolds a portion of the folded border and fixes the free edge of the sheet under the right armpit. He then passes it across the patient's chest, below the left axilla, around the back and over the right shoulder, so as completely to envelop him.

The patient's entire body is then vigorously smacked or chafed through the sheet, so as actively to stimulate the skin. The skin becomes red and the peripheral circulation is rendered increasingly active and respirations are quicker and deeper.

The duration of the drip sheet varies—the attendant should at any rate keep rubbing until the patient feels warm. The effect of the procedure is enhanced and a good reaction more quickly obtained if the patient is previously warmed for a few minutes in a Turkish bath or electric-light cabinet. The use of the shallow warm foot bath is particularly important when the patient is weak or sensitive. On a good reaction being established the patient should be thoroughly dried and allowed to rest for some time on a couch or bed well covered.

As a rule a good reaction is sooner obtained if cold water is used rather than tepid or warm. Under ordinary circumstances there is very little antipyretic action produced by the drip sheet, but if it is desirable heat abstraction may be caused by freely re-wetting the sheet with cold water and by the bath being somewhat prolonged.

If before being applied the sheet is wrung out of the cold water and applied merely in a moist condition it is known as the "cold rub," or it may be preceded by a sheet wrung out of hot water and applied for half a minute.

*General Indications.* This application is a general stimulant and invigorating procedure, which quickens the circulation and improves the metabolism. It is of great service in catarrhal conditions of the digestive tract, and in patients with feeble circulation and with defective metabolism. It should not be employed in arterio-sclerotic conditions.

*The wet pack* is applied as follows: a blanket two and a half yards square is placed on a suitable couch or stretcher bed, and upon this is laid a coarse linen sheet wrung out of water at 48° to 50° F.

A wet compress having been placed around the patient's head, he lies down on the sheet, which is wrapped around him carefully in the following manner. The arms are raised above the head and one half of the sheet drawn across the body, its upper portion tucked alongside the trunk and the lower between the lower limbs. The arms are brought down to the side of the body, and the other half of the sheet so arranged as to include the arms, its border being tucked in along the opposite side between the arms and the legs, so as to prevent the two skin surfaces from coming into contact. The blanket is then brought together at all points, particular care being taken to cover the neck and the shoulders. The blanket is usually equal to one and a half times the patient's girth and serves to retain the heat. It should be pretty firmly wrapped round the patient, so as to restrict the movements of the limbs without causing discomfort. A hot water bottle should be kept applied to the feet.

The surface of the body is at first strongly stimulated by the application of the sheet and circulation and respiration are quickened. Any sensation of cold usually disappears in about a quarter of an hour and a sense of warmth and comfort is felt. The blood-vessels of the periphery dilate, whilst the pulse is retarded and a sense of drowsiness induced. Perspiration gradually comes on, varying in degree with the duration of the pack. A marked antipyretic effect is obtained if the pack be changed frequently.

*Cooling Trunk Compress.* A blanket just broad enough to reach from the axilla to the hip is spread across the bed, with a waterproof sheet of like size spread beneath. Upon these six to eight folds of a cotton sheet wrung out of cold water is laid, being of nearly the same breadth and long enough to embrace the trunk with the arms excluded and well overlapped in front. On this the patient lies down stripped,



and the sheet is brought around and tucked tightly under the flanks, each in turn, the blanket in like manner, and the waterproof over all. A hot water bottle to the feet and cold cloth to the head are then applied and the patient's lower extremities covered up.

This application has a very marked antipyretic effect, especially if frequently renewed. In febrile conditions in which the use of drugs seems to have very little effect on the pyrexia, this application has been found in the author's experience to bring the temperature down several degrees in a few hours and render the patient much more comfortable. It is especially valuable in the feverish attacks of children due to gastric disturbance, and has been found to be of service in acute pneumonia. The antipyretic action is enhanced by renewing it frequently, but it may quite well be left on for four or five hours or even all night without changing. It often induces sleep where it has been previously absent from pain and discomfort.

*Douches.* A douche consists of a single or multiple column of water which is directed against some portion of the body.

The three chief points to consider in connection with a douche are—

1. Temperature of the water—generally 35° to 70° F.

2. Pressure under which the water is discharged—ranging from ten to sixty pounds per square inch. Gravity or mechanically arranged pressure may be employed.

3. The volume of the douche—depending on the size of the orifice from which it is discharged. Half an inch is a common size, but the descending or gravity douche is sometimes as large as two inches. The filiform douche—not often employed—is extremely minute. A pressure gauge and thermometer is always required at the point of discharge from the supply pipe and what is known as a “mixing box.”

Among the most commonly employed douches are the following: horizontal jet, percussion, rain, horizontal and vertical, fan, Scotch and filiform. Local douches may be applied to the liver, spleen, abdomen, perineum, or indeed any part of the body. The douche must be regarded as one of the most powerful stimulating applications in the whole range of hydro-pathy.

*The horizontal douche*, one of the most useful forms, may be employed in the form of a single jet, or the stream may be broken so that the water is discharged in a series of impacts like bullets, or the water may, by means of the attendant's finger or of a mechanical device, be spread out like a fan. Usual size, half an inch. Where the stream is actually broken, as mentioned above, the douche is known as the

percussion douche; the water is under higher pressure than usual, and owing to the more stimulating effect a higher temperature may be employed, a point of some moment where the patient is disposed to shiver after a cold douche.

*The rain douche or spray bath* is a very common hydropathic appliance in use, especially for a morning “dip.” The pressure employed is not usually very high. The holes for discharge are so small and numerous that they are apt to become blocked up by corrosion or dirt.

*The Scotch douche*—a horizontal one—hot and cold alternately, is much used in anæmia for the spine, and in sciatica on the area affected.

*The Aix and Vichy Douches.* These are now widely employed at all watering-places and most hydropathics and take their names, respectively, from the well-known spas. Both consist in douche massage—a warm spray being kept on to the part which the masseur is dealing with—usually at a temperature of 105° to 108° F.

*The Aix douche* is the more localised of the two, being administered usually by two attendants while the patient sits on a stool. A continuous needle spray is directed against the spine, while a warm douche conveyed by a flexible pipe over the shoulder of one of the attendants plays on the affected part. This may be followed by a hose or Scotch douche, and the bath terminates in a needle spray, carefully graduated from warm to cold according to the requirements of the particular case. As a rule the whole bath lasts twenty minutes. It is useful in a variety of affections, chief among which are gout and rheumatism, rheumatoid arthritis, lumbago and sciatica, auto-toxæmia, obesity, etc.

*The Vichy douche* closely resembles the Aix, but the patient here lies on a canvas support or rubber mattress while massage is administered under a spray douche from a series of brackets pierced with pinholes which are suspended over the table or canvas support on which the patient reclines. The bath lasts about twenty minutes and finishes up with a general spray. The effect is often enhanced by previous use of the Turkish bath or of an electric-light bath, but this is only suited to patients of a robust type.

*The filiform douche* consists of a very small jet of water, forced under great pressure through a small hole capillary in character, so that the water vaporizes a short distance from the point of egress. It is a strong counter-irritant, so much so that it may induce bleeding. It may be applied for from two to ten minutes, and is a useful means of applying counter-irritation over the spine.

*Fomentations and poultices* are well-known

and long-used methods of giving what is practically a local bath to the skin when there is any inflammatory condition existing in the skin itself or in the structures covered by it. The combined warmth and moisture dilate the blood-vessels and cause a local hyperæmia in a broader area than that affected by the previously existent inflammation by increasing the collateral circulation, and also relieve the pain. Inflammatory processes are thus checked, sup-puration aborted, etc.

Discrimination is highly necessary in the employment of these applications, particularly in skin conditions. While *acne indurata* and *herpes labialis* are restricted by means of them, *impetigo contagiosa* is made worse. While the formation of an abscess is often prevented, if it has already formed the application of such local heat as a fomentation or poultice tends to bringing the pus nearer the surface, or "to a head," as it is vulgarly termed.

*Poultices* are made of various substances, chief among which are bread, linseed meal, oatmeal and starch, while sometimes charcoal and yeast are used. Each has peculiar advantages. Linseed and oatmeal are very similar in character, they are compact, slightly porous and retain their heat and moisture well; to some skins linseed is rather irritating. Bread poultices, while more porous, also cool more rapidly and dry easily; starch poultices are very soothing, especially to skin inflammations, and retain their heat for a considerable time.

In making poultices it is necessary to have an adequate supply of boiling water at hand and the other materials to be employed. A small quantity of water should be poured into a previously warmed bowl and the linseed meal, etc., added until the mass acquires a doughy consistency, entirely free from lumps. This is then spread on a warm piece of old linen or calico, the edges being turned in to prevent the poultice running over. It is to be noted that the meal is added to the water and not vice versa, otherwise an even consistency in the poultice mass will not be obtained. All the manœuvres should be carried out as quickly as possible, so that the materials do not get cool.

To make a *bread poultice* some stale bread is cut up into thick slices, boiling water is then poured over them and they are soaked for a few minutes, or the mixture may be simmered in a saucepan. The bread is then strained and beaten up into a paste and spread over the fabric used. In making *starch poultices* cold water is first added to the starch to make a thin paste, and then boiling water poured over this and the mixture stirred until a suitable consistency is reached. *Bran poultices* have some advantages from the point of view of lightness. The bran is first placed in a bag

and sewn up and then boiling water poured over it.

*Mustard Applications.* Although not, strictly speaking, hydropathic in nature mustard applications may well be considered in this section. In making a mustard pad a large tablespoonful of mustard for each pint of water, or a breakfast-cupful of mustard bran to the same amount is used. The mustard and water is stirred for one minute and allowed to settle for a similar time, and the cloth is then wrung out of it. As an alternative method, especially for skins that are not over-sensitive, a paste is made of mustard bran and spread over the face of a hot cloth with a thin layer of muslin over it. If no mustard bran be immediately obtainable a very good substitute may be made by mixing oatmeal and table mustard in equal proportions. One of the simplest ways of making a mustard plaster is the following, as advised by Whitla.

A large tablespoonful of mustard is put into a breakfast cup and cold water added so as to produce a soft uniform cream, not quite so fluid as to pour out readily. A sheet of paper is procured of such thickness as to allow the more fluid part of the cream to soak through—newspaper does quite well. This is laid on a smooth surface or table and the cream turned out on it and spread on the centre. The circumferential parts of the paper are then folded over so as to make the sinapism a suitable size, and a covering piece of paper cut out to finish. This sinapism can easily be prepared in a minute's time and is an excellent form of counter-irritation. It is best kept in contact with the skin by means of a flannel bandage. As regards the duration of its application, it will depend on the sensitiveness or otherwise of the patient's skin. Five minutes will be enough for some people, others will tolerate a sinapism so made for twenty minutes or more.

*Wet Compresses.* A wet compress usually consists of a swansdown or linen fabric wrung out of water, which may be hot or cold, and applied to the surface of some part of the body. It is then usually covered with some dry and preferably impermeable material to prevent loss of heat by evaporation, otherwise it will rapidly become dry and useless.

The time for which a compress is applied will depend largely on the effect which is desired. As a general rule cold compresses should be changed as soon as they get warm, and hot compresses as soon as they get cold.

*Throat Compresses.* A very common domestic application. The handkerchief so commonly used is very little use. A piece of lint or coarse linen should be cut out into a suitable shape, with tongues or projections on either side to run up behind the angle of the jaw.



For tonsillitis and associated pharyngitis a compress as follows should be used: a piece of swansdown calico long enough to reach from ear to ear, passing under the chin, is folded into a fourfold layer. A piece of flannel, eight inches by twenty-four inches, is provided with a slit for each ear, these bandages are fitted to each patient. The compress, having been wrung out of water at 15° C., is laid upon the flannel bandage which is to act as cover. The wet compress is now placed under the chin and the covering flannel carried over the head and fixed with safety pins. Care must be taken not to make the application uncomfortably tight. So applied in early inflammatory conditions a cold compress will go far to subdue and check the inflammation.

T. D. L.

### VOICE PRODUCTION AND BREATHING

It is recommended before training commences that a careful examination of the nose, mouth and throat of the pupil should be made, and adenoids, enlarged tonsils, or any obstruction whatever in the nasal passage should be removed.

Mouth breathing is sometimes only a bad habit, but generally it is caused by some stoppage which interferes with proper breathing. A mouth breather cannot be a good speaker. He may articulate correctly, but he cannot sustain connected speech at length.

Breathing exercises should be based on a natural educational method, and be performed when the pupil is fresh, either outside in pure air or in well-ventilated rooms and not immediately after a meal. Such exercises are very tiring, and should not be kept up for more than ten minutes at a time. For the purposes of voice production, as for anything else, general physical fitness is a first condition; and it will, as a rule, be a good plan to make the breathing exercises a part of a good general system of physical training.

For children, nothing better can very well be devised than Ling's system of Swedish exercises, always remembering that in this country we have invaluable aids to all this as regards both juveniles and adults in our national outdoor games. One of Sweden's greatest educators and a personal friend of Ling said to the writer in discussing this subject, "The best physical training in the world is to be found in the outdoor games of the great English public schools." These games are undoubtedly a national asset, but, unfortunately, all the children and people in this country cannot engage in them under ideal conditions, hence the usefulness of such systems as Ling's which are based on sound physiological principles. The 1909 edition of the syllabus of physical

exercises drawn up for the Board of Education is a modification of the Swedish system and can be strongly recommended. The exercises are very varied, easy and natural, and cannot possibly lead to undue strains. Moreover, the correct positions and movements are fully described and illustrated.

They should be practised in good air and easy-fitting clothes.

*Breathing Exercises* consist of various movements of the arms acting in rhythm with deep respiration, the essential feature being the respiratory act, and the arm movements are simply an aid to expansion and contraction of the chest. The changes in the arm movements give opportunity for directing the exercise to any part of the chest required. Forced expiration should not be practised, as it is likely to cause dilatation of the heart, whereas quick inhalation is often very beneficial. Inflation of the lungs to their utmost capacity is not recommended, nor is holding the breath beyond the time of a momentary pause. Natural, easy control and good development without loss of elasticity are the objects to be aimed at. The exercises recommended in the scheme are practised in the upright position, but it should be stated that, with very young children, lying flat down on the back is a most useful method of instruction, as the teacher can kneel down at the side of the child and guide, and estimate the completeness of the respiratory acts, whereas in the standing position this cannot very well be accomplished without disturbing the stance of the pupil. Inspiration should always be taken through the nose. Expiration can be both through the nose and mouth. There are, of course, many other useful forms of exercise which can be used for improving breathing. For example, movements of the arms may be used along with leg movements. Ling states, "that every correct active movement executed with *undivided attention* and *intense will-power*, is to be considered in a measure as a respiratory movement."

The educational basis of all these movements is important. With adults it is quite easy to secure co-operation, as they must generally be interested in the success of the training; but with young children the question is a more difficult one, as they do not so readily give complete attention, or exercise intense will-power to order.

Breathing exercises lessen the heart's action and should be taken for a few minutes every now and again between the more violent physical exercises used in drill.

#### *Scheme of Exercises—*

*Position for all the Movements.* Take up a position with toes pointing outwards and heels a few inches apart. The body should be erect

and the shoulders drawn backwards and downwards. Let the arms hang straight down close to the body and the fingers be outstretched. The head should be erect, with chin drawn in, and eyes looking forward, and mouth closed.

*First Exercise.* Taking up fundamental position, slowly raise the arms outward to the horizontal, with palms pointing downwards, in rhythm with a deep steady inspiration through the nose, keeping the collar bones firm. Then slowly lower the arms to the original position in rhythm with expiration. Repeat this movement two or three times.

*Second Exercise.* From the fundamental position, raise the arms smartly forward to the horizontal, being careful to keep them parallel and the full width of the shoulders apart, palms pointing inward. Then in rhythm with a deep inspiration slowly carry the arms outward to the horizontal in line with the body, palms to the front. Now slowly carry the arms back to the forward horizontal in rhythm with expiration through the mouth. Then smartly drop the arms to the side.

*Third Exercise.* Taking up fundamental position, slowly raise the arms forward and upward to a perpendicular position above the head, palms inward, in rhythm with a deep longer inspiration. Pause a moment. Then during steadily controlled easy expiration slowly carry the arms outward and sideways, turning the palms downward at shoulder line without pause and continuing downward to the side.

*Fourth Exercise.* In taking up fundamental position, slowly raise the arms sideways and upward to a perpendicular position above the head, turning the palms inward at shoulder line, and in rhythm with the movement inspire deeply through the nose. Return movement with slow expiration as in Exercise 3.

*Fifth Exercise.* Take up fundamental position with mouth closed, place the hands lightly on the lower part of the front of the chest with fingers meeting within a couple of inches. Then slowly take a deep breath through the nose, pause for a moment or two, then forcibly, but not noisily, expire through the nose.

W. N.

#### DENTAL SURGERY IN MEDICAL PRACTICE

The public mind is slowly awaking to the effect of dental disease on the general health, but the process is indeed slow. The majority of people, I admit, know that they have teeth, and that one is supposed to pay an occasional dreaded visit to the dental chair. Out of the millions of people in Great Britain and Ireland a few (comparatively speaking) *do* take care of their teeth. A great many know that the

teeth ought to be taken care of, but their knowledge stops there.

I have more than once observed that the ignorance of the British public with regard to their teeth is not merely great—it is monumental! What is the attitude of the man in the street to dentistry in general, and his own teeth in particular? It amounts to merely this: "Does it ache? then have it out!" "Does it not ache? then leave it alone!" To tens of thousands of people this is the Alpha and Omega of "Dentistry." Hence there is considerable reason for saying that the British public is at least fifty years behind the times in its conception of dentistry of to-day. Of late years much has been said and written about the alleged degeneracy of the British race, and I firmly believe that at least one of the causes is not far to seek and that is the almost universal existence of dental disease, and the resulting condition of oral sepsis. But this is not the worst. For while it is bad enough, hopeless ignorance and apathy with regard to it aggravates the matter tenfold.

Something is being done, however, to combat the ravages of dental caries. Education Committees of certain towns have of late years begun to realize the necessity for it and their realization of its far-reaching consequences has resulted in the establishing of school dental clinics in certain towns, for example Cambridge, Liverpool, Kettering, Southwark (London), Bradford and elsewhere. Proprietors of certain large factories have also come to see the importance of the question and its bearing on the health and well-being of their employees. So much is this the case that willingness to submit to dental treatment is made by many firms a condition of employment.

The whole question of dental treatment for the masses is a very serious one. How to deal with it is a problem indeed, and its solution is no mean task. The dental hospitals of our cities are taken advantage of to a large extent by the poorer classes; private school clinics have been attempted with some success, and as already stated, certain municipal authorities have realized the necessity for doing something. Indeed, it would not be difficult to combat all the ravages of dental disease were it not for the one great difficulty, viz. the unavoidable expense of the work. For this very reason, I see nothing for it but that sooner or later the question must be taken up and dealt with by the Government of the country. It is not a mere dental question, nor is it a municipal one, but it is a national question that must before long compel the attention of those in high places. Until that happy day arrives we must perforce be content with such means of opposing the evils of dental disease as are



within our reach, and there is no doubt that municipal authorities have done, and are doing, a great amount of good, especially amongst the children. Inasmuch as I have held the appointment of dental officer to the day industrial schools of Liverpool, under the Liverpool Education Committee, since September 1907, the woeful effect of dental disease amongst Liverpool's poorest children is brought home to me. I have more than once been asked for information as to the best method for establishing a school dental clinic, and it may not be out of place to give a short account in these pages of the particular method I have adopted in Liverpool. It has proved simple, efficient and economical. One of the most central of the day industrial schools was chosen, and a room with a good light was duly fitted up. I remember saying at the time that my dental room was a monument of economy. I have an ordinary hospital "rack" chair, with the addition of a footstool for the younger children which is placed on the seat of the chair. A special children's chair is, however, now made by the Dental Manufacturing Company of Newman Street, London, W. (who by the way have specialized in the manufacture of school dental outfits). Such a chair should prove a boon to a hard-pressed dental officer. In addition to the chair I have the usual bracket table with hand instruments for necessary excavation, pluggers, scalers and the like. An ordinary hospital spittoon, an electric lamp on a swinging bracket, and a Ritter motor engine were also provided. School dental work is a source of very great mental and physical strain to the dental officer. A motor-driven engine is almost a necessity, and greatly increases the rapidity of the work, diminishing at the same time the children's discomfort. Gas apparatus has not been provided, but I get along nicely with a judicious employment of local anæsthetics. I am aware that novocaine is largely used for local anæsthesia, both in surgical and dental practice, but I think I get a better result with a preparation of synthetically prepared cocaine, known as "liquor zirol." It is believed to be non-toxic, as the toxic elements in the drug are omitted in the manufacture of this preparation, and the anæsthesia is excellent. To do the necessary work for the children painlessly is a necessity; for if the children are frightened they tell each other and this has a demoralizing effect on the others. Moreover, the difficulty of parental objection would arise; and with regard to this latter point I have very definite instructions from the Education Committee, viz. to treat no child whose parents object. In treating each child I try to finish his most pressing dental requirements in one visit. All unsaveable teeth are extracted painlessly and all saveable

teeth are filled for the most part painlessly. The children and I are very good friends, but not so the parents, I fear. The latter's ignorance about their children's welfare is only to be expected; so much so that the father or mother has been known to come to the school and storm at the head teacher because the child's hair had been cut. My personal services have also received their due share of abuse.

I attend at my dental room three times weekly for almost three hours each visit, and I try to finish (dentally) three to seven children in a morning. This may mean twelve to twenty-five fillings or extractions, which represents a very long morning's work indeed, especially if one keeps in mind the fact that I take time to anæsthetize by local injection before extracting.

When the work was first started I began by first surveying the mouths of all the children in the schools. In doing so, we have not attempted elaborate charting. Opposite the name of each child are two columns, one for the registering of fillings required and one for extractions; and when the children are sent to me for treatment they bring a copy of this register for my guidance. About a fortnight once a quarter is devoted to the above survey, and thus I am able to keep in touch with all new admissions. Now, as already said, the plan adopted in 1907 has worked well, and the question is "Can we show up definite results?" To some extent I think we can. The medical officers of the various schools report favourably. The children are certainly vastly improved as regards their dental condition, and I am quite sure in their general health as well. The red flannel which used to conceal and protect swollen and tubercular glands is seldom seen. Headache, neuralgia, and of course ordinary toothache have largely disappeared, with correspondingly increased efficiency in school work. Now the ratepayer (that much oppressed individual) says that this treatment is all very well but he wants to know the cost of the work. My clinic, including outfit, repairs, renewals and suchlike, costs only one seven-hundredth part of a penny rate. But, then, it must be remembered that I have only 1,300 children under my care. In other towns the cost is from an eighth of a penny to a third, according to circumstances.

Before closing this account of my clinic in Liverpool I should like to make a passing reference to two points. In private practice, whether surgical or dental, cocaine is reckoned by many surgeons dangerous. I used to employ this anæsthetic for local injection during the first two or three years after the clinic was started, and it appeared to me then that children and young people up to fourteen years bore this

drug better than adults. It is quite likely that dental surgeons may differ from me as regards this point; but I can only say that I have used it in a very large number of cases in the course of my school work, and I do not think more than two children were affected, and then only temporarily, with slight sickness and faintness. I have already referred to the excellent results got from the use of synthetic cocaine (liquor ziro) which I now employ by preference.

There is another matter with which I have been very much impressed in connection with my school work, and that is the lack of backbone or grit amongst so many of the children. One cannot be surprised if the younger children shed tears if hurt; but nothing annoys me more than to find big boys of twelve or thirteen who are given to this sort of behaviour on almost no provocation at all.

It may be that before long each town may have its own school dental clinic. Medical men, especially medical officers of health, are sure to be consulted as to the best method of starting such a clinic, and for their information I should like to state the following, as being the more important of the special recommendations of the representative Board of the British Dental Association.

1. Part-time dentists are to be preferred to special officers.

2. For towns of over 150,000 population special dental clinics would be required—and failing part-time dentists, special dental officers would be necessary.

3. For towns of 30,000 to 150,000 one or two clinics would be sufficient, visited by local practitioners, who would give part of their time to the work and part to private practice.

4. For towns and urban districts under 30,000 a young dentist who has newly started practice is recommended.

5. For the country and rural neighbourhoods, a travelling caravan is suggested.

6. Remuneration for a whole-time dentist should not be less than £300 a year, and a part-time man at the rate of £1 per half-day and travelling expenses.

Such recommendations are excellent if sufficient money be forthcoming; but in towns where there is a strictly limited sum of money available, and yet in which the amount of work is very great, the question of age limit would require to be introduced. No children over nine would be treated. This practically means treatment and retreatment of the first four molars. And, indeed, it is an excellent working rule—to *save the first molars and attempt no more*. If funds permitted the work might be extended so as to include the pre-molars and if possible the second molars. But this, of course, would increase the expense accordingly.

I should now like to make special reference to the ignorance of parents as to the site of eruption of this first permanent molar, *i. e.* the first tooth to erupt of the second set. These teeth appear just beyond the last milk molar. It is quite usual to hear parents say, "Are these permanent teeth? I thought they were all first teeth so I let them go." Preservation of the first permanent molars is exceedingly important, and I ask all medical men to educate their patients who are parents as to this important point.

*Medical Men and Dental Disease.* Ten years have elapsed since I relinquished the practice of medicine in favour of dentistry, for health reasons, and especially during the last six years I have been much impressed with the remarkable attitude of certain medical men towards dental disease and dentistry generally. For instance, there are many medical men who think that dentistry is merely mechanical. It is quite common to meet with lay patients who will tell you that this is so. But I have been surprised to find that such an idea is shared by many doctors. When a surgeon amputates above the knee he shapes his flaps, he divides the femur with a saw; he ligatures the vessels and unites his flaps with what is after all a needle and thread! Is any one going to insult him by telling him that his operation is merely a mechanical one? Are there not grave questions at stake involving an accurate knowledge of anatomy, surgery and pathology? True it is that life and death are rarely involved in dental practice, nevertheless, there are medical men to-day whose idea of conservative dentistry begins and ends with "stopping." They often fail to realize that in dealing with septic root canals and in amputation of septic roots without sacrifice of the affected tooth, and in other suchlike operations, dental surgery and pathology are involved, though to a more limited extent than in general surgical practice. Is the operation for treatment of a diseased antrum merely mechanical? I ask the same question as regards removal of dental and other oral tumours. All branches of surgery, including dental surgery, are to a certain extent mechanical, *i. e.* manipulative, but I protest against the idea which is so prevalent both in the medical and lay mind that dentistry of to-day is a "merely mechanical matter." I like to tell my patients that modern dental practice is largely *surgical*. In spite of these facts a rising aural surgeon said to me recently that while surgery was mechanical it was *not so mechanical* as dental surgery. I am sorry for that man's ideas of modern dentistry. Does the medical profession realize that of the dental student is demanded the same as the medical so far as the preliminary examination is con-



cerned, and that the dental curriculum, including as it does surgery, anatomy and pathology, is only a year less than the medical.

The want of appreciation by dental patients of their dentist's services is proverbial and is due to lack of understanding on their part, but I have been surprised to meet with this, in a measure at least, among medical men.

This article on dental surgery is written in the hope that it may help medical practitioners in their daily work. I wonder if I shall run the risk of offending my medical friends if I touch on the subject of remuneration of dental practitioners for professional services rendered to their medical brethren. Most of my medical patients are at the same time my friends, and the majority of them understand that the practice of dentistry is a costly one (to the dentist) and they as a rule insist on my having a modified fee. I wish to utter a word of protest about this matter, especially in view of the fact that while fees for dental services tend to get less, the actual cost of dental practice to the dentist is ever on the increase. Dentistry is on a different basis from that of medical attendance, and medical men when they are dental patients should remember this.

In my medical days I gave some special study to insanity, to chest disease, diseases of children, gynecology and otology. But I fear that odontology was conspicuous by its absence. I do not think that I examined the teeth of ten patients in ten years. But the medical profession of to-day does in a measure realize the importance of dental disease in its bearing on the general health, but not I think to a sufficient extent.

I am no faddist, and have no wish to try to prove that every disease is due to the presence in the mouth of a septic molar. Nor have I any desire to trace every case of anæmia or arthritis to septic infection from a poorly constructed bridge. But I should most certainly like to find more general practitioners of medicine who realize to its fullest extent the effect of dental disease on the general health; and who, because they realize it, examine every patient's dental condition as a matter of routine practice.

Let me deal shortly with certain general conditions which are caused or aggravated by dental disease.

1. *Blood Conditions.* I am sure that more cases of anæmia and chlorosis and suchlike conditions would be successfully treated if all septic teeth were removed and all cavities filled soon after the case came under notice. That is another way of saying that many such cases would respond to the usual treatment more quickly if the accompanying oral sepsis were removed. Doctors treat their anæmias with the usual ferruginous and arsenical tonics; manu-

facturers claim much for their iron-containing wines; but an early recognition of the presence of oral sepsis is of the highest importance, so far as recovery is concerned. For years, Dr. William Hunter has been a strong believer in the connection between oral sepsis and the general health, and goes so far as to speak of "septic anæmia." In all cases of progressive pernicious anæmia I should insist on the mouth being made healthy and that any non-hygienic bridge work or other cause of oral sepsis should be removed. I saw a bridge the other day which had been inserted with a view to permanency, regardless of the fact that several septic roots were present, which had actually been left, as far as I could see, intentionally. It is strange that such patients, even though they suffer from chronic auto-intoxication—the result of oral sepsis—are apparently able in certain instances to enjoy fairly good health. The question as to whether oral or enteric sepsis is to be regarded as a cause of pernicious anæmia is one which is difficult to answer definitely. There is not the slightest doubt, however, that sepsis of the mouth and severe anæmias are too often associated.

2. A form of *arthritis* has been described by several writers which is believed, in many cases, to be due to oral sepsis; because removal of the cause is followed by beneficial results. The physician will do well, therefore, in cases of arthritis of doubtful origin and nature to examine the mouth and obtain the opinion of a dental surgeon.

3. The most common condition of all, resulting from a septic state of the mouth, is one which I cannot call by any special name except that of *chronic ill-health*. Headache, low spirits, lack of mental vigour are complained of, as well as an unpleasant taste in the mouth in the morning, furred tongue, acidity of the stomach and constipation. Such a patient suffers from chronic septic poisoning. It is an everyday occurrence to find that treatment of this septic state by extraction of all unserviceable teeth, and conservation by modern methods of all serviceable teeth, results in very great improvement of the general health.

4. There is a condition of the teeth and associated parts for long known as *pyorrhæa alveolaris*, which I believe to be a chronic septic inflammation of the periodontal membrane. It is incumbent on all medical practitioners to keep this condition in view as a possible cause of or a source of aggravation of septicæmia, pyæmia and septic endocarditis.

5. During the course of the *exanthematous fevers*, such as scarlet and enteric, and in cases of diphtheria, the prognosis will be favourably influenced if the medical practitioner will see that the mouth is regularly cleansed. If the

patient is very ill the mouth should at least be swabbed out at frequent intervals by the nurse. In typhoid fever it is inconceivable that the progress of the disease will not be prejudicially affected by intense oral sepsis. Besides, in this disease, mouth-cleansing is particularly important on account of possible secondary infection of the parotid.

6. *Tuberculosis.* For some years I have been strongly of opinion that one of the commonest modes of entrance of tuberculosis into the human body is by way of diseased, *i. e.* septic, teeth. When the clinic in Liverpool was first started, and for some time after, one saw many cases of enlarged and tubercular cervical glands, and I am convinced that many a case of pulmonary tuberculosis could be traced to this source. It would be an interesting study to try to ascertain the percentage of patients afflicted with pulmonary tuberculosis who were first induced to seek relief because of "enlarged glands in the neck."

7. *Appendicitis* is seen with comparative frequency in the daily routine of general practice. If the medical man suspects this condition I ask him to give the state of the mouth more than a passing thought. For here again oral sepsis is a factor which will play an important rôle both as regards diagnosis and treatment.

Before proceeding to the next section of this article on dental surgery I do not think reference to the use of the toothbrush and the question of dentifrices is out of place. There are some wisecracks who think they know all about dentistry. They will tell you that dentifrices are a "snare" and the use of the toothbrush a "delusion." They say that nature never intended that the teeth should be cleansed otherwise than by the tongue. They might as well say that nature never intended us to wear clothes or boots. To question the usefulness of cleansing of the mouth and teeth, especially during illness, is rank heresy. Now I am frequently asked, "What is the best tooth-powder?" I like to answer as gravely as possible: "The best tooth-powder is the toothbrush!" By this I mean that the mechanical removal of food particles from between the teeth by an *up and down* movement of the brush is more important than the particular dentifrice one may favour. On the other hand it must be admitted that tooth-powders or creams are most useful adjuncts. Amongst the latter those most familiar to me are American. The investigations which resulted in the following facts were not made by me personally, but I believe my source of information to be unimpeachable.

1. Parke Davis & Co. have for a considerable time put on the market a useful and elegant preparation known as euthymol tooth-paste.

This preparation has been proved to possess most excellent germicidal properties. It has a carbolic acid coefficient of not less than .14; that is, a strength corresponding to a fourteen per cent. solution of carbolic acid; or in other words one part of carbolic acid diluted with six of water. Further, it has been proved that twenty per cent. euthymol at 90° F. is lethal to the bacillus typhosus in less than thirty seconds. If in the ordinary use of the toothbrush one uses one part of euthymol tooth-paste to two parts of water we shall have a strength of about thirty per cent., which so far as bacillus typhosus is concerned gives us a safe ten per cent. margin. A similar strength of twenty per cent. was also found to be fatal to the Klebs-Loeffler bacillus in thirty seconds.

2. Another most useful dental cream has been given to the dental profession by Dr. N. S. Jenkins of Dresden to which he has given the name of "Kolynos." This preparation is found to be fatal to both the influenza and Klebs-Loeffler bacillus in ten minutes when used in the form of a three and a half per cent. emulsion. In full strength as used in the mouth Rettger found the destruction of all germs much more rapid. A ten per cent. solution of Kolynos has been found to effect an almost instantaneous destruction of the pneumococcus.

3. A popular American dentrifice is Colgate's dental cream. This preparation is held to have a germicidal value one tenth that of pure carbolic acid and to leave the mouth cool and wholesome after use. It is also lethal to the bacillus of typhoid and diphtheria and to pneumococci.

It seems to me, therefore, that with efficient dentifrices at hand, combined with equally efficient use of the toothbrush, only beneficial results can follow to the user.

*Popular Fallacies as regards Dentistry.* I have already made reference to the ignorance of the public with regard to matters dental. Medical men rightly require in attending a case that their word shall be law. On beginning dental practice some years ago I was annoyed to find that too many dental patients "knew best." At least they think they do. There are patients who presume to criticize the work of their dentist if the latter is foolish enough to permit such a liberty.

The ordinary dental patient is too often unreasonable, so much so that whatsoever happens of an untoward nature after any dental operation is *the result of the latter*, and is therefore the dentist's fault! In the advocacy of such heretical opinions lady patients excel. Let me cite a few examples of this.

1. If a cavity be carefully filled after equally careful preparation, and in a few months' time such a filling comes out, "the dentist's work is



faulty"; one frequently finds that this opinion is held even by educated people, so great is their ignorance. One occasionally meets a patient who does understand that the teeth may be soft, and that rapid fresh decay may occur round the edge of the cavity and allow the filling to drop out. Such an occurrence, need I say, has nothing whatever to do with the work done, and yet not one patient in fifty is reasonable enough to attribute it to its real cause.

2. One is consulted by a patient who says that a tooth has broken off her denture, and perhaps this has occurred repeatedly. The wearer naturally suspects the work done. The real cause, however, lies in what is known as a "cross bite." It is due to free side to side movement of the mandible at the temporomandibular joint (I have amused many a patient by pointing out to them that they bite like a cow!), and such movement provides an element in the case over which the dental surgeon has no control. There are, of course, certain precautions to be taken to prevent this accident; but, granting they are taken, the dentist can do no more. If such patients were amenable to reason they would be satisfied with this (the only) explanation of it.

3. Another fallacious idea to which dental patients give expression is as follows. If in respect of time, material, etc., one piece of work exceeds another by say six times, manifestly the fee must be different in each case; and yet the usual dental patient expects to pay so much for a filling, so much for a crown, and so much for a denture; and mentally compares such fees with those paid by a friend for similar work, when in reality the two will not possibly compare.

4. When one makes a lower denture with back teeth only for a patient whose lower front teeth are still efficient the back artificial teeth must meet the upper teeth and articulate properly so as to form an efficient masticating surface. One sometimes finds that in a few months' time after the insertion of the denture the mandibular alveolar process has absorbed (even though no teeth had been extracted for years previously), the denture follows gravity, and sinks down in exact proportion to the amount of absorption of the alveolus, and an appreciable space is left between the upper teeth and the lower artificial teeth. The patient will say, "I can't bite on it now, and I did not expect my lower plate to go like this so soon." Here, again, the work is blamed. Neither the plate nor the position of the teeth alter, but the alveolar process does, and ceases to give support, with the above result.

5. A patient came to me with regard to her front teeth, the cavities in which were fairly deep. Keeping in view the fact that devital-

ization is better avoided in front teeth I expressed the opinion that a non-conducting filling might be sufficient to prevent subsequent pain. If events proved otherwise, the nerve must be devitalized and removed. One of the teeth did ache as I warned her it might. "She did not remember" that I had warned her and promptly blamed the work. It would be easy to multiply *ad nauseam* the extraordinarily fallacious ideas that exist in the public mind about their teeth and dentistry generally. I can only express the hope that medical practitioners may derive some help from the foregoing and in their turn do something towards the dental education of their patients.

I cannot close this article without making some reference to the question of unregistered practitioners of dentistry, more especially with regard to anæsthetics and their use, or rather misuse. The law as it at present stands is in a most chaotic state as far as anæsthetics are concerned. It practically says that if you desire to sell chloroform to the public you must be qualified. But if you want to merely (!) administer it to a fellow creature you *need not* be qualified. So long as you do not sell it, unless you are a qualified chemist, the actual administering of it is a trifling matter; you can do as you please! If ever there was a subject with regard to which legislation is necessary this is one.

Sir Frederick Hewitt has done valuable work with a view to the regulation of the administering of anæsthetics. He has kindly sent me in book form a reprint from the *Lancet* of June 3 and June 10, 1911, entitled "The Position of the Present Reform Movement in Anæsthetics." I have found its perusal a most interesting study, and the whole question is reviewed up to the date of the publication of the paper in the *Lancet*. At page 39 Sir Frederick Hewitt says: "We see that the legislative, academic and professional bodies to whom the main question of the desirability of legislation has been submitted agree that the time has fully come for the protection of the public against the employment of anæsthetics by unqualified persons. Nothing, indeed, can be more striking than the similarity between the independent opinions expressed by the Home Office Departmental Committee and by the General Medical Council upon this main issue."

He adds later on in the paper, "It is difficult to understand why there should be the smallest delay on the part of the authorities concerned in giving effect to the practically unanimous recommendations of the various bodies that have been consulted directly or indirectly upon this important matter. Surely there was never a clearer case for legislation."

My personal feeling is that it is absolutely

and urgently necessary to confine the administration of all anæsthetics both general and local to duly qualified and registered medical and dental practitioners. Anything short of this is fraught with great and increasing danger to the public.

Much has been said and much might be written on the subject of unregistered practitioners of medicine and dentistry. So far as the law is concerned any one may practice medicine, surgery or dental surgery without let or hindrance, so long as they do not arrogate to themselves a title, *e. g.* doctor, surgeon, dental surgeon or dentist. They may mutilate the mouths or bodies of his majesty's lieges as much as they please, so long as they do not *use* the titles above stated. No one is allowed to inscribe the words "dentist" or "dental surgeon" on his doorplate unless he be properly qualified in dental surgery, but any one may erect a board twenty feet long bearing the words, "dental surgery" or "dental consulting rooms." Patients sometimes ask to be enabled to distinguish between a properly qualified dentist and a "quack." I tell my patients to look for the words "dentist" or "dental surgeon." Except for a few dentists in the large towns who are so well known that they pride themselves on not requiring any designation or title, the absence of the words "dentist" or "dental surgeon" may be taken to mean that that practitioner is not duly and properly registered. In instructing patients accordingly, medical men will render genuine service to the public.

Medical men may say that it is quite natural that the dental profession should want them to tell their patients to have their teeth preserved, and hint that the object aimed at is financial in nature. I shall prove that it is not so; for if care of the teeth is in our favour financially, neglect of them is still more in our favour. If care be not taken to preserve the natural teeth, then crown and bridge work or dentures become a necessity, and these are the only part of our daily work for which patients are willing to pay a reasonable fee. Therefore, in proposing and carrying into effect school or factory dentistry, and dental treatment for the masses, we are advocating a line which may affect us and our sons or grandsons in no small way. Nevertheless, the teeth of the people have been rightly called a national asset, and we want to do our part in promoting national health and prosperity. What has preventive medicine done for the public health? Sir W. Jenner in giving us vaccination sounded the death knell of smallpox. And in discovering his comma bacillus did not Dr. Koch give us a means of fighting that dread disease—cholera? The late Prof. Miller of Berlin gave us the result of his studies as to the cause and pathology of dental caries

with a view to more efficient treatment and if possible prevention of dental disease.

All this work has been done with the object of ameliorating disease, and preventive medicine has done an incalculable amount for the public health. I believe I am responsible for the term "Preventive Dentistry," and this latter will accomplish more and more in the form of early conservative dental treatment, with a view not only to prevention of dental caries, but also of the diseases caused by it. Therefore, the claim we have made for years, to the righteousness of which the public have slowly awakened, is more than justified to-day—our claim to be a profession in the best sense of the word. Hence my plea for a closer union between the medical and dental professions. If I have succeeded in broadening the minds of the readers of this article as regards the scope of dental surgery and the whole question of dental disease and its treatment I shall feel amply rewarded.

R. J. E. Y.

#### DEFECTIVE SPEECH AND STAMMERING

Stammering is a bad habit which usually begins in early childhood. It originates in many ways, but the most common are:—imitation and sometimes mocking of other stammerers, attempting to talk hurriedly, fright and general weakness. The starting-point with the stammerer is undoubtedly from some of the above causes, or others of a similar nature due to disturbance in the speech impulse. There is lack of breath control, and consequently much misdirected energy, which interferes with the smoothness and ease of the oral mechanism. This affects chiefly the lips and the tongue at first, but if allowed to grow, the habit leads to most frantic efforts and struggles, and disturbs not only the particular organs mentioned, but even the facial muscles and the limbs. When the stammerer has reached this pass, the greatest terror of all comes on: he is afraid to try to speak. This constant fear and dread of speech failure is at the bottom of nearly all permanent stammering. It leads its victim into all kinds of pitfalls, such as a too cautious hesitation in articulation, needless repetition, halting and a nervous magnifying of the slightest oral difficulty. The faculty of self-reliance is so weakened that natural utterance becomes impossible. This bad habit brings on fear, and fear increases the difficulty of overcoming the habit. Stammering is sometimes acquired very rapidly, but more generally it has its progressive stages of growth into fixed habit. Children who go back over odd words in a sentence, repeating them nervously, are on the way to the acquirement of this speech defect. At this initial stage,



however, permanent cure is comparatively easy and should be based on the simple insistence of the completion, without any turning back, of every sentence uttered, either as a formal exercise or in everyday speech. On no account must any impatience be shown in dealing with the afflicted child at this critical stage. Telling it not to say this or that, in a harsh or scolding manner, will but accentuate the trouble. The better plan is to show clearly and distinctly the right way, and to leave out all useless and fear-compelling "don'ts."

Then there is the stuttering stage due to lack of tension in articulation, and shown chiefly in initial explosive consonants, in which you get in words like "pepper" too many p's. The sound is no sooner made than it is instantly returned to, and repeated by a loose spasmodic closing and opening of the lips in the "p" position. This lack of control is not entirely of the lips but also of the breath which regulates the easy glide from the consonant to the vowel following. The intense consciousness of this stuttering leads to another and further stage in the defect, namely, a tendency to check and hold the organs of speech at the different voice stoppages. For example, after the stoppage for "p" has been taken up at the lips it refuses to move and explode, and the same thing occurs at "t" with the tip of the tongue firmly fixed at the roots of the upper teeth, and at "k" and "g" further back in the mouth, causing a choking gurgle, and so on perhaps through the whole gamut of the consonants at different times. This spasmodic hesitation is most distressing and affects not only the lips and tongue but the lower jaw, and leads to all sorts of contortions of the face in the violent effort to break through the various stoppages. There are other forms of stammering, but they all have to do with misdirected energy and may be cured in their early stages by proper educational methods.

There is, and can be, no fetish or secret process in this cure. *It should be based on good breathing, self-control and a correct personal knowledge on the part of the pupil of the whole mechanism of speech.* Establish these, and you give the power which does away with fear. The teacher of stammerers must rely chiefly on individual instruction. The defect varies so much that, as a rule, class teaching cannot be very efficient, except with small numbers, say of not more than half a dozen at a time, in the drill which is set out fully in the scheme of breathing exercises. The number being thus limited allows of greater watchfulness on the part of the teacher and a readier notice and correction of faults.

The separate sounds of speech should all be taught by individual instruction, and fixed

by constant repetition and combination. A small hand-mirror will be found extremely useful in pointing out positions. The sense of touch, as well as hearing and sight, will also be often useful in leading pupils to a more exact realization of what takes place in the vibratory apparatus (see *Voiced Consonants*).

The personality of the teacher is of the utmost importance. No one who is lacking in patience and sympathy should attempt to cure stammerers. The whole success of the work depends largely on creating, in the mind of the pupil, a feeling of self-reliance and confidence through knowledge. This is brought about as much by kind and wise encouragement as by scientific method. The inculcation into the minds of the pupils of the power of self-control constitutes a faculty in teaching power of the very highest order. It presupposes an intimate knowledge of child-nature and a careful study of each individual as a unit presenting its own special difficulties. No ready-made method of dealing with the individual has yet been devised which can be accepted as a royal road to educational success. With the idea of diverting the pupil's mind from the difficulty of the speech impulse many teachers have resorted to such adventitious aids as the beating of time with hands or feet to the word, and to a drawing, singsong utterance. This, besides producing unnatural speech, is unnecessary. The goal to be aimed at is ordinary, natural speech, with correct timing of breath and stoppages.

The method advised is as follows—

1. A systematic course of breathing exercises (see *Voice Production and Breathing*).
2. The teaching of the separate sounds of speech (see *Mechanism of Speech*).
3. Voice exercises, apart from breathing exercises, (a) the pure vowels alone, (b) in combination with initial consonants, (c) with final consonants, (d) in words in full sentences, following a plan of covering the whole of the sounds such as is to be found in the "Nellie Dale Readers" (Geo. Philip & Son).

If a stammering child is sent to school a certain amount of teasing is likely to take place however excellent the tone and discipline may be. This will accentuate the trouble. It is therefore advisable that an attempt should be made to effect a cure before school life begins. In some of our large towns special classes for stammerers have been established, and these are to be recommended where private tuition is impossible. In all cases of defective speech it is recommended that the hearing of the child should be carefully tested by an aurist, as many forms of deficient hearing exist which interfere with the acquisition of speech. Consonant deafness is very common

and leads particularly to the dropping of final consonants.

Lisping is a very common form of simple defect and is usually caused by wrong management of the tongue. The fault lies in a pronounced forward action of the organ. The "s" sounds are peculiarly favourable to lisping and are due to the middle of the tongue being too flat. In cases of cleft palate it is necessary for speech purposes that an artificial palate should be provided, but after that has been successfully accomplished exercises for its definite use must be arranged, otherwise the nasality and enunciation will still be unsatisfactory. Before the operation there was no back point of contact for the tongue, therefore when the new curtain is in place it must be trained to meet it. W. N.

### ORAL METHOD OF TEACHING THE DEAF

There will be no attempt made in this article to go into the history of the teaching of speech and lip-reading to the deaf. Suffice it to say that such teaching is now general both in Europe and in America, and that its principles are based on the establishment in the child of ordinary speech and lip-reading as a means of personal communication. Oral teaching cannot, however, be applied with advantage to all the deaf. About twenty per cent. of the deaf children under instruction in schools are mentally backward. They are decidedly slow in acquiring a useful knowledge of language. Their word-memory is poor, and although they are capable of some amount of educational training their range of intelligence is so limited that oral tuition has generally proved a waste of time and a failure. Finger spelling, writing and industrial training is really the best that can be done for them. The other eighty per cent. are composed of intelligent born-deaf children, and children who have acquired deafness through illness or from other causes, but whose mental faculties are normal.

What, then, are the most favourable conditions for successful speech tuition? In the first place an *early start is absolutely essential*. The deaf baby babbles and crows and uses its voice like other babies, but it is cut off from all articulate sound, and the babbling, instead of leading on by imitation to speech, ceases, and the inherited tendency to use the vocal organs gradually dies away.

The hearing baby picks up the rudiments of speech and language naturally and almost as simply as it learns to walk. The fundamental principles which lie at the base of linguistic science, and without grasping which no intelligent study of the subject may be made, are, firstly, that all language is merely arbitrary,

and secondly that language is not an inherited race characteristic like colour, physical constitution, etc. Language is learnt—learnt during childhood, learnt by imitation. Thus a child of parents residing in a foreign country will grow up to speak the foreign tongue as well as that of his parents, and to speak it just as naturally as do the children of the native parents. A child learns to observe the persons and things about him and to distinguish and recognize them by some characteristic quality or act. At the same time he discovers and begins to exercise his organs of utterance and, by imitating the speaking persons around him, gradually gains conscious and intelligent command of them. A child brought up in solitude would be almost, if not quite, silent. By the time he has gained sufficient control and management of the organs of utterance he has learnt to associate with objects most familiar to him the name by which they are called—this as a result of hearing the two often put together by his—one might say—instructors. This mental association of sound and object is by no means an easy matter to the child, and it is only by constant repetition that the lesson is driven home. But the child begins as a learner and continues as such. He never gets beyond that stage. There is continually before him more than he can grasp. We say of a hearing child that he has "learned to speak," but by that we mean no more than that he has acquired a sufficient number of signs for the ordinary purposes of child life, while outside that circle English is still as much an unknown language as Chinese or Hindu. This is what happens to the ordinary hearing child. It is the sense of hearing which differentiates it from the deaf child and puts it in a position to acquire naturally, through process of time, speech and language.

The question for the parent of the deaf child is how to make up for the lack of this most important sense, which means so much, not only in regard to speech, but to all that speech and language imply as a means of thought and expression. The answer is very simple: always talk to the child as if it could hear, but direct its attention to the lips and give it every possible chance to *see* what is said. It is of no use talking to it with the face in shadow. Speech, as has been shown, is imitation of what is heard by the hearing child, and it should be imitation of what is seen by the deaf child. Intelligent repetition is the keystone to effective work on the part both of the parent of the deaf child and of the teacher. *The enormous difference at five years of age between deaf children who have been talked to and those who have not is remarkable. What the mother can do for her child during those receptive years*



of early infancy cannot be over-estimated. Neglect of speech-training at this stage of any child's life means a loss to the language faculty which can never be recovered. The doctor is generally the first person whose advice is sought by the parents of a deaf child, and he should tell them, if they wish it to acquire a spoken language, to be ceaseless in their efforts to enable it to do so. Parents who can afford the expense should secure a good teacher as early as possible and certainly not later than at four or five years of age, although this will depend on the amount of personal attention in the direction indicated which can be given.

At the very least ninety per cent. of the parents of deaf children are not in a position to afford private tuition, and considering the number of really good schools available, it is a moot point whether they could possibly do better than send them to one of these. Really good private teachers are few and far between. The skilful teacher enjoys work in the schools best, because the scope is greater and the work less monotonous than in teaching one child.

The child destined for the public or private school should go to school at five. If some few deaf children succeed fairly well after first admission to school at eight or nine years of age it is in spite of great difficulties and because of very exceptional intelligence. It is, indeed, possible that the twenty per cent. of backward children might be greatly reduced if all deaf children were obliged to enter school at five years of age.

The second essential to success is *physical*, and has to do with good nutrition and all that goes to the making of a healthy, vigorous body—the *mens sana in corpore sano* of pedagogics. It may, in fact, be safely laid down as a general law that weakness of body in addition to deafness will generally prove an insuperable barrier to self-supporting citizenship.

The third essential, both for the privately taught and the school child, is a life brimful of active interest and opportunity in all directions for self-expression. Everything and everybody about the child should be bright. There is no excuse for drab surroundings and dull teaching. All real living education breathes and has its being in an atmosphere that is coloured with love and brightness and never-ending interest.

The fourth essential is *good classification* and does not touch the home-taught child except that it would indeed be all the better for rubbing shoulders with children at the same stage of progress and of equal intelligence. Without efficient classification in school life it does not matter how early the commencement, or how physically fit the child may be, or inspiring the atmosphere, the pace of progress will be retarded. A good system of classification will take

into account ability, age, state of deafness and backwardness, and can only be secured where the numbers in the school are sufficiently large to allow of these divisions. The lowest number allowing of a fair classification may be said to be about eighty on the roll. In the best private schools selection of pupils possibly does away with the necessity of this standard.

The actual teaching in detail cannot be dealt with here at sufficient length to serve any useful purpose. It should, however, be assumed that the teacher is qualified by experience and study to undertake the work. A very complete knowledge of the mechanism of speech is necessary for the teacher of the young deaf child, and, added to this, an intimate experience of the best kindergarten methods. In fairly large schools the teacher of these young children is set apart, generally on account of special aptitude, entirely for beginning work, and when she has trained her class in the rudiments of speech and expression they are passed on to a teacher of simple language. This teacher has also most likely been specially successful with children at this stage of progress. Besides the building up of language she must give a good deal of attention to the speech sounds in a revisory way. Following this plan, the children may be said to pass from one stage to another until they reach the upper school. In the lower and middle school no actual lessons in grammar are given. All the work plays round centres of interest and differs from ordinary school teaching in many ways. The method of work cannot be said to be included in reading, writing and arithmetic. It has to take into account the difference between the hearing and the deaf child. The different experiences of life which call forth language and particular forms of expression have to be gone through—brought as it were on to the educational stage and acted out in as living and real a manner as possible. This method of teaching, although dealing with the simplest and most elementary forms of knowledge, may be said to be the very bedrock of pedagogics. Like the climber up some difficult shoulder of the Matterhorn each foothold must give its secure support for the next upward step. So the teaching, up to a certain stage, instead of being based on conventional school subjects, deals mainly with persons, places and things, and exhausts, as nearly as possible, all the simple expressions which can be applied to them.

Beginning with immediate surroundings and friends and relatives, the children are led out, as it were, into the world of activity; trades, trams, railways, canals, shops, nature, newspapers; all these provide their distinctive terminology. The power to associate spoken, written and printed forms with their actions

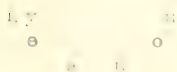
and objects, and to express ideas is gradually acquired. Then is opened up a new and much more rapid way to the acquisition of language—the power to read. When the deaf child can read a storybook of any kind with interest it may be said to be fairly on its way to a good education. After that, the ordinary school subjects may be tackled with confidence, and almost any skilled ordinary teacher may do the work, but it should always be borne in mind that the *unit of expression is the sentence and not the isolated word.* W. N.

## MECHANISM OF SPEECH

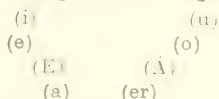
## TABLE OF SOUNDS

| Non-Vocal. |           | Vocal. |           | Nasal. |           | Double Sounds. |           |
|------------|-----------|--------|-----------|--------|-----------|----------------|-----------|
| Sound.     | Key Word. | Sound. | Key Word. | Sound. | Key Word. | Sound.         | Key Word. |
| p          | path      | b      | bath      | m      | man       | x              | wax       |
| f          | fat       | v      | van       | n      | nan       | x              | exact     |
| t          | top       | d      | dog       | ng     | bang      | nk             | bank      |
| th         | thin      | th     | thine     |        |           | nq             | conquest  |
| s          | sun       | z      | buzz      |        |           | ng             | finger    |
| sh         | shop      | zh     | azure     |        |           | tch            | patch     |
| ch         | church    | j      | jack      |        |           | g              | magic     |
| king, cat  |           | z      | gap       |        |           | dg             | midge     |
|            |           | l      | lamp      |        |           |                |           |
|            |           | r      | ring      |        |           |                |           |
|            |           | w      | water     |        |           |                |           |

## Short Vowel Triangle.



## Long Vowel Triangle.



## Key to above.

|      |      |             |       |
|------|------|-------------|-------|
| pity | push | marine, he  | truth |
| pet  | pot  | rein, baby  | note  |
| pat  | muff | there, Mary | all   |
|      |      | father      | fern  |

## Key to above.

## Combinations

|        |        |          |         |
|--------|--------|----------|---------|
| —music | i—kind | ou—trout | oi—boil |
| care   | fire   | sour     | shower. |

## The Consonant Sounds briefly described.

## p—path

The breath passes through the throat and mouth until it is stopped by the lips being pressed slightly together. As the breath bursts rapidly through this obstacle the sound is produced. The rising of the soft palate prevents the escape of the breath through the nasal passage. A good test and exercise for this sound is to puff pieces of paper off the open hand.

## b—bath

The position is the same as for *p*, but the pressure of the lips is slightly less. The breath sets the vocal cords vibrating, swells out the cheeks in a gentle expansion, and explodes quietly, the resonance being confined in the mouth in a quiet rumble. The sense of touch must here be used by the deaf pupil by its hand being placed on the teacher's larynx.

## f—fat

The lower lip is pressed gently against the upper teeth and the breath allowed to pass steadily through between. The tongue is well down on the floor of the mouth. By holding the hand in front of the mouth the breath should be felt in a continuous flow. Use the paper again.

## v—van

The position is the same as for *f*, but the lips and teeth are not quite so close, giving more freedom for the vibration set up by the vocal cords. The pupil should again be allowed to feel this vibration by touching the teacher's larynx.

## t—top

This sound is produced by the point of the tongue touching the gum ridge above the upper teeth, the breath being allowed to escape by its sudden release. The teeth are held slightly apart.

## d—dog

Produced exactly in the same manner as *t*, the tongue being a little flatter at the point of contact and the vocal cords vibrating.

## th—thin

The tip of the tongue gently touches the upper teeth, the breath passing through between, and the sound is produced by its friction against the teeth. There is great similarity between this sound and *f*, but the tongue in *th* takes up a position more between the two rows of teeth. Prof. Rippmann says this similarity explains the "fumb" of little children.

## th—thine

This sound is produced in exactly the same manner as non-vocal *th* except that the vocal cords vibrate.

## s—sun

This sound is produced by the breaking of the current of breath against the teeth. The sides of the tongue press against the side teeth and a little channel is formed down the middle of the tongue to its tip, directing the breath against a point in the middle front teeth. This rubbing of the breath against a particular point produces the sound. Unless the channel down the middle of the tongue is formed a lisping *s* may result.



*z—buzz*

The position is the same as for *s*, with the vocal cords vibrating.

*sh—shop*

This sound is formed a little further back than *s*; but unlike that sound, which is concentrated on one point, the current of breath is diffused by the tongue being arched and brought nearer the palate, the breath travelling along nearly the whole length of the hard palate to its point of escape. The breath should not be allowed to escape at the sides of the tongue.

*zh—azure*

This sound is simply *sh* vocalized by the vibration of the vocal cords.

*ch—church*

This sound is a combination of *t* and *sh*, but should be taught as a whole. The tongue is broadly pressed against the hard palate with the point at its commencement in the *t* position, and suddenly released. It is one of the difficult sounds.

*j—jack*

This sound takes the same position as *ch*, but as it is voiced it is a combination of *d* and *zh*. The pressure of the tongue is less against the hard palate as it is essentially gliding and not held.

*k—king ; c—cat*

The stoppage in this sound is effected by the middle or back of the tongue being pressed against the palate. On the tongue being quickly and forcibly released the sound is produced. The mouth should only be slightly open and the nasal passage closed.

*g—gap*

This sound is the vocal counterpart of *k*. Like other voiced consonants it should be uttered with as little sound as possible.

*l—lamp*

This sound is produced by the tongue point touching the top of the mouth along the middle line and the breath being allowed to escape past the sides. The side rims of the tongue and the vocal cords vibrate, and for this reason the point of contact must only be gently held. It should be taught in combination with a vowel.

*r—ring*

This sound is produced by a narrowing between the raised tongue point and the upper gums. The sides of the tongue are held against the side teeth. The tip of the tongue and the vocal cords vibrate as the current of breath passes through. It should be taught in combination with a vowel, *e. g. ra—in rather*.

*w—water*

This sound is produced from the sustaining of the sound *u* in *brute* or *oo* in *tooth*. The bottom lip being dropped at the glide.

*Nasal Sounds**m n ng*

The distinguishing feature of the nasal sound is that the breath is exhaled through the nose.

For *m* the position or stoppage is the same as for *p* and *b*.

For *n* the stoppage is the same as for *t* and *d*.

For *ng* as for *k* and *g*.

*Description of Long Vowel Sounds**a—in father ; ar—in tart*

The tongue lies on the floor of the mouth, the front of which is opened wide and naturally (see Prof. Rippmann's Chart of Lip Positions in *Elements of Phonetics*). In producing the voice, care should be taken that it is pure and full. The breathing exercises prepare for this, but they should not be practised with the voice exercises. The lungs are the bellows, not the voice producers. They should be developed separately from the voice, otherwise what is called a breathy voice is likely to be acquired. Too much importance cannot be attached to getting this vowel well established without laboured utterance. It is the key to the other vowels and to voice generally.

*er—in fern*

The position for this sound varies very little from (*ar*) except that the mouth is less open and the tongue slightly raised in the middle.

*a—in all ; aw—in paw*

Refer to the vowel triangle. This sound is intermediate between (*a*) in *father* and (*u*) in *truth*. The tongue position is the same as in (*a*), but the lips are very slightly rounded.

*u—in truth ; oo—in tooth*

The place of articulation is farther back than in (*a*) or (*aw*). The back of the tongue is raised towards the soft palate and the front down and slightly back. The lips are rounded and protruded. The resonance cavity is large and the sound is of very low pitch.

*e—in there ; a—in Mary*

This sound occupies a similar position between (*a*) in *father* and (*i*) in *marine* that (*a*) in *all* does between (*a*) in *father* and (*u*) in *truth*. The lips open are less than in (*a*) and the angle of the jaw is smaller. The point of articulation is the front and middle of the tongue ridge.

*i—in marine ; ee—in teeth*

This sound is perhaps the most difficult of all the vowels to acquire. The lips are narrowed

to a mere slit and may be drawn back at the corners, but not necessarily so. The middle of the tongue ridge is close to the hard palate and the tip rests at the root of the lower teeth. There is close parallelism between this sound and (*u*) opposite one another in the vowel triangle.

*o*—in *notc*; *oa*—in *boat*

This is a compound sound made up of (*a*) in all and (*u*) in truth. Starting with (*a*) the lips are with an easy movement brought to (*u*), the second part of the sound being shorter than the first.

*c*—in *rein*; *a*—in *baby*

This is also a compound sound, the separate parts of which are (*e*) in there and (*i*) in marine. Starting with (*e*) there is a quick glide to (*i*), and the voice finishes smartly.

#### *Other Compound Sounds*

*u* in music is composed of (*i*) in marine and (*u*) in truth.

*i* in kind is composed of (*a*) in father and (*i*) in marine.

*ou* in trout is composed of (*a*) in father and (*u*) in truth.

*oi* in boil is composed of (*a*) in all and (*i*) in marine.

#### *The Short Vowels*

In the short vowels the position of the tongue and the angle of the lower jaw are most important. The lips do very little. The movement of the lower jaw and the position of the tongue vary the passages through which the breath passes and give distinctiveness to the sounds.

*a* in pat is not quite shortened (*a*) in father, the tongue is more arched and the lips are in a natural breathing position.

*e* in pet may be taught from (*e*) in there.

*i* in pit may be taught from (*i*) in marine.

*u* in muff may be taught from (*er*) in fern.

*o* in pot may be taught from (*a*) in fall.

*u* in push may be taught from (*u*) in truth.

#### *General Observations*

There are three distinguishing properties in the sounds of speech: length, force and pitch.

Fast or slow speech depends on the length given to the sounds.

Loudness or lowness of speech depends on force.

High or deep tones, as in music, depend on pitch.

Force is the most important factor for distinct ordinary or public speaking, but without precision in the consonant sounds, particularly the finals, audibility is lessened.

W. N.

## FOOD AND DIETETICS

It is quite impossible to deal either completely or extensively with the subject of food and diet in a short and somewhat fragmentary general article. We shall endeavour to sketch out roughly certain more or less universally approved principles, and later to refer briefly to the more modern dietetic methods in treatment. The practitioner is, of course, advised to consult the separate articles in this volume as to the dietetic treatment in such diseases as the acute fevers, disorders of metabolism—*e.g.* diabetes, gout and obesity, gastric and intestinal affections—diseases of the blood and of the entire circulatory system, also diseases of the excretory organs.

First as regards Food, Hutchinson has defined it as "anything which when taken into the body is capable either of repairing its waste or of furnishing it with material from which to produce heat or nervous and muscular work."

Now both in selecting foods and in arranging individual dietaries, we must have, among other data, the following general principles to guide us.

1. The food must contain all such nutritive elements as will assist in the growth and repair of the body, as well as supply that necessary energy which can ultimately be converted into heat and the power to do work.

2. A diet, in order to be effective, must contain the proper amount and proportion of the various chief chemical compounds, such as proteids, carbohydrates, fats, water and inorganic salts.

3. The diet must be adapted to the age, sex, race and other personal factors, as well as to the habits, mode of life, amount of work required of the individual, to the climate, temperature, and the season of the year.

4. The food must combine "digestibility" together with the necessary amount and proportion of its chief chemical elements.

5. As a general rule, when arranging the diet in gastric and intestinal disorders, our first object must be to select foods which are easily and "readily converted into absorbable material by the digestive secretions" (Saundby); at the same time we must direct our attention to its proper chemical composition, its solubility, and to the possibility of any chemical or physical capacity for causing irritation. According to Saundby the following articles of food are "very readily digestible": boiled or sterilized milk, meat soups and broths without added vegetables, softly cooked eggs, meat extracts, jellies made from meat gelatine or isinglass, plasmon and somatose.

6. In all dietetic treatment it is a good plan



to endeavour to adapt the diet to the needs of the particular individual, rather than to give exclusive attention to the disease *per se*; in other words, the important factor of idiosyncrasy and of "the personal equation" must ever be borne in mind, for we are not treating an individual disease, but a diseased individual.

7. In all forms of acute disease the practitioner should, as a rule, draw up a special plan of diet, which is to be strictly adhered to until he modifies it; whereas in most types of chronic disease he should simply forbid all such articles as he considers likely to prove injurious to that particular individual, at the same time giving the patient some intelligent reasons for doing so.

8. In arranging the dietary the practitioner should more or less consult the taste and feelings of his patient, finding out if any proposed article of food "agrees" with his digestive capacity, while, on the other hand, if any article is known to "disagree," it is now thought better to reduce the quantity than to exclude it at once and altogether.

9. The practitioner should aim at great *simplicity* in prescribing a diet: he should thoroughly understand his patient's environment, habits, personality, mode of life, daily work, exercise, recreations and general social conditions. All changes in a diet should be made both cautiously and, as a rule, very gradually. The practitioner should resolutely discourage any food "faddism," or a tendency to go to extremes in the matter of food and drink among his patients.

10. It is well to bear in mind that, in a great majority of instances, both in health and in disease, the quantities of food generally taken may be largely in excess of bodily requirements, and, that an improvement in, or a restoration to health will often follow an intelligent and self-denying reduction, or a wiser readjustment of the dietetic plan. In both acute and chronic disease a regular and periodic revision of the dietary should invariably be made.

11. Let us also bear in mind that to follow any definitely laid down or "routine system" of diet in any given disease is by no means always a satisfactory method, as indeed every "case" must be treated on its own individual merits, and it has been well said that there is really no such thing as a "diabetic diet" or a "gouty diet."

12. In prescribing a dietetic régime, always impress upon the patient the necessity of moderation and self-control in the matter of all the foods that he is able to digest, the importance of maintaining a thoroughly healthy condition of the mouth, teeth, etc., the thorough mastication of all food, both animal and vegetable, the necessity of a suitable variety in the

diet, the avoidance of such habits as food "bolting," of eating between meals, taking too much fluid at meals, etc., and lastly direct attention to the value of having good quality and good cooking in all food, as well as a sufficient time for, and regularity in, meals.

We shall now briefly review various **Dietetic Cures**, the number of which seems steadily to increase, leaving the reader to use his judgment as to their respective values or practical advantages. There are two chief groups; in one the employment of methodical over-feeding for a limited time, with or without physical rest (Weir-Mitchell, Playfair), is undoubtedly useful in the malnutrition of certain neurasthenics, in cases of hysteria, and in phthisis; the other consists in a systematic and gradual reduction of food for a limited time, in the cure of such conditions as obesity, hyperpiesis the result of habitual over-feeding and insufficient exercise—this method had been advocated by Brillat-Savarin, Banting, Oertel, Ebstein and others.

The **Milk Cure**, which usually lasts from five to six weeks, consists in taking about three litres of fresh milk daily (= 1800 calories). It is recommended in cases of malnutrition, in some forms of diabetes, gastric ulcer, renal disease, neurasthenia, cardiac valvular disease, asthma, obesity, and in some "neuralgias of intestinal origin," as well as some forms of liver disease. Its advantages are that it is a bland, "de-chlorinating" diet, lessening alimentary putrefaction and the excretion of uric acid.

The **Whey Cure**, with which is combined a fruit and vegetable diet and exercise in the open air, consists in taking from one to three litres per diem, gradually increased; it is useful in the dyspepsia of "gross feeders" the subjects of "abdominal plethora." "Cures" with *koumiss* (fermented mare's milk) and *kephir* (fermented cow's milk) are advantageous in phthisis, in chronic renal disease, in the malnutrition of chronic gastric and intestinal catarrh, in some cases of obstinate vomiting, and in some long-continued febrile states.

The **Grape Cure**, a purely vegetarian diet, is useful in gout and chronic renal disease, in chronic constipation, and chronic bronchial catarrh; also in the "abdominal plethora" of those who habitually eat too much and take too little exercise. In this "cure" the patient, in addition to spending the day in the open air, takes from three to five pounds of ripe grapes daily, divided into three portions, one in the morning fasting, the second before the mid-day meal, and the third before going to bed. Among the best places for this "cure" are Meran, Montreux, Vevey, Bex, Interlaken and Rudesheim (Rhine), between September and November.

Taillens has recommended a **Fruit Cure** in various forms of arthritism; its effect is laxative and diuretic, for while it lessens the acidity of the urine and intestinal fermentation, it more or less stimulates the action of the liver. The fruits in this "cure" consist of ripe oranges, pears, apples, grapes or raisins, and they are combined with a lacto-vegetarian diet.

The **Lacto-Vegetarian Diet** is a purely non-flesh diet. The patient must first be gradually "weaned" from his ordinary "mixed" diet, and the "cure" on such a diet ought not to be longer than six weeks or two months. According to Hutchison, the advantages of this diet are: (1) comparative freedom from purin bodies, (2) lessening of intestinal putrefaction, (3) richness in mineral salts, and (4) a more bulky residue of faecal waste in the large bowel, which tends to obviate constipation. He considers that it is beneficial in corpulence plus constipation occurring in middle life, in some forms of alcoholism, in functional gastric and intestinal dyspepsia of neurotic origin, in the headaches of constipated neurasthenics, in cases of nervous insomnia, in some cases of cardiac irritability neurotic in origin, and in some forms of skin disease. George Oliver recommends this diet for a few weeks at a time in the general treatment of raised blood pressure.

**A Purin-free Diet.**—This is not a universal "cure-all," although it is a valuable dietetic method in properly selected and suitable cases, especially those of a chronic nature. According to Bryce it is decidedly beneficial in periodic headaches associated with uricacidemia, in epilepsy, especially if a minimum of fluid is taken, all salt in food excluded, the bowels freely evacuated daily, and the quantity of food ingested wisely limited. To these indications we would add that it is beneficial in asthma and in some cases of neurasthenia, gout and chronic rheumatism. The following foods are practically free from purins: milk, cheese, eggs, butter, sugar, white bread, rice, tapioca, cabbage, cauliflower, lettuce, macaroni and strawberries. Foods which are comparatively poor in purins are: oatmeal, peas, beans, potatoes, onions, carrots, parsnips, turnips, asparagus, sea-kale, rhubarb, spinach, figs, dates, codfish and sole. The following are rich in purins: tea, coffee, cocoa, chocolate, malt liquors, beef, mutton, pork, veal, chicken, game, liver, sweetbread, duck, goose, turkey, salmon, halibut and plaice; also meat soups, extracts, essences, beef-teas, and gravies.

Discussing the question of the therapeutic value of a purin-free dietary, Chalmers Watson wisely remarks that "the points which should guide us in framing the dietary can only be laid down after consideration of all the available

clinical facts in each case." The change to a purin-free diet should always be made very gradually, and in the first stage Haig recommends giving up tea, coffee and meat soups; then bacon, egg or fish, then fish, meat, fowl or game. In addition, peas, beans, lentils, oatmeal, asparagus and onions should be avoided. For further information on this subject consult Walker Hall's book on *Purin Bodies*, and the standard works on food and dietetics.

**Dr. Hare's Dietetic Régime** consists in "a small, mainly proteid diet" of lean meat or fish, dry toast and a little butter, tea and coffee with a little milk, no sugar at all, and only a few green non-starchy vegetables. Under this régime the patient's weight is carefully watched, and the weight of each ingredient in the diet accurately recorded. This diet is useful in such periodic or paroxysmal disorders as migraine, asthma, and the so-called "bilious attacks" occurring in such well-nourished persons whose tendency is to eat more than is good for them.

In the **Salisbury Cure**, which is an exclusively proteid diet, only fresh, minced lean meat and hot water are allowed thrice daily. This diet has been tried in some cases of chronic atonic dyspepsia with gastric dilatation, in certain skin diseases (psoriasis), and in some forms of chronic gout and rheumatism; this diet should not be continued for longer than six weeks, when a very gradual return should be made to a moderate "mixed" diet.

In connection with dietetic methods at *spas and climatic health resorts*, special diet sheets are now issued in which the appropriate dishes are "starred" or underlined on the menu, a duplicate sheet is given to the chef, and a covering letter sent which serves as a general guide to those responsible for the food and the preparation of the meals. In France there are "tables de régime" at most of the spa hotels, and in both Germany and France excellent "dietetic homes" exist, where the benefits of a "change of diet" as well as a "change of air" may be fully experienced. The articles of diet usually prohibited are: vinegar, pickles, spices, sauces, any strong artificial flavouring; any excess of fat, grease or dripping in cooking; certain fish (e.g. salmon, herrings, mackerel, eels and all shellfish); also such "meats" as tongue, brawn, liver, sweetbreads, pork, sausages, duck and goose; all twice-cooked food or "made-up" dishes, pastry, mushrooms, currants, gooseberries and rhubarb.

In the **Weir-Mitchell** treatment of neurasthenia the main factors are isolation, rest, diet and massage. As regards the diet, fresh skimmed milk is given at first every two hours, from two to four pints daily; later on farinaceous food (e.g. arrowroot or cornflour) is added,



then lightly boiled eggs, fish, chicken, game, red meat, and bread and butter as the digestive capacity increases, until the patient can digest three full meals a day combined with the former amount of milk, part of which is taken with the meals and part between them. This diet is often of much service in those cases of gastric atony in which the purely gastric trouble is only a part of a general neurasthenic condition, a condition often complicated, in women, with visceral ptosis (Hutchison).

**The Sour Milk Diet (Lactic Acid Treatment).**—This diet somewhat rapidly attained a rather fashionable and widespread popularity a few years ago, receiving its earlier impetus from the *Observations on Curdled Milk* by Metchnikoff, and of the now far-famed Bulgarian bacillus we have read the following encomium: "tenui bacillo longum aevi spatium." Therapeutically, this diet is of some service in certain selected cases of abnormal intestinal fermentation, in chronic intestinal catarrh which causes either diarrhoea or constipation, in some cases of infantile gastro-enteritis, in cases of mucomembranous colitis, and in those skin affections which apparently have a somewhat close relationship to chronic intestinal auto-intoxication (e.g. eczema, urticaria, carbuncle, acne and furunculosis); it is also of use in some cases of neurasthenia, gout, arterio-sclerosis, and that somewhat vague and unsatisfactory morbid condition labelled "chronic ill-health without obvious cause." The practitioner should always see that the soured milk is properly prepared, by directing that it should be first sterilized by keeping it nearly boiling for one hour, and he should satisfy himself that only pure and fully-active cultures are used.

**A Salt-free Diet.**—This diet is of especial service as a part of the general treatment of the dropsy of chronic parenchymatous nephritis (Widal), and in some cases of dropsy due to hepatic cirrhosis, as well as that dependent on cardiac valvular disease. In order to test renal efficiency we must, among other things, ascertain the grade of chloride elimination, as well as the excretion of urea. In all cases of chloride retention we must endeavour to rid the body of its surplus salt, and, as far as possible, to frame a practically salt-free dietary, so that "the proportion of chloride is brought within the limits of renal impermeability." Roughly the chloride content of milk is about eleven grains to the pint, of raw meat about eighty centigrammes per kilogramme, and of ordinary bread about five grammes per kilogramme. Hutchison gives the following as a typical "bill of fare" on this diet:—Breakfast—egg, saltless bread, fresh butter, tea or coffee and cream. At 10 a.m. a glass of milk. Dinner—chicken or freshwater fish, potato, jelly. 3 p.m., a glass of milk.

Supper—egg, chicken or freshwater fish, saltless bread, fresh butter and custard. 8 p.m., a glass of milk or plain water.

**Zomotherapy.**—This is a form of dietetic treatment consisting in feeding the patient on raw meat juice, which is obtained fresh by expression from the best English rumpsteak. The meat juice is usually given in tepid beef tea, and the daily amount is from three to five ounces, according to the nature and requirements of the case. This form of treatment has been tried in the various stages of tuberculosis, in some cases of neurasthenia, anæmia, general debility, and in protracted convalescence after acute illness or severe operation.

For further information on the subject of food and dietetics the practitioner is advised to consult any one or more of the following standard works:—*A System of Diet and Dietetics* (G. A. Sutherland); *Food and the Principles of Dietetics* (R. Hutchison); *The Food Factor in Disease* (F. Hare); *Food and Feeding in Health and Disease* (Chalmers Watson); *Modern Theories of Diet* (A. Bryce); *Foods and their Adulteration* (H. W. Wiley), works which have been of very material assistance to the author of this article.

"Eprouvez toutes choses; retenez ce qui est bon."

N. H. F.

#### SANATORIUM TREATMENT

The sanatorium treatment of consumption may be considered under two main headings, viz.: (1) *Febrile Cases*, (2) *Afebrile Cases*, for the actual stage of the disease is only a subsidiary factor.

The first class includes all those cases with a morning (rectal) temperature over 98·4° F., and all others come under the second heading.

It may be said here that in most cases a rectal temperature is the only one which is of any use in treating patients on open-air lines, because under such conditions the mouth temperature may, in winter, be as much as four or five degrees below that of the rectum, being affected by the temperature of the surrounding atmosphere, and the same remark applies to that taken in the axilla.

**Febrile Cases.**—Patients with a morning temperature above 98·4° F. should be kept at rest—the degree of rest necessary varying, with the temperature, from rest on a couch up to absolute rest in bed, such as is required for a case of typhoid fever, where the patient is not allowed to do anything for himself. Temperature is, of course, only an expression of the activity of the tuberculous processes and is due to the absorption of toxins from the diseased area. Hence it follows that the quieter a patient is kept, the smaller is the amount of toxin washed out by the blood stream and the

lower the temperature will tend to be. The toxins affect not only the temperature, but also the appetite, and a good appetite is a great help towards recovery. Further, rest—in addition to limiting the absorption of toxins—lessens the amount of cough, and this acts beneficially by saving wear and tear of muscular tissue, by reducing strain on the already damaged lung, by reducing the liability to vomiting after food, and by doing away with one cause of cardiac excitement, and it is usually found that a patient with a rapid pulse does not do well.

So that it follows that rest is one of the most important factors in the treatment of a febrile case.

The bed or couch on which the patient is resting should be placed in such a position that he gets the maximum of fresh, pure air and light, though a certain amount of discretion is necessary, as it is never good to expose a patient to strong wind or driving rain, which only irritate the diseased lung and produce cough, while direct strong sunlight undoubtedly sends up the temperature still farther in an already febrile case. But the nearer the condition of the air in the room approaches to that outside the better it will be for the patient, for he will tend to get more oxygen and stand less chance of breathing the same air twice, while it will probably improve his appetite, relieve night sweats and diminish the amount of cough. The patient must have sufficient bedclothes or rugs to keep him warm, but large quantities are harmful, as they oppress him and tend to produce sweating and to keep the temperature raised. Provided that the patient is warmly clothed and lives in a pure atmosphere, with its slight fluctuations of temperature, there is no liability to "catch cold," and he soon learns to appreciate its beneficial effects and misses them if the conditions are altered in any way.

In a majority of these patients the appetite is not affected adversely by a raised temperature, and they should be given three good meals a day at fairly long intervals, say at 8 a.m., 1 p.m. and 7 p.m., with a light afternoon tea, if desired, because by this arrangement the stomach is given the chance of a rest after doing its work. At least half a pint of milk should be given with each meal, but the practice of giving milk or any other food before breakfast, after supper and between meals is in most cases distinctly bad, for just when the stomach is beginning to empty itself of the products of digestion a large supply of food is poured in and it has to set to work again and only gets one chance of resting in the twenty-four hours and will soon rebel. Patients with a feeble digestion may be given smaller quantities of food at more frequent intervals, but rest for the stomach between

meals is always beneficial, and those who have formerly suffered from indigestion will often lose it and be able to eat properly if the stomach is given a proper proportion of rest.

Antipyretics such as phenacetin, antipyrin, quinine, pyramidon, etc., are practically useless, because though they may bring the temperature lower for the time being, it almost always rises again as soon as they are discontinued, and, beyond relieving any discomfort due to the temperature, they have no permanent effect on the disease, as they do not get at the root of the evil.

I may here say that if the temperature still remains raised after three months' rest in bed I have occasionally found it beneficial to allow the patient a very small amount of exertion—such as is afforded by being carried down into the garden. This causes slight auto-inoculation, with a subsequent increase in the amount of protective substances, and the toxæmia is lessened and the temperature consequently falls.

Continuous inhalation of antiseptics, as recommended by Dr. Lees, may help to reduce the activity of the disease and so lower the temperature, and is quite worth a trial, as of course it can easily be carried out whilst the patient is resting, but personally I have been disappointed as to its effects. The usual formula is as follows—

Tincture of Iodine ̄ i  
Creosote ̄ ii  
Carbolic Acid (pure) ̄ ii  
Spirit of Chloroform ̄ ii  
Spirit of Ether ̄ i.

Eight to ten drops of the mixture to be placed on the cotton-wool of a Yeo's inhaler every half-hour. The inhaler to be worn continuously for three or four hours at a time.

Pneumosan and Dioradin have lately been brought forward as remedies, but my small experience of them does not warrant me in saying more than that they may be worth a trial if the case is not improving.

So that the treatment of a febrile case may be summed up as follows:—Continuous rest in bed, abundance of fresh air, and plenty of good food.

**Afebrile Cases.**—When the morning temperature has remained at 98·4° F. or below for at least a week the patient may be allowed up, but if the evening temperature remains high the patient should still rest, especially in the afternoons. The patient should now spend the whole of the twenty-four hours practically outside and should never—if possible—be in a room with closed windows. He should wear sufficient clothing to keep him warm while



resting, but when on exercise should not wear too much, as it will only tire him. If an overcoat or waterproof is necessary the undercoat should be taken off. While dressing or undressing the windows may be nearly closed and the room warmed a little. If living in a town, during a fog it may be better to close the windows and open the door and then change the room frequently, so as to avoid the irritation caused by the soot and smoke.

Food should be plain, with as much variety as possible, and all patients should eat sufficient to make them gain—even a little—weight weekly. The interval between meals should be fairly long and an hour's rest before meals—lying on a bed or couch—rigidly enforced, as this not only gives the stomach a rest but enables the waste products formed during exercise to be eliminated. A certain amount of exercise may now be given, but the quantity and quality must be carefully regulated. To begin with it should consist of a hundred yards or so on the level, at a pace not exceeding two miles per hour. The temperature must be noted either directly afterwards or at the end of half an hour. If directly after it should not exceed  $100.4^{\circ}$  F., but if half an hour later it should not exceed  $99.5^{\circ}$  F. This exercise should be taken in the morning, and on the first day the patient should rest in the afternoon, but on succeeding days the morning walk may be cautiously increased every second day and a short walk—much shorter always than that of the morning—may be given in the afternoon. Until a patient can do a walk of one and a half miles with a gentle rise of about three hundred feet without any ill effects I do not usually give a stiffer climb, but afterwards the length and climb are gradually increased. If any walk causes a rise of temperature beyond the limits mentioned above, the next walk must either be of the same length or shorter until it can be managed without any undue rise.

The exercise may be taken on all days, but its direction should be determined by the direction and force of the wind, and on wet days it should not be as far as on fine ones. When not exercising the patient should be resting in the open, and all walks must be taken with frequent rests.

The question of graduated labour is a more difficult problem unless the patient is under constant supervision in a sanatorium. The gradation of the various stages must be worked out very carefully and the patient must remain on each stage until the work can be accomplished easily and without any undue rise of temperature, but from the point of view of the general practitioner, who cannot be continually looking after the patient, it is probably best not to attempt it.

As regards sleep the patient should be sent

to bed early, say not later than 9.30 p.m., so that a full night's rest may be obtained.

*Special Treatment.* In febrile cases tuberculin is usually contra-indicated.

In afebrile cases tuberculin may be used, but as it does not suit all patients—even though there may be no apparent reason against it—it should only be used when the patient can be carefully watched. One of the mildest preparations, such as P.T.O. in very small doses, may be given to begin with and the dose cautiously increased every fourth or fifth day, but personally I think that better results are obtained from the bacillary emulsion (T.B.E.), and the composition of this approaches more nearly to that of an ordinary vaccine.

If any dose causes a reaction—rise of temperature, malaise, pain and swelling at the seat of inoculation, etc.—it is best to repeat it next time or to go back to the previous dose.

This, however, is not the place to enter into a discussion as to the administration of tuberculin, as it is a difficult and lengthy subject, but I may say that I believe it to be one of the most useful forms of treatment that we have in suitable cases.<sup>1</sup>

*Mixed Infections.* A point not to be overlooked is the question of mixed infection, and if the temperature remains high the sputum should be examined and autogenous vaccines prepared of the organisms found.

*Cough.* Cough can be largely checked by the exercise of will-power, and should be restrained as much as possible, as this will avoid putting strain on the damaged lung. The patient should only cough to get rid of sputum. Irritable cough is best relieved by an opium preparation or its derivatives, such as heroin or codeine.

*Excessive Sputum.* This can often be reduced by the use of the inhalant mixture mentioned previously or by thiochol (potassium guaiacol sulphonate) in five- or ten-grain doses given before meals, as it is tasteless. Personally I have not seen much benefit result from the administration of pure guaiacol or creosote.

*Night Sweats* usually disappear when the patient is treated on open-air lines.

*Hæmoptysis.* Inhalation of amyl nitrite as soon as the attack begins will usually check it at once, but it is not of any use for the small recurrent oozings, for which hypodermics of morphia may be given.

If the disease is diagnosed early, in the majority of cases it is curable, but in all cases the patient should at once be sent to a sanatorium to learn how to live before attempting treatment at home, as home treatment is always difficult.

G. A. C.-C.

<sup>1</sup> Consult *Tuberculin Treatment*, by Riviere and Morland.





# ADDENDA

## I.—GENERAL MEDICINE

### DISEASES OF THE MYOCARDIUM

THE muscle is by far the most important part of the heart, and on its condition is dependent the severity of the symptoms of heart disease. The muscle cells have certain properties, each of which may be injuriously affected by disease: viz. (1) the power of building up a stimulus, (2) excitability, (3) conductivity, (4) contractility and (5) tonicity.

On tonicity is dependent the size of the cardiac chambers. The larger these are the greater is the force required to empty them; thus where tone is deficient and the chambers dilated more force is required to maintain the circulation. Tone probably diminishes all the other properties of the muscle, so that with loss of tone the rate would be increased from increased excitability and the force from increased contractility. In this way tone would act as a regulator both of the force and rate of the heart, adjusting them to the requirements of the circulation. There is not an unlimited amount of contractility present, but a certain proportion is kept in reserve by the muscle tone and perhaps by other unknown factors. This reserve can be released by loss of tone, tension of the muscle fibres, nervous influences, etc., but the total supply of force can only be increased by hypertrophy of the muscle.

The myocardium may be affected by inflammation, degeneration, bacterial or other poisoning, the most commonly occurring toxic agent being that of acute rheumatism. The physical effects of inflammation are usually slight, though the wall may be weakened by an abscess leading to rupture, or the band connecting auricles and ventricles may be interfered with. Micro-organisms, however, manufacture toxins which directly affect the neighbouring muscle cells and indirectly the entire myocardium after absorption into the general blood stream. The rheumatic toxin has a special influence on tone and can lower that of the adjacent cells. The myocardial lesions of rheumatism are most abundant near the mitral valve, around the orifice of which the muscle fibres are arranged as a sphincter, and loss of tone in these fibres will lead to widening of the orifice and cause incompetence of the valve, which affords the explanation of the early systolic murmur heard in acute rheumatism. Toxins brought by the blood stream may be derived from bacterial foci

in the heart or elsewhere: those of rheumatism cause a general dilatation of the cardiac chambers, a common, if not invariable concomitant of this complaint. Contractility is also interfered with by the rheumatic toxin, but to a less extent than by those of diphtheria and enteric fever. Loss of contractility is shown by a feeble first sound and sometimes by lowering of blood pressure, whilst there is dyspnoea on exertion from deficiency of the reserve force, and the phenomena of heart failure with attendant dropsy are prone to develop. Recovery may be complete, or some deficiency of one or both properties may remain permanently, whilst in some cases the muscle cells themselves may degenerate and disappear.

The degenerative processes in the myocardium are usually secondary to vascular changes and appear as patches of fibrosis or fatty degeneration of the muscle fibres. To compensate for these there is often some hypertrophy of the rest of the muscle. That the change in the coronary arteries is of more importance than the fibrosis is proved by the fact that a considerable portion of the cardiac muscle may be destroyed (*e.g.* by malignant disease) without interfering with the heart's action, provided the rest of the muscle is healthy, whereas deficient blood supply lowers the contractility of every fibre, leading to dyspnoea on slight exertion, angina pectoris, feeble heart sounds, and sometimes dilatation of the heart and dropsy. Sudden death is also not uncommon. When the connecting strand between auricles and ventricles is involved there is delay in the conduction of the stimulus, ventricular intermissions, or complete dissociation of auricles and ventricles; prolonged ventricular pauses are also apt to occur, with giddiness, syncopal attacks or convulsions, and sometimes sudden death.

Premature contractions of the muscle, or extra-systoles, are common, and in healthy hearts are of no significance. They are more frequent in diseased conditions and sometimes may occur in prolonged groups forming one type of paroxysmal tachycardia. In cases of rheumatic heart disease and of myocardial degeneration a complete and permanent irregularity may develop, due to fibrillation of the auricles. This condition is generally associated with dilatation, often with dropsy, and always with considerable dyspnoea on exertion.

In the treatment of myocardial disorders it

is important to give the heart no more work to do than it can easily accomplish. In acute conditions, whether due to inflammation or toxin poisoning, the patient should be kept in bed for several weeks to give the muscle a good chance of recovery. In the degenerative cases complete rest is very valuable where there is cardiac failure and dropsy, but in other cases the patient should be encouraged to take gentle exercise in the open air. It is essential, however, that the exercise should never reach the point of inducing dyspnoea or attacks of anginal pain: the patient should be warned that he must rest on the slightest sign of either. The diet should be light, excluding highly seasoned dishes and excess of carbohydrate food, since flatulent distension of the stomach tends to hamper the heart. Much of the action of digitalis is probably directly on the muscle; the slowing of rhythm is mainly due to stimulation of the vagus, but digitalis also increases the muscular tone and thus diminishes the other properties, while it lessens the work the heart has to do. Its action is most striking in cases of auricular fibrillation, where it should be given freely (ten to twenty minims of the tincture every four to six hours) until the pulse rate is much diminished and then be continued in smaller doses. Some of its action in these cases is directed on the conductivity of the heart, more or less completely blocking the passage of auricular stimuli to the ventricles. Digitalis should not be given where contractility is markedly deficient, and it fails to benefit where there is acute inflammation or toxic poisoning.

A. M. G.

## FUNCTIONAL DISORDERS OF THE STOMACH

### I.—MOTOR DISORDERS

#### 1. Atony (Atonic Dilatation)

*Etiology.* Atony and the dilatation of the stomach to which it gives rise may result from neurasthenia and from prolonged febrile diseases, anæmias and all conditions leading to malnutrition.

*Symptoms.* The chief complaint is an uncomfortable sensation of fullness during or immediately after meals, which leads to progressive diminution in the amount of food taken, the patient thereby hoping to diminish his discomfort, but actually increasing the atony by starving his nervous and muscular tissues. In uncomplicated cases pain is never present and vomiting is very infrequent.

*Diagnosis.* Vide "Investigation of the Motor Functions of the Stomach" for the signs of atonic dilatation and its diagnosis from dilatation due to obstruction.

*Treatment.* Rest in the recumbent position

is not only valuable for the depressed nervous system, but it also places the atonic stomach in a condition of mechanical advantage, especially if the patient lies on his right side. In slight cases it is only necessary to lie down for an hour after each meal; in advanced cases the patient should at first remain in bed all day.

An ordinary mixed diet should be given, but the bulk of the meals should be as small as is compatible with the provision of a proper amount of nourishment, and fluids should be drunk only when the stomach is empty. A glass of water may be taken on rising in the morning, a glass of milk or some broth an hour before lunch, one or two cups of tea at five p.m., and a glass of milk last thing at night. Carbohydrates need not be restricted in uncomplicated cases, but when catarrh is present the quantity of sweet and starchy foods should be reduced. Abdominal massage is of great value.

Strychnine is often of use, as it improves the appetite, though it is doubtful whether it has any direct effect upon the gastric tone. It may be combined with dilute hydrochloric acid, particularly if there is deficiency in gastric secretion, and with a bitter such as gentian, which stimulates the appetite and consequently increases psychological secretion.

In uncomplicated cases lavage is likely to do more harm than good, but in severe cases complicated by catarrh lavage with plain water may be of use. Gastro-enterostomy is strongly contra-indicated.

#### 2. Acute Dilatation of the Stomach

*Etiology.* After abdominal operations with or without peritonitis and much less frequently in the course of acute and chronic infections, especially pneumonia, the stomach suddenly becomes greatly dilated owing to a complete loss of tone. The acute dilatation of the stomach leads to obstruction of the duodenum by the mesentery at the point where the latter crosses it, the dilatation of the stomach thereby becoming greatly increased.

*Symptoms.* The abdomen becomes greatly distended; large quantities of dark, but not faecal, fluid are vomited, and the patient rapidly becomes very collapsed.

*Treatment.* The stomach should be kept empty by a tube, however ill the patient may be. Nothing should be given by mouth, but saline solution should be injected into the rectum or subcutaneously.

#### 3. Vomiting

(a) *Central Vomiting.*—Hysterical individuals who have vomited a number of times owing to some central, reflex or toxic cause, may suggest to themselves that certain circumstances will invariably cause them to vomit (vide *Hysterical*



*Vomiting*). Various emotions also result in vomiting, especially in individuals with an abnormally excitable nervous system, and certain organic diseases, such as cerebral tumour and meningitis, are frequently accompanied by vomiting.

(b) **Reflex Vomiting.**—Reflex stimulation of the vomiting centre is the most common cause of vomiting. The most important source is the stomach itself. Irritation of the mucous membrane by abnormal constituents of the gastric contents, whether introduced in the food or resulting from bacterial decomposition or excreted into the stomach, as in uræmia, and the irritation of the surface of an ulcer or growth frequently cause vomiting. Over-distension with food, especially if it has occurred rapidly, as when food is bolted, or if it is prolonged, as in pyloric obstruction, has the same effect.

Reflex vomiting is common in attacks of pain associated with disease of the stomach or duodenum and in biliary colic, appendicitis, intestinal obstruction and peritonitis. It may be excited reflexly by tickling the fauces, from the lungs in phthisis, from the heart when dilated, and in migraine from the eyes or alimentary canal. Sea-sickness is due to a reflex from the semi-circular canals, and vomiting in diseases of the ear, in which the semi-circular canals are directly or indirectly involved, as in Menière's disease, is of similar origin. The vomiting of early pregnancy is probably reflex; when persistent it may be partly toxic and in hysterical women it is aggravated by auto-suggestion. (*Vide also Gastric Crises.*)

(c) **Toxic Vomiting.**—Some emetics, such as apomorphine, cause vomiting by direct irritation of the vomiting centre; others, such as mustard and copper sulphate, act reflexly from the stomach, whilst drugs such as tartar emetic and ipecacuanha act in both ways. Poisons produced in the body, as in uræmia, and the toxins of acute fevers may irritate the vomiting centre.

*Treatment.* The first consideration is to remove the cause. In toxic cases and those due to reflexes from the stomach itself complete evacuation by the stomach-tube gives relief. As purely symptomatic treatment the most useful drugs are acidum hydrocyanicum dil. ℥ iii, tinct. iodi ℥ ii, and chloretone gr. v, repeated, if necessary, three or four times at intervals of two hours. In severe cases, especially when due to organic disease of the nervous system or painful diseases of other organs, morphia is required.

#### 4. Regurgitation

Regurgitation of small quantities of food into the pharynx and less often into the mouth

occurs in various forms of dyspepsia and ceases when this is cured.

No special treatment beyond that of the primary condition is required.

#### 5. Rumination (*Merycism*)

Rumination is the return into the mouth in successive portions of a large part of a meal after its completion; it is chewed again and swallowed, the whole process appearing perfectly natural and not distasteful to the patient. Occasionally several members of a family are ruminators. It occasionally arises as a result of imitation and is most frequent in neurotic individuals. Rumination differs from regurgitation in being unassociated with dyspepsia and in the regurgitated material being re-chewed before being swallowed.

*Treatment.* The food should be eaten very slowly. Rumination is sometimes prevented by smoking and by deep breathing. Occasionally its suppression makes the patient feel unwell, in which case it is advisable to leave it untreated.

## II.—SECRETORY DISORDERS

### 1. Excessive Secretion (*Hyperchlorhydria*; *Hypersecretion*)

Excess of hydrochloric acid may be present in the gastric contents as a result of the gastric juice containing an excessive percentage of hydrochloric acid (*hyperchlorhydria*), or more frequently as a result of the secretion of an excessive quantity of normal juice (*hypersecretion*). One or other of these may occur (a) most frequently during digestion only, (b) continuously, and (c) in paroxysms independent of digestion.

(a) **Digestive Hypersecretion.**—*Etiology.* Healthy individuals occasionally have digestive hypersecretion without gastric symptoms. The most common cause of slight hypersecretion is the chronic irritation caused by habitual over-eating and insufficient mastication, especially if much indigestible food, strong tea or alcohol is consumed, or much tobacco is smoked. Gastric hypersecretion may therefore precede and accompany the early stages of chronic catarrhal gastritis. The dyspepsia of chlorosis is often associated with hypersecretion, which is perhaps in part also due to gastric irritation. Severe digestive hypersecretion occurs most commonly in gastric or duodenal ulcer, but also with chronic appendicitis and gallstones.

*Symptoms.* The chief symptom is *heartburn* or *pyrosis*: a burning sensation is felt in the epigastrium, which is often accompanied by a similar sensation behind the sternum and by the regurgitation into the pharynx of a small quantity of scalding fluid. The heartburn begins two or three hours after meals and is relieved by drinking, eating and by alkalies.

A small quantity of very acid fluid, which generally contains fragments of vegetable food but no meat, may be vomited, complete relief resulting. In the absence of ulceration tenderness is slight and ill-defined. The patient often complains of flatulence (*q. v.*) when the heartburn is at its height. The appetite is good and constipation is commonly present. Occasionally reflex salivation occurs at the height of the attack: when excessive this runs from the mouth, or it is swallowed and accumulates in the lower end of the œsophagus, whence it is ejected in considerable quantities as an alkaline, opalescent fluid, the condition being known as *water-brash*.

**Diagnosis.** The presence of hypersecretion can only be recognized with certainty by means of a test breakfast. The proportion of fluid to solid removed is excessive, and the percentage of active hydrochloric acid is greater than 0.2 per cent. Hypersecretion having been diagnosed, it is necessary to exclude gastric and duodenal ulcer, gallstones and chronic appendicitis before the condition can be regarded as functional.

**Treatment.** Treatment should be primarily directed to the removal of the cause. In all cases the diet should contain plenty of fats, which inhibit the flow of gastric juice, and of proteins, which combine with much of the hydrochloric acid, the secretion of which they call forth, but as little carbohydrate as possible, as this stimulates secretion without combining with the acid. The most valuable articles of diet are therefore milk, cream, butter, eggs, fish, chicken and tender meat. Lentils, peas and beans are the best vegetables, but small quantities of green vegetables may be taken as purées. Meat extracts, raw and coarse vegetables, pips and skins of fruit, unripe fruit, pickles, vinegar, mustard and other condiments, cheese (except cream cheese), new bread, alcohol, and effervescing drinks must be avoided. The food must be slowly eaten and thoroughly chewed.

As symptomatic treatment the patient should take a very small quantity of a powder containing equal parts of magnesia, sodium bicarbonate and bismuth carbonate, at the first suspicion of discomfort, and should continue taking small doses until the pain is controlled.

(b) **Continuous Hypersecretion (Reichmann's Disease).**—When a gastric or duodenal ulcer involves the pylorus the secretion of gastric juice becomes continuous. A test breakfast gives the same result as with digestive hypersecretion, but the stomach instead of being empty before breakfast contains a quantity of very acid fluid, food being absent unless the condition has become complicated by definite obstruction.

The symptoms and treatment are those of pyloric ulcer.

(c) **Paroxysmal Hypersecretion.**—Secretion of an excessive quantity of gastric juice in paroxysms, quite independent of the presence of food in the stomach and separated from each other by weeks or months, constitutes one form of *tabetic gastric crisis* (*q. v.*), and it may be associated with severe headache in migraine (*gastroxyntesis*), the attacks being generally brought on by overwork and relieved by bromides, belladonna and codeine.

## 2. Deficient Secretion (Hypochlorhydria; Hyposecretion; Achylia Gastrica)

Deficient secretory activity may manifest itself in the secretion of a weak juice (hypochlorhydria) and in the secretion of an abnormally small quantity of gastric juice (hyposecretion). It is generally impossible to distinguish between these two conditions; they must therefore be discussed together. They result in the disappearance of free hydrochloric acid and in the diminution of active acid below the normal minimum of 0.1 per cent. They are generally accompanied by a corresponding diminution in ferments, the complete absence of acid and ferment being known as *achylia gastrica*.

**Etiology.** The secretion of hydrochloric acid diminishes in the later years of life. It is deficient in most diseases resulting in malnutrition, in acute fevers, in acute gastritis, in all but early cases of chronic gastritis and in cancer of the stomach. When chronic gastritis leads to atrophy of the mucous membrane *achylia gastrica* may finally result; this is constantly the case in the atrophic gastritis of Addison's *anæmia*. When food is eaten with a preoccupied mind and without appetite, as in neurasthenia, when it is distasteful, when the individual is suffering pain, and when the tongue is furred and the sense of taste impaired, the psychical stimulus is deficient and hyposecretion results.

Gastric hyposecretion leads to deficient digestion of proteins and connective tissue; the latter appears in the stools, and meat reaches the colon in large fragments, which cause mechanical irritation and are apt to undergo putrefaction, so that diarrhoea, accompanied by general abdominal discomfort, frequently follows.

**Primary Achylia Gastrica** is a condition in which little or no hydrochloric acid, pepsin and rennin are secreted, probably as a result of a congenital abnormality of the mucous membrane. It is often completely latent, but more commonly there is a history dating from childhood of repeated slight attacks of abdominal discomfort with anorexia and nausea, which had led to



the patient being described as having a "weak stomach." In adult life these attacks may become more frequent and severe. In the majority of cases, however, the chief symptom is chronic diarrhoea, which resists all ordinary methods of treatment.

*Diagnosis.* The gastric contents recovered after a test breakfast are small in bulk, viscid, neutral or alkaline and contain little or no active hydrochloric acid.

*Treatment.* The food should be chewed until it is quite fluid. Very little meat should be taken, but otherwise no dietetic restrictions are necessary. Except in cases of complete achylia, a bitter mixture taken before meals may stimulate secretion. In all cases hydrochloric acid should be given; acidum hydrochloricum dil.  $\mathfrak{m}$  x with pepsin should be given in an ounce of water twice during each meal and three times after at intervals of a quarter of an hour; this treatment is generally sufficient to overcome the diarrhoea, but it may be necessary at first to give some bismuth salicylate and tannigen if intestinal catarrh has resulted from the achylia.

### III.—FLATULENCE

*Etiology.* Flatulence, or the presence of excess of gas in the alimentary canal, may be due to (a) excessive production of gas as a result of fermentation and putrefaction, (b) excessive introduction of gas from aerophagy, and (c) deficient elimination of gas.

(a) **Excessive Fermentation** in the stomach occurs when the quantity of hydrochloric acid present is deficient and the evacuation of the stomach is slow, the latter being the more important, as flatulence is often absent in achylia gastrica, but never in pyloric obstruction, even when hypersecretion is present.

(b) **Aerophagy** is the commonest cause of flatulence; in most cases it is associated with nervous dyspepsia, but it also occurs with organic diseases such as gastric and duodenal ulcer. The patient feels some slight discomfort in the stomach, which he thinks is due to "wind" and which he imagines he can "disperse" by eructation; as there is really no excess of gas present, the attempt proves unsuccessful but results in the swallowing of air. After half a dozen or more attempts have been made without success, air being swallowed on each occasion, the stomach becomes so distended with air that an attempt is at last successful. Excessive salivation in gastric disorders associated with hypersecretion and in septic conditions of the mouth leads to constant swallowing of saliva and air. The severest cases of aerophagy occur in hysteria independently of any dyspepsia; a little saliva with a large quantity of

air is swallowed until the stomach is distended, when it is either pumped backwards and forwards between the stomach and œsophagus by spasmodic movements of the diaphragm, or periodically expelled with a single loud report or a series of discharges.

(c) **Deficient Elimination of Gas** occurs in pyloric obstruction, and also when absorption is diminished owing to catarrh or the obstruction to the portal circulation in cirrhosis of the liver and heart failure; the air swallowed and the gases produced by fermentation are insufficiently absorbed and severe flatulence results.

*Symptoms.* The most common symptom resulting from flatulence is a sensation of fullness in the abdomen. The abnormal accumulation of gas in the stomach pushes the diaphragm up, and dyspnoea results in those predisposed by such conditions as asthma and heart failure; it may also be the immediate cause of an attack of angina pectoris.

*Diagnosis.* When a patient complains of "flatulence," it is first essential to ascertain whether excess of gas is really present. *Pseudo-flatulence* may be due in neurotic individuals to spasm of the diaphragm: a sensation of great distension is suddenly experienced and the abdomen is found to be greatly enlarged. The distension disappears as suddenly as it came without eructation or passage of flatus; it also disappears under an anæsthetic. The absence of excess of gas in the stomach can at once be detected with the X-rays, which also show the low position of the diaphragm and the absence of respiratory movements. The condition can be cured by teaching the patient to breathe properly with her diaphragm. Pseudo-flatulence is more often due to the patient misinterpreting the sensation of fullness caused by the increased intra-gastric pressure, which results from hypertonus and excess of solid or liquid contents as well as from excess of gas. There is no abdominal distension nor increase in gastric resonance, and the patient is unable to bring up any gas, but the condition is often complicated by aerophagy.

The gas brought up in cases of aerophagy is odourless, but may be offensive when it is produced by fermentation. Eructation frequently repeated at very short intervals is invariably due to aerophagy.

*Treatment.* Flatulence due to excessive fermentation can be diminished by giving small meals, which must be properly masticated and eaten slowly; new bread and excess of potatoes and green vegetables should be avoided. Antiseptics are of little use, but glycerinum acidi carbolici  $\mathfrak{m}$  v may be given after meals.

When flatulence is due to aerophagy, it is

often only necessary to explain to the patient the cause of his trouble in order to cure him. He should be told not to try to eructate unless he is certain he will succeed, and he should swallow saliva as infrequently as possible. Neurotic patients, who are at first unable to control the habit, should keep their mouths open or insert a cork between their teeth when they feel inclined to swallow or eructate. The dyspepsia, which has led to the aerophagy, should be treated by appropriate means. The patient often wants some rapid method of relieving the discomfort, as he is not allowed to eructate; such relief can generally be obtained by hot water, chloroform water or carminatives such as oil of cinnamon or peppermint, but the use of whisky for this purpose should be prohibited.

In severe cases of hysterical aerophagy, isolation is required; a stomach-tube should be passed and kept in the stomach for ten minutes at a time, the patient having previously been told that the treatment will give her permanent relief.

#### IV.—SENSORY DISORDERS

##### 1. Abnormalities in the sense of Hunger and Appetite

(a) **Excessive Appetite (Bulimia).**—Bulimia may result from the necessity of compensating for excessive metabolism in diabetes and Graves' disease and for the loss of nutrient material in chronic diarrhoea. It also occurs with gout, pregnancy, worms, cerebral tumour, epilepsy and hysteria. In a slight form it is present in conditions, such as duodenal ulcer, which are associated with gastric hypermotility and hyperacidity.

*Treatment.* The treatment of the primary condition is the chief indication. When bulimia is leading to obesity, as it frequently does in gout, a mixture containing potassii bromidum, gr. x, with tinct. belladonnæ, ℥ v, taken half an hour before meals may diminish the appetite.

(b) **Loss of Appetite (Anorexia).**—Anorexia occurs in gastritis and cancer of the stomach and in toxæmic conditions such as acute fevers, tuberculosis and cancer. It is an extremely common symptom in neurasthenia, in which it is due to the depressed condition of the nervous system and in part to dietetic restrictions made with the object of relieving the dyspepsia so often present, the diminished intake of food leading to a diminution in the appetite. In hysteria fear of indigestion or of becoming fat leads to a gradual diminution in the quantity of food eaten, the appetite diminishing to a corresponding extent, until finally the condition known as *anorexia nervosa* develops, in which the patient refuses all food and becomes excessively emaciated.

*Treatment.* The anorexia of neurasthenia and hysteria can only be overcome by forcing the patient to eat more. As soon as he can be persuaded to eat an increased quantity of food the appetite returns; in severe cases complete isolation is essential, and in exceptional cases of hysterical anorexia feeding through a tube may at first be necessary.

(c) **Abnormal Sensations accompanying Hunger.**—In neurasthenic and hysterical individuals a distressing sense of hunger may suddenly appear, especially when the patient knows that no food is at hand; it is often associated with a feeling of great anxiety and exhaustion and sometimes with cold sweats, vertigo and nausea. In neurasthenia a few mouthfuls are sufficient to make the patient comfortable, but in hysteria the condition may be associated with bulimia.

*Treatment.* In addition to the general treatment for neurasthenia and hysteria the patient should always carry a little food in his pocket and have some by his bedside, so that he can take it the moment he feels hungry; this prevents the development of the other symptoms.

(d) **Depraved Appetite (Parorexia).**—Parorexia may occur in hysterical and insane patients and in a mild form in chlorosis; the patient has a craving for very acid or highly spiced food, or, in the insane, for non-edible articles, such as earth.

##### 2. Abnormalities in the Sensation of Fullness and Pain

(a) **Anæsthesia (Absence of Satiety; Akoria).**—Akoria is generally associated with bulimia and occurs most commonly in gout, but also in hysteria. The patient always feels empty, even after a large meal. It is an important factor in the production of obesity in gouty individuals.

*Treatment.* The patient should be instructed to take only a defined amount of food, even if he does not feel satisfied with it; he should select bulky non-nutritious articles of diet, such as clear soup and green vegetables. Small doses of bromide and belladonna may also be of service.

(b) **Hyperæsthesia.**—The excessive irritability of the central nervous system in neurasthenia and chlorosis results in a lowering of the minimal adequate stimulus and an exaggeration of the sensory response to visceral stimuli. Consequently digestive processes, which are normally imperceptible, become perceptible, and conditions which would otherwise lead to nothing more than a sensation of slight discomfort, give rise to pain. Neurasthenic individuals moreover tend to be *hypochondriacal* and to concentrate their attention on every slight sensation



in their digestive organs, thereby further increasing visceral sensibility.

(i) **Rapid Satiety.**—This is most common in neurasthenia, the patient complaining of a sensation of fullness and distension as soon as he has taken a very small quantity of food, although he may immediately before have had a ravenous appetite. It is one cause of the inanition common in neurasthenics.

*Treatment.* The patient should be persuaded to eat a normal amount of food in spite of the feeling of fullness by impressing upon him that in order to get well he must go through a certain amount of discomfort. The feeling of fullness gradually disappears as his weight increases and his general condition improves.

(ii) **Gastralgia.**—(Vide *Hysteria* and *Chlorosis*.)

## V.—SECONDARY FUNCTIONAL DISORDERS

[The individual symptoms are more fully discussed under the separate headings.]

### 1. Nervous System

(a) **Neurasthenia (Neurasthenic or Nervous Dyspepsia).**—*Etiology.* Most neurasthenic patients suffer from indigestion, partly as a result of gastric hyperæsthesia (*q. v.*), and partly as a result of depressing emotions, mental and physical overwork, and the other factors concerned in the production of neurasthenia, as these tend in themselves to inhibit the motor and secretory functions of the stomach.

*Symptoms.* The gastric symptoms in neurasthenia are characterized by their extreme irregularity, the patient feeling very ill one day and quite well the next without obvious reason for the change. The most constant complaint is of vague abdominal discomfort, which rarely amounts to actual pain. It is generally worst in the morning and improves towards evening; it is increased after meals, a sensation of fullness being felt as soon as a small quantity has been eaten. The discomfort has little relation to the amount or the kind of food; it is increased by worry and excitement, whilst some new interest, whether it be a change of surroundings, the visit of a friend, or a new medicine, leads to its temporary disappearance. Nausea sometimes occurs, but vomiting is unusual. Most patients complain of flatulence, which is more commonly due to aerophagy than to excessive fermentation, but may be nothing more than the result of misinterpreting the sensation of fullness, no excess of gas being present (vide *Flatulence*). The appetite is always diminished, though it varies considerably from day to day (vide *Anorexia*). As insufficient food is taken, the nervous system becomes more depressed; this reacts again on the digestion, a vicious circle being produced.

Examination of the stomach shows that in many cases atonic dilatation (*q. v.*) is present; the secretion of gastric juice varies considerably from day to day, deficiency being rather more common than excess. Constipation is almost constantly present.

The gastric symptoms are invariably associated with other symptoms of neurasthenia, such as headache, backache and insomnia, and the anorexia leads to progressive loss of weight and strength. The abdominal discomfort may be accompanied by flushing of the face, palpitation and coldness of the extremities. The patient is generally depressed and pessimistic and very liable to mental and physical fatigue. He makes the most of the least abdominal discomfort and pays great attention to all his bodily functions, often making a study of his excreta and keeping an accurate record of his pulse and temperature. His account of his symptoms is long and full of details, and he often has some theory to account for it, believing himself to be suffering from "acidity" or "liver," or fearing that he is afflicted with cancer or other mortal disease.

*Treatment.* The patient's confidence can only be gained after a very thorough examination. He must then be told that he has no organic disease and that with perseverance he will get well. The general neurasthenic condition first requires attention; for this mental and physical rest and sufficient food to overcome the inanition, which is generally present, are of most value. Pleasant surroundings, cheerful companions and appetizing food are of great importance, and consequently strict isolation is rarely required. The treatment of the stomach itself depends upon the condition of the motor and secretory functions, and has already been described (vide *Atony*, *Deficient Secretion*, etc.).

(b) **Hysteria.**—*Etiology.* When symptoms such as vomiting or abdominal pain have been caused by gastritis, gastric ulcer, chlorotic dyspepsia or appendicitis in hysterical individuals, they may continue or recur as the result of auto-suggestion after the original cause has disappeared. Many cases of persistent vomiting in pregnancy are really hysterical. Less frequently digestive symptoms arise in hysteria as a result of imitation, as, for example, vomiting in the hysterical daughter of a mother suffering from some organic gastric disorder.

*Symptoms.* (i) **Vomiting.** Hysterical vomiting occurs during or immediately after meals; it is effortless and generally unaccompanied by nausea, so that the patient is frequently ready to return to her meal immediately afterwards. The stomach is generally only partially emptied, so that nutrition is preserved, but in rare cases nothing is retained and severe emaciation results.

*Treatment.* The patient should be kept in

bed and strictly isolated. It should be explained to her that the original cause of her vomiting has disappeared, and that her stomach has simply got into a bad habit which it must be educated to give up. She should be given an additional helping of any food she vomits, even if this has to be repeated two or three times.

(ii) *Gastralgia*.—Gastralgia is a not uncommon symptom in hysterical girls, who have previously suffered from genuine gastric pain as a result of chlorosis or gastric ulcer. It is very irregular in its relations to the time and character of meals; it may occur before as well as after breakfast, and may be absent after a very indigestible meal during which the patient has had her mind distracted. It is accompanied by very diffuse deep tenderness and often by a large area of cutaneous hyperæsthesia. It may be associated with vomiting, which does not always relieve it.

*Treatment*. Rest in bed, isolation, full diet and the application of a blister to the epigastrium generally effect a rapid cure. (*Vide also Aero-phagy and Anorexia*.)

(c) *Gastric Crises of Tabes*.—Gastric crises generally appear in the pre-ataxic period of tabes and often disappear as the more obvious symptoms develop.

*Symptoms*. The symptoms appear and disappear with extreme suddenness, the patient being completely free from digestive symptoms in the intervals. The attacks may last from a few hours to several days; short attacks may occur daily or the intervals may be as long as six months.

Pain and vomiting generally occur together, but either may be present alone. The pain is in the epigastrium and is excessively severe; it has no relation to meals and is only slightly relieved by vomiting. The vomiting is very intractable; the food last taken is first brought up, after which pure gastric juice (paroxysmal hypersecretion) or mucous fluid, often bile-stained and sometimes streaked with blood, is vomited. The pain and vomiting lead to profound collapse.

*Diagnosis*. Attacks of severe pain or vomiting beginning and ending suddenly, uninfluenced by treatment, and of a character which does not correspond with that of any ordinary gastric disease, should arouse a suspicion of tabes. Even when there are no other symptoms of tabes, the knee-jerks, and still more frequently the tendo-Achillis-jerks, are absent, the pupils may be abnormal, the cerebro-spinal fluid contains lymphocytes and the Wassermann reaction is generally positive.

*Treatment*. The patient should have nothing but fluids, and when vomiting is persistent a continuous rectal infusion should be given.

When there is hypersecretion, frequently repeated drachm doses of sodium bicarbonate may relieve the pain. In other cases the pain is associated with a great rise in blood-pressure, and inhalation of amyl nitrite and subcutaneous injections of sodium nitrite give relief, but frequently nothing but morphia is effective.

## 2. Chlorosis

Gastric symptoms are present in nearly all cases of chlorosis. A slight degree of atony, digestive hypersecretion and hyperæsthesia, leading to a sense of fullness and pain high in the epigastrium immediately after meals, are frequently present. Nausea may occur; it is often followed by vomiting of a portion of each meal with some relief to the discomfort. Deep tenderness is well marked but diffuse, the left rectus muscle is somewhat rigid, and there is often a large area of cutaneous hyperæsthesia on the left side. The symptoms are no worse with a full diet than with milk, but are aggravated by exercise and disappear on resting in bed.

*Treatment*. The patient should be kept in bed for at least three weeks. She should be given ferri et ammon. cit., gr. x, and liq. arsenicalis, ℥ iii, with as much sodium sulphate as is required to keep the bowels open, three times a day after meals. Even if she has been suffering from a considerable amount of pain and sickness, she should be given a full diet. With this treatment the symptoms rapidly disappear.

## 3. Liver and Gall Bladder

(a) *Cirrhosis*.—The portal obstruction in cirrhosis of the liver leads to congestion of the gastric mucous membrane; this, together with the direct effect of alcoholic excess, leads to chronic gastritis. In addition to the ordinary symptoms of gastritis, occult blood may be found in the stools and vomiting of watery mucus frequently occurs before breakfast.

(b) *Gallstones*.—Apart from attacks of biliary colic, the presence of stones in the gall bladder leads to pain and flatulence, associated with hypersecretion two or three hours after meals. The relief obtained from alkalies and by food is less than in duodenal ulcer, and vomiting is more frequent. Tenderness is present over the gall bladder and often to the right of the dorsal spine.

## 4. Chronic Appendicitis

Chronic appendicitis also leads to digestive hypersecretion with intermittent attacks of epigastric pain, which tends to radiate downwards. The pain is increased by food and is often brought on by exercise. Tenderness is more marked in the right iliac fossa than in the epigastrium, although spontaneous pain



may be confined to the latter situation. Pressure in the right iliac fossa may also give rise to pain in the epigastrium and to nausea.

### 5. Circulatory Disorders

(a) **Heart Failure.**—The congestion of the gastric mucous membrane in heart failure leads to symptoms of chronic gastritis; excess of mucus and traces of blood are present in the stomach, and in severe cases reflex vomiting occurs. A constant sensation of fullness is present, which is increased after meals, and is accompanied by dyspnoea, palpitation and a feeling of tightness in the chest.

(b) **Arterio-sclerosis and Atheroma.**—Degeneration of the abdominal arteries in middle-aged and elderly patients may lead to attacks of painful distension and flatulence, especially after exertion or excitement. Relief is obtained by means of iodides, nitrites and diuretin. Arterio-sclerosis may also help in the production of chronic gastric ulcer.

### 6. Phthisis

In the initial stages symptoms almost identical with those of chlorotic dyspepsia are frequently present, but they do not respond in the same way to treatment. In the terminal stages extreme anorexia with atony and hyposcretion are present. Food causes abdominal discomfort, and attacks of coughing may terminate with vomiting.

### 7. Urinary System

(a) **Uræmia.**—In chronic nephritis anorexia and nausea are common, and when uræmia is present vomiting and diarrhoea may occur. These are best relieved by putting the patient on a farinaceous diet and washing out the stomach and colon.

(b) **Retention of Urine.**—Distension of the bladder leads to anorexia, nausea and reflex vomiting. It is relieved by the regular use of the catheter.

### 8. Gout

The gastric symptoms present in gout are frequently due to the consumption of excessive food and drink, chronic gastritis being often present. Bulimia and akoria may occur.

A. F. H.

## TYPES OF NEUROTIC TEMPERAMENT

Although there are many subdivisions, two main types of neurotic or emotional temperament may be distinguished—the *unrestrained unstable type*, and the *restrained and receptive type*.

In the **Unrestrained Type** there is hypersensitiveness and excessive reaction to all forms of stimuli, physical and mental. Their emotions

are strong for the moment but shallow, and they have little or no control over their outward manifestations. Their moods are constantly changing. They are extravagantly affectionate, or callous and indifferent by turns; selfish, clamouring for sympathy, aggrieved and infuriated by any thwarting of their immediate desires; enthusiastic and overjoyed or needlessly depressed and abased by inadequate causes; arrogant, boastful and determined one day, and on the next timid, self-depreciatory and irresolute. They are the prey of every passing fancy, mood or emotion, and soon exhausted by emotional excesses, yet unless supplied with a daily changing menu of stirring emotions they speedily become bored, introspective and hypochondriacal.

Intellectually they are often above the average, quick at learning though forgetful, seldom capable of prolonged industry, but working with feverish energy in fits and starts. Even brief periods of zeal and ambition may raise them to the rank of genius, but they are more apt to become the brilliant wasters of the community.

In childhood they are pale, thin and sallow, with dark-ringed eyes, dilated active pupils and puffy lower eyelids. Their expression is animated, they talk fast and volubly, often stammer, and ask strings of questions without waiting for an answer. For days together they will be full of life and tireless energy, then collapse suddenly in consequence of some trivial ailment.

They are liable to repeated night terrors, somnambulism, headaches, migraine, various forms of tics and bad habits, phobia and obsessions, asthma, cardiac palpitations, flushings, pallor, syncope, sweating, dead fingers and cold extremities, eczema and various forms of erythema exudativum. Cyclic vomiting and cyclic or functional albuminuria, enuresis, and lenteric diarrhoea alternating with constipation and mucous colitis and attacks of so-called gastric catarrh are frequent. The appetite is capricious, and they often show idiosyncrasies as regards food, such as intolerance of fat, carbohydrates and other common articles.

If rheumatic they invariably develop chorea, severe out of all proportion to the amount of arthritis and endocarditis which may be present. But, as a matter of fact, true rheumatism and valvular heart disease are very rare in neurotic subjects, although aches and pains, palpitation and functional cardiac derangements are common.

They are usually treated with the utmost deference on account of supposed proclivities to weak hearts, weak lungs, weak digestion, threatened consumption, and suffer accordingly in mind, body and character.

True idiopathic epilepsy is uncommon in this class, but under great emotional excitement or physical or mental strain they may be subject to epileptiform seizures.

**The Restrained Emotional and Receptive Type.**—In this type, as in the first, there is hyper-sensitiveness to all forms of stimuli, but the reactions are suppressed. Emotions are very strongly felt, but the control of their outward display is equally strong. The features are expressionless and apathetic, the attitude statuesque or stooping, the gait is slouching, slow and clumsy. Children of this type are often regarded as wanting in natural affection, but really yearn to be loved, brood over slights, imaginary or otherwise, and become gloomy, morose, solitary in habits, introspective and superstitious, gloating over, yet terribly frightened by all that is uncanny and horrible. They harbour various kinds of phobia and sometimes develop abnormally conscientious scruples of moral and religious nature—ponder over the reason of their existence and entertain thoughts of suicide. Their apparently stolid indifference to their surroundings is varied by sudden fits of ungovernable rage or weeping. Some are observant, intelligent, but so reticent that they often pass for being stupid, sullen and obstinate. They take all things seriously and have little or no sense of humour. This disposition, with its characteristic suppression of outward expression of emotion, is as exhausting as that of the other type in which emotional excess is obvious, and is associated with many similar complaints.

The character of the suppressed emotion varies; it may be fear in one shape or another, or desire for love and sympathy, or ambition coupled with a sense of inferiority, and envy, hatred and malice towards others who succeed. In any case the suppressed emotion becomes an obsession, governing or excluding all stimuli derived from experience and environment which normally should counteract it. The result is mental and physical exhaustion, dreamy mental states, somnambulism and vigil-ambulism, psychasthenia, neurasthenia and hysteria.

**Etiology of the Neurotic Temperament.** The neurotic temperament is partly inherent and partly the result of environment.

The neurotic child is most frequently the only one, or, what is practically the same thing, a long interval of years separates it from brothers and sisters. He may be the pet or the ugly duckling, or on account of his delicacy he is treated differently from the rest of the family.

One or both parents are often themselves neurotic or neuropathic, and the child, having no companion of his own age, learns to imitate his parents, to share all their worries and

anxieties about himself, his ailments and theirs, and the household cares in general.

Environment has more to do with the development of the neurotic temperament than heredity. Parents are not always to blame, the influence of nurses, governesses, teachers and companions has to be taken into account.

As regards directly exciting causes, any severe illness may yield crops of functional neuroses, though frequently they arise in children who are never very ill though never very well.

Sudden emotional shocks may be the exciting cause, and also long periods of fear, worry, anxiety, suppressed or not, as the case may be, or over-pressure or a life of unhealthy excitement, an environment uncongenial for any reason.

Errors of refraction, diseases of naso-pharynx and other forms of peripheral irritation are rarely the sole cause of neuroses. In all neurotic children the hyper-sensitiveness and ready response to irritation and stimuli of any description which make up the neurotic temperament have to be considered. L. G.

### CONVULSIONS IN INFANTS

**Convulsions** are purposeless, spasmodic and inco-ordinated muscular movements either tonic or clonic in character, with or without loss of consciousness. Their occurrence depends on the mutual relationship of the exciting cause (liberating stimulus) and the degree of excitability of the nerve centres. If the centres are in a sufficiently excitable state normal stimuli such as ordinary sounds, smells, tastes or tactile impressions may excite an attack. In infancy and early childhood the nerve centres of the cortex, the base of the brain, the bulb and spinal cord, are, from developmental causes, in a condition of relative excitability, but they become more excitable still if they suffer mechanical injuries (birth injuries, hæmorrhages, etc.), if they are exposed to unusual or detrimental forms of stimulation, or to inadequate or injurious conditions of nutrition. A special degree of irritability of the nervous sphere tends to develop under the same conditions of bad hygiene as produce rickets. This condition is known as *spasmophilia*, and is characterized by certain definite signs and symptoms shortly to be described.

The character of the attack itself is largely determined by the nature of the underlying cause, whether this be chronic, as in organic disease, epilepsy, spasmophilia and blood diseases (uræmia, diabetes, etc.), or acute and accidental as in indigestion and in intoxications whether of extrinsic (drugs) or intrinsic origin (auto-intoxications).



*Convulsions in Organic Disease.* There may be a history of trauma, prolonged birth or instrumental delivery. The spasms appear within the first two weeks of life and they are apt to be persistent; if they continue beyond the third year they are almost certainly due to organic mischief. There is a tendency for the spasms to remain strictly localised, and for muscular contractures to ensue. In meningitis there is usually bulging and tension of the fontanelle between the convulsions. Lumbar puncture and bacteriological examination of the cerebro-spinal fluid may settle the diagnosis. In syphilitic conditions there may be other evidence of the disease.

*Convulsions in Epilepsy.* There is often a family history. The attacks ensue apart from reasonable causes, and they are apt to recur frequently. There may be stigmata of defective mentality, the convulsions may be accompanied by involuntary passage of fæces and urine, the tongue may be bitten, and there is usually foam about the mouth. At the conclusion of the attack the child may relapse into a prolonged stuporous sleep.

*Convulsions in Spasmophilia.* There are almost invariably concomitant signs of rickets. The exaggerated irritability of the nervous sphere is shown by Chvostek's sign or facial spasm on digital percussion of the malar bone, Trousseau's phenomenon or the production of carpal spasm on pressure of the brachial plexus in upper third of arm, and Thiemich-Mann's symptom or raised excitability of the peripheral nerves to galvanic excitation in which K.O.C. is below 5 M.A. and K.O.C. > A.C.C. Both during the attacks and between the attacks there is a great tendency for the development of respiratory spasms, such as sighing or sobbing respirations, spasm of glottis and spasm of larynx. In spasmophilia the spasms may take the form of (1) eclampsia, (2) tetany, (3) laryngeal spasm, (4) spasmus nutans, or (5) nystagmus.

*Convulsions in Transient Hyper-Excitability of Nervous Sphere.* This is the condition in which occasional spasms arise. The exaggerated excitability may be due to the commencement of some specific infection such as measles, scarlet fever, pneumonia, etc., in which case there may be a rise in the temperature, the pulse frequency and the rate of respiration. The condition may also be due to auto-intoxication from intestinal decomposition, to hepatic inadequacy, or to renal inflammation or inefficiency.

The *exciting cause* is generally some form of reflex stimulation, therefore carefully examine the skin for sources of irritation, the mucous membranes for inflammation, the motions for undigested food, and the urine for acidity or gravel. The most common causes are: (1) indigestion, or excessive quantities of food; (2)

flatulence and colic; (3) ear trouble (otitis media); (4) sore gums (dentition); (5) painful fissure of anus.

*Treatment of the attack itself—*

For convulsions with unconsciousness, give a bath at 90° F. and apply ice or a cold pack to the head and neck.

With high fever, give a bath at 70° F. or lower.

With prolonged muscular spasm, give chloroform inhalations.

With respiratory spasm in which chloroform cannot be inhaled, give a rectal injection of chloral hydrate (four to six grains in one ounce of warm water), or an hypodermic injection of morphia  $\frac{1}{30}$  gr. with atropine  $\frac{1}{200}$  gr. Apply cutaneous stimulation to the chest and back by striking it smartly with a wet towel.

With gastric symptoms, give an emetic (mustard and water or two teaspoonfuls of ipecacuanha wine with five grains of carbonate of ammonium), or wash out the stomach.

With colic, give castor oil and opium, or calomel. If an immediate action is desired, give an enema.

*Prophylaxis*, or treatment of the underlying condition—

*Organic Disease.* With prolonged and repeated spasm in new-born babies consider the advisability of an operation for the removal of a possible clot of blood. Always bear in mind the possibility of syphilis and perform Wassermann's test on infant or mother.

*Epilepsy.* Pay special attention to condition of bowels so as to avoid intestinal intoxications. Remove all sources of peripheral irritation such as those due to enlarged tonsils, adenoids, nasal polypi, rectal fissures, and phimosis.

*Spasmophilia.* Treatment as in the case of rickets.

Breast milk is regarded by Thiemich as specific, while phosphorus is strongly recommended by Kassowitz. It may be given in cod-liver oil in a strength of 1 in 10,000. Dose one teaspoonful three times a day.

The following mixture is useful for a child of eighteen months suffering from chronic convulsions—

R Ammonii Bromidum gr. v  
Liq. Arsenicalis ℥ i  
Tinct. Belladonnæ ℥ i  
Calcii Glycerophosphatis gr. ii  
Elix. Glusidi ℥ i  
Aquam ad 5 i.

t.d.s.

E. P.

#### ADIPOSIS DOLOROSA (DERCUM'S DISEASE)

A disease of middle life, almost exclusively of women, and occurring chiefly at or after the menopause. The cause is unknown, but

the autopsies usually demonstrate induration, atrophy with compensatory hypertrophy, and calcareous infiltration of the thyroid gland. Tumour of the pituitary gland has also been found. The pain is probably referable to interstitial neuritis of the nerves of the adipose tissue.

The onset is insidious, with the formation of irregular fatty tumours or diffuse deposits of fat of independent origin or as a further development of a pre-existing obesity. Nodular raised areas appear, two to four inches across, soft, painful and tender. The elevations soon subside, leaving indurated areas in the fat tissue. This process may be repeated, a definite tender nodule resulting, the deposits, at first limited to the original areas, later spreading extensively. Face, hands and feet, however, always escape. There may or may not be excessive general deposit of fat; if there is, the nodules appear distinctly raised, resembling multiple lipomata. In other cases the fat is diffusely deposited in large, localised masses, containing sensitive, indurated areas. The distribution is often symmetrical.

Pain is a constant feature, may be shooting and sharp or a dull ache, spontaneous or elicited by pressure, and is frequently associated with tenderness along the nerve trunks.

Weakness, irritability and depression, diminished cutaneous sensibility and anæsthesia are also manifested.

*Prognosis* is bad as to cure, but good as to life.

*Treatment* is unsatisfactory and is mostly symptomatic, although thyroid extract should always be tried.

E. P.

### EPILEPSY IN RELATION TO INSANITY

*Definitions.* Epilepsy is a paroxysmal neurosis affecting consciousness. It has also been defined as a paroxysmal apyretic neurosis, the victims of which are easily impressed neurotics. Insanity is a mental failure on the part of an individual to adapt himself to his environment, and is tested by the quality of conduct. A disturbance of consciousness is common to both; it is a constant and necessary concomitant of epilepsy, although there are epileptic phenomena, such as vertigo, loss of memory, a "dreamy state," or a special delirium (*épilepsie larvée* of Morel, masked epilepsy of Esquirol, psychical epilepsy or the convulsive idea of Maudsley) which are without complete loss of consciousness. In the status epilepticus the loss is complete, for in this state there is total abolition of mind power.

*General.* A high degree of intelligence, sometimes the highest, is said to be associated with epilepsy; and Julius Cæsar, Mahomet, Peter the

Great, Napoleon, Swedenborg and many others are alleged to have suffered from epilepsy—which implies an uneven and irregular discharge of nervous power. A certain instability is essential to nervous action, and genius may co-exist with morbid instability. Epilepsy may also co-exist with a healthy growth and development of the intellectual faculties. It is only when epilepsy is frequent that a destructive influence is exercised on the mind, and in this way the frequent *petits mals* produce a more retrogressive effect upon mental integrity than infrequent *grands mals*; but there is nevertheless in the whole epileptic class an easily impressionable nervous system. They possess a fervour or zeal, a susceptibility which influences their character, and this is familiar to every observer. In an exaggerated degree the fervour of an epileptic originating from no definite cause may develop into a fury and become the most unreasonable as it is the most uncontrollable form of violence. As a class epileptics are sensitive, suspicious and irritable. They are also self-sympathetic and the pious aspect of life as an outer cloak of hypocritical religiousness appeals to them. Few of them are truly pious—there is much profession but little action.

*Numbers.* It is computed that there are 40,000 sane epileptics in this country and about 20,000 insane. The number of registered insane in 1912 was 133,157, and it is computed that over fourteen per cent. of the total are epileptic. Every year about 1,600 epileptics are certified as insane and brought into the asylums of England and Wales, and this in the proportion of nine males to seven females, although women suffer from epilepsy more frequently than do men, but the proportion of epileptics of both sexes admitted into asylums compared with other forms of insanity is 7·3 per cent., showing that the epileptic insane live longer under care than do the other forms of insanity, and that therefore they tend to "accumulate" when under care. It is believed that one in every 1,500 of the population is epileptic, but in some districts, as when families containing any of them have intermarried, this proportion may amount to one in 1000, and even to more. It is estimated that the metropolitan area of greater London has somewhere about 6000 epileptics.

*Age.* Three-fourths of all epilepsy occurs before the age of twenty, and one half of this between ten and twenty years. One-eighth only occurs before the age of three years.

*Civil State.* From the above it is seen that most epileptics are single, but among the insane most of the epileptics are married, because their epilepsy has occurred later in life and until their admission there has been no marked dementia. The majority of insane persons come under treatment between the ages of



twenty-five and thirty-five years, and adult epileptics would be included in this class. If fits come on before twenty years of age imbecility may result—twenty-five per cent. of all imbecility is from this cause; if after adult age mental enfeeblement and dementia ensue.

*Inheritance.* Insanity is frequent in the ancestry or in the families of epileptics. It is stated to occur in thirty-three per cent. of the parents of epileptics and of epileptics who become insane. Uncomplicated epilepsy is more common in the parents of epileptics than in the parents of the epileptic insane. As in the depressed form of insanity the transmission of epilepsy is more often from father to son and mother to daughter.

*Fits.* The fit is described as (1) the paroxysm, (2) the period before the fit, the pre-paroxysmal, (3) the period after the fit, the post-paroxysmal, and (4) the time between the fits, the inter-paroxysmal period. The fit is preceded by the aura, which is the last act recorded in consciousness, and which immediately precedes unconsciousness, most often by a few moments, although it may do so by hours or days. The aura may be sensory (most often of sight), motor, visceral, vaso-motorial or psychical. If there be no aura there is no recollection of the fit; unless the bitten tongue, the stiffness from convulsive movements, the soiled personal linen or the bedding excite a train of inference. The "cry" is not an aura, it is the first effect of the tonic spasm forcing air through the closed glottis. The aura is subjective, the cry objective. Patients are often known to their nurses by the cry and such a warning may enable the nurse to prevent falls and injuries.

1. *Paroxysm:* this is fully described on p. 320.

2. *Pre-paroxysmal period.* This may be a dazed stupid dullness lasting a few minutes or longer. The patient may not fall and there may be no convulsions, but following the dazed or vertiginous condition is a dreamy stage during which actions may be performed of which there is no recollection. The pre-paroxysmal stage may only be a change in the affective feelings or in the moral conduct. There may be sullenness, but most often excitement amounting to mania of a wild and terrifying nature with destructive outbursts and extreme noisy raving with sleeplessness. If the paroxysm or fit now occurs all will be quiet and reasonable conduct will follow, but if, as may happen, no fit occurs, then the patient's condition passes on to what is described as true epileptic mania, this taking the place of the fit.

3. *Post-paroxysmal.* This is the stage of true epileptic automatism, in which epileptics are more dangerous than at any other time. This is the stage of hallucinations, systematized

delusions and persecutory ideas. In this stage patients are less explosive and impulsive than in the pre-paroxysmal, but they are also more continuously noisy. This is the true dreamy state, the commonest period of automatism and the state of dual consciousness, allied to somnambulism. Acts most commonly performed in daily life tend most frequently to be repeated, so undressing is a frequent one, and hence improper exposure, walking to places where they have no right, committing assaults under imaginary wrongs, or taking other person's property, all performed unconsciously, may bring these persons under the jurisdiction of the law courts.

4. *Inter-paroxysmal.* This is the patient's normal state, during which many of the insane are orderly and well conducted.

*Forms of Insanity.* Most adult persons subject to epileptic fits undergo some mental changes in consequence of their epilepsy, and two types result, either the irritable, distrustful, sombre and resentful, or the shallow, obsequious and the effusive. The general tendency, however, of repeated epilepsy is towards mental enfeeblement ending in dementia, and the demented of this class are like the maniacal, the most dangerous of all others. They constitute the "very" dangerous among the insane.

*Treatment.* The chief indication for treatment in epilepsy, and in epilepsy associated with insanity, is to break the habit of the fits, *i. e.* to restrain the explosive activity of the nerve cells. If this is possible in infancy imbecility may be avoided, and in adult life the onset of insanity or dementia may be indefinitely postponed. Hitherto only one class of drugs has any effect in this direction and this class is the alkaline bromides, *viz.* of potassium, sodium, ammonium, or strontium, separately or in combination. What the effect of these upon the nerve cells is has not hitherto been ascertained, but it is known that an allied salt, chloride of sodium, has an intimate relation to the nerve cells through the blood plasma. Calcium bromide and magnesium bromide have been found efficacious when the others failed. Continuous daily administration of bromides for a year after the cessation of fits is necessary and then a tapering or diminution of the dose for another year. Several patients have been so discharged recovered from Claybury after a longer interval of freedom from fits than two years. Strontium bromide is preferable when there are cardiac complications, and ammonium bromide when there are digestive troubles. Biborate of soda is a most effective help to bromides in doses given at bedtime and in twice the dose of the bromides. The bromides are best given in alkaline media, and milk

is a good vehicle. Persons subject to acneiform eruptions can take the bromides best by the addition of arsenic and the aromatic spirits of ammonia. The bromides are most effective when no sodium chloride is taken—hypo-chloridization—and the salt-cellars at table for the worst cases at Claybury are filled with sodium bromide—the deprivation of common salt thus goes unnoticed. The bromides should be given in one large dose rather than repeated small doses, but they should be stopped for a time if heaviness and dullness supervene, as a state of dementia may ensue through their prolonged administration, which must be guarded against. Belladonna, Indian hemp and digitalis added to the bromides have been very successfully used in Claybury. Flechsig's treatment, consisting in the administration of less than a grain of opium increased gradually to four or five grains to a maximum of ten to fifteen grains daily for a period of five or six weeks has proved disappointing. Bechterew's fluid in so far that it consists of the bromide salts has been found beneficial, and the same may be said of Dr. Gelineau's *dragées anti-nerveuses*, which probably derive their medicinal value from bromides together with arsenic and picrotoxin.

In the status epilepticus, bleeding up to ten or twelve ounces has been attended with marked relief in some cases, but the best treatment is to begin with a small glycerine enema, then a free soap-and-water one followed by a double dose of chloral and bromide as a rectal injection; oxygen inhalations and the capsules of nitrite of amyl have also successfully been used in the "status."

For the control of excitement the bromides with chloral may be used to commence with, but hyoscine hydrobromate subcutaneously may be necessary to secure an immediate effect. Sulphonal may be used for the excitement of incurable dementia.

It is very necessary to avoid constipation in the case of epileptics, and the bowels should be daily relieved by means of cascara tabloids, or Apenta, Hunyadi Janos or Friederichshall waters. Calomel or croton oil, jalap or pod-

phyllin are often most effective, and it is better to give too frequent laxatives or purgatives than to administer them too seldom.

As to diet I have tried an exclusively vegetable one with no diminution of the average number of fits per month, and to give the patient what he ordinarily prefers within limitations is to give him what he can best digest, and what also suits him best. Care should be exercised that the food, especially the meat, is finely minced when there is present the dullness of dementia. No stimulant is needed for the epileptic under ordinary circumstances.

It is often suggested that head operations or ligaturing the main arteries to the head are accompanied by marked improvement. If the convulsions are noticed to commence or to proceed in a definite order, then trephining locally may afford relief, or where there is thickened bone, a tumour or a cyst suspected, but for idiopathic epilepsy an operation in the region of Scarpa's triangle or upon the hand will probably be equally efficacious as a surgical remedy.

For the epileptic—sane or insane—occupation is the best remedy as affording the means for a full and regular life; any pastime, preferably out-of-doors, that can prove of interest will help to moderate the fits, and possibly horticulture will be the best of them. This is the basis of the successful colony system now in vogue in London and elsewhere.

For treatment in an asylum two medical certificates are necessary if the patient is to be a private patient, if a pauper—only one. No person mentally affected and suffering from epilepsy can be detained against his or her will after the age of sixteen years. A medical certificate of insanity is necessary if such a person is to be thus detained. For residence in a "colony" an epileptic may be received voluntarily, but he must not be insane. For detention in an imbecile asylum (such as Earlswood) only one certificate is necessary, but this must be on a special form under the Idiots Acts, 1888, and not under the Lunacy Act, 1890.

R. J.

## II.—GENERAL SURGERY

### INTESTINAL OBSTRUCTION

**Introductory.**—Intestinal obstruction is a clinical term for a condition produced by many different causes. It is classified, broadly, into acute and chronic obstruction, but such a classification is bad, because it implies a distinction which is often absent. Cases of acute obstruction, undoubtedly exist as a result of strangulated

hernia, volvulus and intussusception, but many cases of acute obstruction become chronic, as in cancer of the bowel, whilst chronic obstruction may end in an acute attack, as in patients who are suffering from intestinal bands, or adhesions. Cases of intestinal obstruction, therefore, are often incorrectly diagnosed and badly treated because they have not fallen readily into one of the two groups and have been neither



typically acute nor chronic. It is better, therefore, not to attempt any system of broad classification but to ascertain and treat the cause in each case, and attempt to relieve it as quickly as possible.

**Clinical Picture.**—The commonest form of intestinal obstruction occurs in a person advanced in years, a woman more often than a man—who is suffering from an unrecognized cancer of the large intestine. Such cases are frequent in hospital practice, and are not rare in private. The patient has sought relief for an obstinate constipation which has not yielded to the ordinary domestic remedies. She has had similar attacks which have passed off spontaneously with diarrhoea, or, have disappeared after a purge. The attack has been worse this time. She has lost her appetite, felt sick or has actually vomited. She is full of “wind” which rumbles and gurgles, but she is unable to pass any, though she belches up a good deal. The “wind” she thinks causes spasms of colic which have at last compelled her to send for advice. She may or may not have lost flesh lately, but she has never felt any pain or passed blood by the bowel, though she has suffered from vague symptoms of dyspepsia.

Examination shows that she is lying flat on her back in bed, dreading the return of the colic, which made her send for relief. The pulse rate is only slightly increased, the temperature is raised a few decimal points, and her tongue is either red and glazed, or coated with a thick, white fur. The abdominal walls are somewhat distended and tympanitic, occasionally dull in the flanks, for there may be free fluid in the peritoneal cavity. Palpation may show some increased tension in the left iliac region, or, the patient may be able to localise the seat of obstruction by a point of maximum pain, or of discomfort on pressure. Rectal and vaginal examination may reveal the existence of an unrecognized carcinoma, or the rectum may be empty and its walls “ballooned,” as happens when the seat of obstruction is beyond the reach of the examining finger. *A rectal examination should never be omitted*, because faecal impaction closely simulates intestinal obstruction due to a stricture, but in faecal impaction the rectum will contain faeces and will not have lost its muscular tone. An enema may be given, but in all probability it will be returned, clear, or hardly tinged with faecal material if there is real obstruction due to a mechanical cause.

Such a patient is in a critical condition, although it often happens that no one is alarmed about her. There have been previous attacks from which recovery has taken place. She is not in violent pain, she has had a fairly good night and she has not been very sick. It is a difficult matter to persuade the friends to allow an opera-

tion to be done. But wait a few hours and the whole scene is changed; the colic becomes unbearable, the vomiting is more frequent and abundant, it is offensive and eventually faeculent. The abdominal distension increases, the facial aspect changes, she becomes restless, has difficulty in breathing, hiccough sets in, and she dies from exhaustion or more suddenly from cardiac failure.

**Treatment.**—Early recognition of the cause of the obstruction gives a clue to the treatment. In the early stages the seat of the colic gives some indication as to the position of the stricture, though it should always be remembered that the symptoms due to obstruction on the right side of the abdomen may be referred to the left, a fact with which surgeons have long been familiar in appendicitis. When the vomiting is early and severe it rarely becomes faeculent, and the obstruction is to be looked for at a higher point in the intestines than when it comes on later and gradually. *An abdominal exploration should be undertaken as soon as the surgeon has made up his mind that the patient is suffering from intestinal obstruction—the sooner the better.* If there is a reasonable probability that the stricture is due to carcinoma of the rectum or pelvic colon, the incision should be made for a left inguinal colotomy. *No attempt should be made to remove the stricture, however tempting and easy it may seem, whilst the patient is suffering from the symptoms of acute obstruction.* It is sufficient to relieve the obstruction, and to excise the bowel at another time. The colotomy may be completed at once, and this is often necessary when the patient is only seen after several days of obstruction, or it may be done in two stages, as seems to me to be the more desirable when it is possible. If the bowel is opened at once, a glass tube with a flange is tied into the intestine and a dressing of rubber dam is applied. When the bowel is left unopened for two or three days to allow of adhesions being formed, it should be opened without any anæsthetic and by cutting away a portion of the wall of the intestine, rather than by a simple incision. The bowel is sensitive to pressure, but not to incision. It is better, therefore, to cut with a sharp and light knife like a tenotome, than to use scissors or a heavy scalpel.

**Differential Diagnosis.**—It is often impossible to make a diagnosis of the cause of the obstruction if the case be only seen in the later stages when there is much abdominal distension, and in such cases the necessity for an immediate abdominal exploration should be urged. The conditions to be thought of are—

1. **Faecal Impaction** is likely to be mistaken for the form of obstruction described above. It is the result of very obstinate and chronic constipation, and may lead to an erroneous diagnosis

of intestinal obstruction due to stenosis of the bowel. The history of constipation in cases of faecal impaction differs from that where the obstruction is due to narrowing of the bowel. In the one case it has been chronic, with occasional attacks of diarrhoea due to irritation of the intestinal wall by the faecal mass; in the other case there may have been repeated but transient attacks of constipation which have ended in diarrhoea, the bowels being relieved naturally in the intervals. The really misleading cases are those in which the bowels have been relieved with greater or less regularity, even though the large intestine is filled with faecal material.

When obstruction has occurred as a result of faecal impaction the symptoms are more chronic and less severe than in true stenosis. The abdomen is less distended, the vomiting is less severe, and it is *only in exceptional cases that the peristalsis is visible through the intestinal wall*. Examination of the abdomen shows that one or more doughy masses are present in the large intestine, though it must be remembered that the natural position of the colon may be altered by the weight of the masses. Exploration of the rectum, as has already been pointed out, shows that there is no loss of tone, and may prove that the bowel is loaded with faeces. A delay of a few hours will show that the faecal masses have altered their position, perhaps only slightly, but still sufficiently to show that they are being pushed onwards. In some very severe cases there may be a localized tender spot in the right iliac region, due to the ulceration of the caecum which is associated with over-distension.

Faecal impaction occurs in young women of a neurotic type, who have wholly neglected the care of their bowels, and in very old persons who have become too feeble to assist themselves, but it is most common in women between fifty and sixty, who state that they have been constipated all their lives.

Operation is very rarely required in these cases. It is highly desirable, therefore, to distinguish them clearly from intestinal obstruction due to cancer of the bowel. The patient should be kept in bed, and evacuation of the bowels should be promoted by the use of enemata of warm olive oil or of hot soap and water, though it is sometimes necessary to remove the impacted faecal material with the fingers or with a spatula. Aperients should not be given until the enemata have brought away a considerable quantity of the impacted mass, and they should even then be of the milder type. Calomel, castor oil, and salines give better results than cathartics, which may increase the irritability of a colon which is already inflamed. Abdominal massage, too, is often serviceable. In one of my cases all attempts at relief were ineffectual, even after a

colotomy had been performed, and the post mortem examination showed the whole colon to be filled with a mass of solid faecal material. Ulceration of the caecum had led to perforation, and the patient died of a suppurative peritonitis.

2. **Internal strangulation** due to a loop of intestine becoming strangulated by a band, which may be the result of a previous attack of peritonitis, or may be congenital. The congenital bands are usually Meckel's diverticula which have become attached by secondary inflammation to the mesentery, omentum or bowel. I had a case under my care recently in which the obstruction was produced by a loop of intestine becoming strangulated beneath the vermiform appendix, whose tip had become adherent to the internal abdominal ring, and another in which the obstruction was caused by a kink where previous inflammation had joined one loop of intestine to another. In these cases the obstruction begins so gradually that the patient does not seek advice for several days, although when he is questioned he is often able to date the commencement of the attack to some sudden movement followed by an unusual intra-abdominal sensation. Many patients give a history of similar, but less severe attacks which have been cured by purgatives. It happens, therefore, that they are considered and treated as "bilious attacks," although the constipation has been complete from the beginning and vomiting has commenced. The increasing severity of the vomiting and the change in its character at last alarms the friends, or the medical practitioner who has failed to make a correct diagnosis. Even then it is difficult to believe that the patient is in serious danger. He does not complain much of pain, he is fully sensible, and may even be more alert, mentally, than is usual. The temperature is hardly raised, the *pulse is only slightly quickened*, and he perspires freely. Examination of the abdomen shows that it is moving freely, that it is nowhere tender to pressure, and that the abdominal muscles are neither rigid nor "on guard." Examination of the rectum, however, demonstrates that the lumen is empty, and the walls are relaxed: taking these factors into account, together with the absolute constipation and the increasing vomiting, the surgeon is compelled to recommend instant operation, and to give a gloomy prognosis. The intestine is seriously injured. It may be only greatly congested below the point of stricture, but equally it may be gangrenous. The mildness of the symptoms has led to delay, and the indiscriminate use of purgatives has caused much harm. It may be taken as an axiom, therefore, that an exploratory laparotomy is urgently needed in the case of every young adult who has previously appeared to be healthy if he



shows signs of a gradually increasing intestinal obstruction, and *the great mortality which attends these cases is largely due to the practice of administering purgatives, and waiting until abdominal distension, vomiting and collapse render the diagnosis certain.* In the absence of any definite indication of the seat of stricture, an incision should be made below the umbilicus, and to the right of the middle line, for the band is more often on the right than on the left side. The surgeon at once introduces his hand as far as the wrist into the abdominal cavity. The intestines are thus prevented from prolapsing, and a thorough examination can be made rapidly. The constricting band may be found at once, when it should be divided between two ligatures, and the congested loop of bowel set free. But the operation is often extremely difficult on account of the distended state of the small intestine, and if the constricting band is not found, it is better practice to turn out the intestines as quickly as possible, rather than to search through them piecemeal. The seat of constriction will often be found deeply seated in the right iliac region, or actually in the pelvis. If the operation is done quickly, and the intestines are not handled much, they can generally be replaced with comparative ease, but delay and hesitation militate greatly against success.

Acute obstruction is sometimes the result of a piece of small intestine slipping through a hole in the omentum or into one of the retro-peritoneal pouches. The ileum is usually strangulated in these cases. Great pain, abdominal distension and early vomiting, occurring suddenly in persons who have always been healthy, are the indications for an early operation, but it is impossible to diagnose the actual cause of the symptoms without opening the abdomen. The state of the patient is generally so serious that an early operation is readily agreed to, or is even urgently demanded.

Intestinal obstruction is easier to recognize when it follows some weeks, months or years after an abdominal operation which has left a pedicle or has allowed adhesions to be formed by which the bowel may have become constricted. In these cases the patient has probably become conscious of increasing intestinal disturbance, though the onset of the obstruction may have been quite sudden.

Early operation is desirable in these cases, when the patient is clearly suffering from the symptoms of intestinal obstruction, and even in doubtful cases the bias should be rather towards operation, than the continued use of purgatives and enemata. It is almost needless to add, that in opening the abdomen, special care should be taken not to wound the bowel, which may be adherent to the scar. The site of the operation should be explored systematic-

ally. A slight adhesion of the intestine to some stump or pedicle from the previous operation may alone be found, or the intestine may be so kinked, and narrowed by thickening and adhesions, that the surgeon finds himself launched on a prolonged and perilous operation before the intestine can be restored to anything like its original condition. There is a strong probability of the symptoms recurring in cases of this type, for the adhesions are often reformed. It is desirable, therefore, to leave as few raw surfaces as possible, by joining peritoneum to peritoneum.

**3. Volvulus.**—Volvulus usually occurs in the large intestine at the sigmoid or less commonly at the cæcum, and occasionally in the small intestine, where it may be so extensive as to involve the whole of the jejunum and ileum, from the duodeno-jejunal angle to the ileo-cæcal valve. The volvulus may be the result of the bowel twisting upon its own axis or it may be due to a twisting of the mesentery, which then carries with it the attached portion of the intestine. It may occur spontaneously, it may be associated with new growths of the bowel or with the impaction of gallstones, or it may be caused by the adhesion of one loop of intestine to another in consequence of previous ulceration or inflammation of the bowel. It is seen more often in men than in women, and no age is exempt, though it is most common in adults. The attack begins with dramatic abruptness in a person who has seemed to be in perfect health; sometimes without any known cause and sometimes after a slight abdominal injury, or some unusual effort leading to abdominal strain. The initial symptoms are violent abdominal pain, early and profuse vomiting, absolute constipation from the moment of onset. Abdominal distension occurs very rapidly, and if the patient be seen early the distension may often be limited to the volvulus, the position of which may thereby be localised. In the later stages the distension becomes general, and is usually a very marked feature of the condition. *The abdominal walls in volvulus are not held rigid, nor is the abdomen tender to pressure in the earlier stages.* It may be diagnosed from acute duodenal and gastric perforation by the absence of these signs.

Death occurs quickly from collapse, or more slowly from peritonitis.

The prognosis is extremely bad, and immediate operation affords the best chance of relief, although there is a school of surgeons who think it is better not to operate except in the very worst cases. The great distension, the general distress, and the very slight chance of spontaneous recovery, are powerful advocates for early operation and should prevail over every other consideration.

The abdomen must be opened by a sufficiently long incision to allow the volvulus to be fully exposed. The distended loops of intestine should be incised and emptied if any difficulty is experienced in untwisting them, but in some cases it is impossible to effect reduction, whilst in others it may be necessary to make an artificial anus.

**4. Thrombosis of the Mesenteric Vessels.**—Thrombosis of the mesenteric veins occurs more frequently than embolism of the mesenteric arteries, and the superior mesenteric vessels are involved more frequently than the inferior. The onset is sudden, and if it is associated with intestinal hæmorrhage it is sometimes possible to guess at the cause before the abdomen is opened. It happens, however, in many cases that there is no bleeding from the bowel, and the surgeon is then summoned to treat a case of acute or subacute intestinal obstruction with evidence of early peritonitis. There is sometimes a history of previous embolism or thrombosis in some other vessel. Examination of the abdomen shows a remarkable absence of tenderness, rigidity and distension, and the condition is said to be associated with great excitability of the nervous system. Abdominal exploration shows that the mesenteric vessels are thrombosed, more or less extensively, and that the bowel is either intensely engorged with blood, or is actually gangrenous for a very considerable extent. A few cases have recovered after excision of the inflamed gut, and the formation of an artificial anus, but most of the patients have died.

**5. Torsion of the Omentum.**—The great omentum sometimes becomes twisted more than once in its long axis. It then becomes strangulated and causes symptoms of intestinal obstruction. The cause of the twisting is unknown, but it is usually on the right side, and is often associated with an inguinal hernia. In a case which was recently under my care, the omentum was attached to the tip of an inflamed appendix, and I operated in the belief that the patient had a localised appendix abscess. Torsion of the omentum occurs more often in men than in women. The prognosis is good, because most of the patients recover if the abdomen is opened and the inflamed omentum is tied off and removed.

**6. Impacted Gallstones.**—Gallstones sometimes become impacted in the small intestine to which they have gained access, by a process of chronic ulceration, leading to the formation of a fistulous passage between the gall bladder or common duct and the duodenum. They may block the small intestine at once, or be passed onwards until arrested at the ileo-cæcal valve. The impaction takes place more often in women than in men; in women of a gross habit of body and

in those who are getting on in years. Very often there have been no recent symptoms of gallstones, except that the patient has complained of dyspepsia, but careful inquiry will often elicit a history of long antecedent hepatic inflammation. The symptoms may set in suddenly and with great violence when the stone is impacted in the duodenum, for the pain may be intense, the vomiting violent and the collapse great. In these cases the vomiting is bile-stained, but in all cases of impaction it is a marked feature, and soon becomes fæulent. It is occasionally possible to feel the gallstone through the abdominal walls, or to gain some indication of its presence by local pain on pressure. In less urgent cases the impacted gallstones may lead to ulceration of the intestine followed by a suppurative peritonitis, or it may be discharged through an abscess in the abdominal wall.

Patients who suffer from acute intestinal obstruction caused by an impacted gallstone are always a source of serious anxiety to the surgeon. He recognizes, on the one hand, that they are bad subjects for operation and that a certain proportion recover spontaneously, whilst on the other hand, the symptoms are so acute, and the risk of ulceration of the bowel is so great, that he is tempted to operate at once. In suitable subjects in whom the collapse is not very great, immediate operation is best. The collapse of the small intestine below the seat of impaction readily leads the surgeon to the seat of obstruction. A small longitudinal incision into the bowel allows the stone to be removed, and the intestine is closed at once with Lembert's sutures. When there is great collapse, in old, feeble and very fat people, or in those who are suffering from bronchitis or other constitutional disease, it is better not to operate, but to treat the various symptoms, at any rate for twenty-four hours, in the hope that the obstruction may be relieved. Opium will diminish the pain, and perhaps relieve the impaction by relaxing the muscular wall of the intestine.

**7. Idiopathic Dilatation of the Colon, Megalocolon (Hirschsprung's Disease).**—This is a congenital condition of the large intestine, manifested in a young child, by the symptoms of intestinal obstruction. The infant does not pass fæces, its abdomen becomes greatly distended, and intestinal peristalsis is visible through the thin abdominal walls. When the surgeon introduces his finger into the anus expecting to find an imperforate rectum, he discovers that the bowel is patent, and after passing through a constricted portion, it enters a greatly dilated large intestine. Withdrawal of the finger allows flatus and the contents of the bowel to escape, and the signs of obstruction are temporarily relieved. The cause of megalocolon



is not the same in every case, and is certainly not always mechanical. But, whatever its cause, it leads to habitual constipation of the most obstinate character, great dilatation with thickening of the bowel wall from the cæcum to the upper part of the rectum, and to ulceration of the intestinal mucous membrane. The majority of the patients die, but a few have recovered after the colon has been short-circuited and when an artificial anus has been made.

D'A. P.

### HERNIA IN INFANTS AND CHILDREN

It is a well-known fact that hernia is an extremely common ailment in infants and children in all classes of the community, though for obvious reasons it is impossible to state the exact percentage.

The commonest forms met with are the inguinal and umbilical; femoral and lumbar herniæ are so rare that they will receive only scant notice.

**Inguinal Hernia** affects both boys and girls, though it is nearly twice as frequent in the former as in the latter. It may be single or double, but is considerably more common on the right than on the left side. The dominant cause of this greater tendency to hernia in the male sex, and the preponderance of right over left-sided hernia, is due to developmental changes associated with the descent of the testis from the abdomen into the scrotum.

*Causation of Hernia in Infants.* Though it cannot yet be taken as strictly proven, there is much evidence to lead one to the belief that all inguinal herniæ in children (and most also in adults) result from imperfect closure of the processus vaginalis testis and are in the strict sense of the word congenital, though their actual recognition may not take place for weeks, months or even years after birth. In order to appreciate this point one has to review the development and descent of the testis in the human embryo and compare it with that of other mammalia.

The testis, which in the early stages of embryonic life is placed high up in the abdomen close to the kidneys, by a process of growth of the individual reaches the brim of the pelvis close to and just external to the inferior epigastric artery at the site of the future deep or abdominal inguinal ring. A pouch of peritoneum known as the processus vaginalis testis grows out at this spot, surrounded by extra-peritoneal fat, and, preceding the testis, passes through the inguinal canal and reaches, in the normal state, the bottom of the scrotum. The testis follows, not within the pouch, but surrounded by it in the same way as the intestine is surrounded by the peritoneum. About the

seventh or eighth month of intra-uterine life the testis follows, reaching the scrotum shortly before birth. The testis on the right side is generally about three weeks later in its descent than the left, and this fact accounts for the preponderance of right-sided hernia.

The present conditions of the parts is then that the testis is at the bottom of the scrotum, partly covered by a thin pouch of peritoneum, which extends upwards through the inguinal canal and communicates with the peritoneal cavity.

Turning to mammalia, this is the normal adult condition in the higher forms, and development continues no further. This is also exactly what is described in textbooks as a "congenital hernia." It represents a delayed development, for in the human species a further change should occur in which the whole of the extruded portion of the peritoneum is obliterated except that part which surrounds the testis and persists throughout life as the tunica vaginalis testis.

**Partial but Incomplete Closure of the Processus Vaginalis.**—Very frequently it is found that, though a portion of the processus vaginalis has been separated off, forming the tunica vaginalis, there still remains a funnel-shaped portion of peritoneum which extends downwards from the internal ring for a variable distance and may be adherent to the top of the tunica vaginalis or may only extend part of the way. This pouch is known, from its shape, as the funicular process, and a hernia into it as a funicular hernia or a hernia into the funicular process. These conditions are well known to all operating surgeons, and they are described here not on account of their academic interest, but because their recognition and comprehension are essential to any one undertaking operations on these forms of hernia.

A further but still uncompleted development may take place in which closure of the processus vaginalis occurs above and below, leaving a space in the middle which becomes filled with fluid, a condition known as encysted hydrocele of the cord.

There is reason to believe, then, that there are many babies born in whom these developmental changes are not completed in intra-uterine life, but may go on post-natally, provided that there are no other reasons or predisposing causes to determine the descent of any of the abdominal viscera into the sac, a fact that is prejudicial to its obliteration.

*Predisposing Causes.* If the persistence of a patent sac is admitted it is easy to understand that anything causing an increase of intra-abdominal pressure might favour the formation of a hernia.

Gastro-enteritis may be cited as a very common secondary factor, and so much is this

the case that many physicians have been led to believe that it is sufficient to cure the intestinal trouble to cure the hernia.

To phimosi and its attendant straining much attention has been given, and it seems that many still consider circumcision sufficient treatment. This belief is negated by the fact that the rupture is just as common among the children of the Jews as of the Gentiles.

*Diagnosis.* This is generally an easy matter when there is any protrusion. There is a swelling in the inguinal region which becomes markedly prominent on crying and is usually easily reducible. The swelling may be very small or it may distend the scrotum. From hernia have to be distinguished hydrocele and a partially distended testis. Both are, of course, irreducible, and the nature of the former is shown by its translucency and the latter by the absence of the testis from the scrotum. It is only when a parent complains of a swelling, and none is present at the time of the examination, that any doubt may arise, and no diagnosis should be made unless the swelling is actually seen.

*Treatment.* The object to be aimed at is to assist nature to its own remedy of completing the closure of the processus vaginalis by preventing the descent into it of any of the abdominal viscera which will keep the walls of the peritoneal pouch apart. This may be accomplished by an operation and removal of the sac, or by the application of a truss. In no case should a child be left untreated, for while no doubt a certain number may undergo a spontaneous cure, it is a palpable fact that many do not, and it is impossible to foresee in which cases it will occur.

The choice, then, has to be made between wearing a truss and performing an operation; some hold that all cases should be submitted to operation, and others that all should wear trusses. Probably the truth lies somewhere between the two.

*Treatment by Truss.* It is reasonable to believe that if it is possible for post-natal closure of the sac to occur, and if an efficient truss is applied, preventing any descent of the bowel or omentum into the sac, a permanent cure may result. This is borne out by experience.

*Form of Truss.* The truss should be fashioned of a light steel spring covered with indiarubber, and of such a size that the pad may cover the whole length of the inguinal canal and shall not press upon any part of the pubic bone. Careful measurements must be taken with a tape measure which passes well above the buttocks behind, at the sides in the groove between the crests of the ilium and the tips of the great trochanters, and is brought round in front to the upper margin of the symphysis pubis. The

truss should be worn day and night and only removed for purposes of cleanliness. In no case should a skein of wool be substituted for a truss, for this is quite useless, and indeed worse than useless, for parents may be deluded into the belief that something is being done.

*Length of Time a Truss should be worn.* This is a difficult point to decide, for without dissection it is impossible to say when a hernia is cured. Roughly speaking, a truss should be worn for at least a year after all signs of protrusion have disappeared, and it is safer to allow two years.

Objections to wearing a truss are numerous. It is irksome and adds considerably to the work of the nurse; trusses have constantly to be renewed, and there is always a possibility that this treatment will not effect a cure and resource to operation eventually become necessary.

*Treatment by Operation.* This is simple and effective, and if it were not for the fact that undoubted cures do accompany treatment by trusses and the general unwillingness to subject small infants to operation, it would generally be recommended. The indications for operation may be stated as follows—

1. In all cases of children over the age of four, unless there are reasons against any form of operation.

2. In all cases of children below this age in which a truss fails to retain the rupture.

3. In all cases of irreducibility at any age.

*Nature of the Operation.* This is exactly the same as in adults, except that it is a little more difficult on account of the small size and delicacy of the parts. The sac is to be dissected out from the cord, the neck tied and the stump allowed to retract. One or two stitches should be put in uniting the internal oblique muscle over the cord to Poupart's ligament. Some surgeons omit these stitches as unnecessary; it is not wise to omit them, for they make for greater safety and the time taken is very little longer. The skin is sewn up with a fine continuous suture and either left without a dressing or a collodion dressing applied.

If the processus vaginalis is entirely unclosed and the proper tunic of the testis is incomplete, a new tunica should be fashioned out of the lower portion of the sac.

*Hernia associated with Partial Descent of the Testis.*—This presents no difficulty; the rule is to treat the patient as for the hernia and to leave the testis to look after itself. It will very likely descend later on.

In females the radical operation is simpler, for there is no cord to be considered and the internal oblique muscle can be united to Poupart's ligament along the whole length of the canal.



**Umbilical Hernia.**—This is very common in infants and is generally noticed soon after birth, either before or after the fall of the cord. It is not dangerous and can almost always be cured without operation. The usual treatment is to wrap a lead plate in a piece of lint and to keep it applied to the umbilicus with strips of adhesive strapping. This may be sufficient. It is better and cleaner to use a spring truss with a flat circular pad. The pad must not have a central conical eminence, for this tends only to increase the size of the aperture.

**Exomphalos.**—Very rarely a child is born with a hernia which has developed in intra-uterine life, and in which there is a protrusion of the abdominal viscera actually into the substance of the umbilical cord. In these cases there is danger of including the bowel in the ligature which ties the cord.

**Femoral Hernia.**—This is extremely rare in either sex before the age of puberty. If it does occur it may be treated either by the application of a truss or by operation, but the latter is generally preferable.

**Lumbar Hernia.**—This is almost unknown in children. Occasionally in wasted and ill-developed babies a swelling may be noticed in the lumbar regions on crying, but it is seldom of such a size as to call for any treatment.

G. E. G.

## SURGERY OF THE PANCREAS

The diseases of the pancreas which may require surgical intervention are: cysts of the pancreas, inflammatory affections, acute, sub-acute and chronic, calculus in the pancreatic duct close to its junction with the common bile duct, and localised malignant growths.

1. **Cysts of the Pancreas.**—Cysts of the pancreas, which may be either single or multiple, usually the former, give rise to the development of smooth, rounded and elastic swellings in the region of the gland, most frequently in the tail or portion of the body adjacent to the spleen. These swellings generally increase slowly in size and project forwards towards the anterior abdominal wall, first pushing the stomach in front and then projecting either above or below it, or below it and towards the left. In the majority of cases the stomach is pushed upwards towards the liver, whilst the tumour projects forwards below the greater curvature of the stomach and between it and the transverse colon. Less commonly the stomach is pushed downwards and towards the left, the cyst projecting above the lesser curvature and having in front of it the gastro-hepatic omentum, whilst in rare cases the cyst bores downwards behind the transverse colon and appears as a

prominence below it. The symptoms caused by cysts of the pancreas are often slight and are generally due to pressure upon either the stomach, the branches of the coeliac plexus, or the common bile duct. Pain is the usual symptom, located in the lower portion of the epigastrium and in the back, and jaundice when the common bile duct is pressed upon. Cysts of the pancreas are best treated by exposure through an incision in the anterior abdominal wall over the prominent portion of the swelling formed by the cyst, evacuation of the contents of the cyst, fixation by suture of a portion of the cyst to the margins of the parietal opening and establishment of drainage. The contents of the cyst consist of changed pancreatic secretion, blood, cholesterin; and in the case of hydatid cysts, hydatid fluid, daughter cysts and hooklets. The exudation from the drainage aperture may cause irritation of the skin, owing to the presence of pancreatic secretion, whilst the fistula remaining after drainage often takes a long time to heal. On a few occasions it has been found feasible to drain a pancreatic cyst from the lumbar region, but this route of surgical approach is not recommended. When a cyst is diagnosed whilst still small, it may be possible to extirpate it by dissection from the bed of tissue in which it lies. Drainage is, however, necessary afterwards on account of the extreme vascularity of the pancreatic tissues and the difficulty in completely arresting all oozing.

2. **Acute Pancreatitis.**—Acute pancreatitis may be either suppurative, gangrenous or hæmorrhagic. All the cases are probably septic in character, usually they commence quite suddenly without any apparent cause, or they occur in association with a gallstone in the common bile duct, or after typhoid fever, mumps or influenza. In two cases which I have recently had under my observation, the streptococcus pyogenes was the only organism found in the diseased area. As already stated, the onset may be very acute, the patient being seized with acute abdominal pain in the upper portion of the abdomen a little above the level of the umbilicus, and also often being referred to the lumbar region. The symptoms may be suggestive of hepatic colic, perforation of an abdominal viscus, or even a severe attack of lumbago. One patient, whom I saw a short time ago, was seized with a sudden attack whilst walking in the street; this was so severe that he nearly fainted. The pulse was rapid, the respiration shallow and frequent. On examination of the abdomen this was tender in the lower part of the epigastrium. There was, however, no rigidity, only the localised tenderness. Absence of abdominal rigidity appears to be a constant condition in acute cases of pancreatitis during

the earlier stages, and is of considerable diagnostic importance. The course of acute pancreatitis is generally progressive from bad to worse, and often ends fatally unless surgical measures can be carried out at once. Whenever acute pancreatitis has been diagnosed as probable or possible, abdominal exploration should be carried out without delay. The incision should be made above the umbilicus and through the left rectus abdominis muscle, or through the linea alba. After opening the peritoneum the nature of the affection will generally be confirmed either by the presence of islands of "fat necrosis" in the peritoneum of the great omentum, or of the presence of blood-stained fluid in the lesser sac of the peritoneum. In all cases the lesser sac should be opened below the greater curvature of the stomach and the anterior aspect of the pancreas laid open to view. When the seat of hæmorrhage, suppuration or gangrene, the anterior and lower aspect of the gland should be incised—in several places when the case is a hæmorrhagic one, and in one moderately long incision in suppurative and gangrenous ones. The margins of the opening in the abdominal wall should then be sutured to those of the aperture in the anterior part of the great omentum and drainage established. The prognosis in cases of acute pancreatitis is not good, but the sooner active surgical measures can be carried out, the greater will be the number of recoveries. Some cases of acute pancreatitis are not so severe as those above described; the very acute symptoms subside, become subacute and an abscess forms. This causes the development of a tender, deeply-seated swelling in the epigastric or upper portion of the umbilical regions, accompanied by pains in the lumbar region and probably jaundice. The treatment to be adopted is abdominal incision, exposure of the swelling, incision and evacuation of the contents, and establishment of drainage. The prognosis in these cases is quite good, although a fistula often remains for a very long time. In both the above classes of case the course of the common bile duct ought always to be examined at the time of operation in order to search for the presence of one or more gallstones. When detected they should be removed.

**3. Chronic Pancreatitis.**—Chronic pancreatitis is often associated with the presence of a gallstone in the lower portion of the common bile duct, and is due in part to extension of inflammation from the lumen of the bile duct, and also to partial or complete blocking by the calculus of the terminal opening of the duct of the pancreas. Two forms of inflammation are described, *intra-acinar* and *intralobular*. The symptoms resemble in many respects those of cholelithiasis with arrest of a calculus in the

common bile duct. Jaundice is very often present, and in the severer forms the head and body of the pancreas become the seat of a hard slightly tender swelling which may be mistaken for carcinoma of this region. The characteristic stools of pancreatic disease, wasting—generally rapid—and pains in the epigastric region, in association with a positive Cammidge reaction, will usually enable the surgeon to distinguish between chronic pancreatitis and malignant disease of the head of the pancreas. Concerning treatment, the biliary system should be drained by cholecystostomy, and all calculi removed from the common bile duct. If, however, the gall bladder is contracted choledochotomy should be performed and drainage to the surface of the abdomen established. Generally one or another of these procedures will be effective, drainage going on for a sufficiently long time to enable the bile to become aseptic. In very chronic cases it may be necessary to provide for a more prolonged period of drainage; in these cases cholecystenterostomy should be performed. The results obtained are quite good.

**4. Calculus in the Duct of the Pancreas.**—Pancreatic calculi are not common, and when met with are usually located in the terminal portion of the duct close to its junction with the common bile duct. The symptoms to which they give rise are in the main those of chronic pancreatitis, but on investigation of a skiagram of the pancreatic region a shadow will be found at the site of the calculus. The treatment is exposure of the head of the pancreas by the route already mentioned, and dissection of the head of the pancreas from the adjacent portion of the duodenum, incision of the duct and extraction of the stone. Only a few cases of this kind have been recorded.

**5. Tumours of the Pancreas.**—Carcinoma is the most common form of neoplasm met with in connection with the pancreas, although sarcomata have been described. Usually the seat of the growth is the head of the gland in the region of the junction of the pancreatic and common bile ducts, less commonly in the body or the tail. When the head is the site of the disease obstruction in the lumen of the common bile duct is caused, and gradually increasing jaundice. Often the onset of jaundice first brings the patient under observation. Surgery does not hold out many hopes of success in cases where jaundice has developed. On two occasions recently I have excised the head of the pancreas on account of carcinoma, but in each case unsuccessfully. If one is fortunate enough to meet with an early case in which the disease is localised to the tail or the left portion of the body, an attempt should be made to excise it, the gland being cut through some



distance from the diseased area. These cases offer the best hopes of success. Non-malignant tumours adenomatous in structure have occa-

sionally been met with, but they are so rare that little is known concerning them.

H. J. W.

### III.—OBSTETRICS AND GYNÆCOLOGY

#### HYDATIDIFORM MOLAR PREGNANCY

THIS disease is a condition of degeneration of the chorionic villi leading to the formation of cysts in connection with the placental site. The primary seat of the process lies in the epithelial covering of the villi. Both layers of cells actively proliferate. The deeper zone is composed of Langhans' layer. On the surface of the villus the syncytium exists in varying degrees of thickness. This may invade the muscular wall of the uterus and even reach the peritoneal surface.

The villi as a rule form masses of cysts, often pedunculated and branching from the parent stem.

The vessels in the wall of the villi undergo degeneration and can rarely be detected. The contents of the villi are serous fluid. As a rule, the whole of the chorion is involved in this process, which commences in the early weeks of pregnancy, almost always before the end of the third month. The nutrition of the foetus is seriously interfered with, and death usually takes place. In many instances the embryo is completely absorbed.

*Etiology.* The affection certainly originates primarily in the chorion, and is of foetal origin. This is shown by the occasional occurrence of a hydatid mole, in association with a normal twin pregnancy. Little is known as to the precise causes of this disease. It occurs with relative infrequency, not oftener than about once in two thousand four hundred (Williamson) pregnancies.

*Symptoms and Clinical History.* The earliest symptom observed is the disproportionate enlargement of the uterus. This may attain the size of a six months' gestation during the third month of the actual pregnancy. This is often attended by severe reflex symptoms, such as vomiting or albuminuria (in twenty per cent.). On palpation the uterus presents a doughy sensation, and it is impossible to recognize the foetal limbs; auscultation is also negative. After a variable time hæmorrhage occurs and may be very free. This usually continues until the mole is expelled from the uterus.

In exceptional instances cystic villi are recognized in the uterine discharge and are of diagnostic importance. There is always a possibility of the villi invading the wall of the uterus, even reaching the peritoneal surface.

This produces symptoms of peritonitis and may terminate in rupture of the uterus, with fatal intraperitoneal hæmorrhage.

*Diagnosis.* This condition must be distinguished from abortion, or other forms of molar gestation. Its existence should be suspected if the size of the uterus is much greater than corresponds to the term of pregnancy. If this is attended with irregular hæmorrhage, and dilatation of the cervix, the diagnosis is probable. Occasionally it may be possible to palpate masses of cystic villi in the lower part of the cavity of the uterus, or cysts may be expelled in the hæmorrhagic discharge.

*Prognosis.* Hydatid mole is associated with considerable risk to life, the mortality amounting to between five and ten per cent. Hæmorrhage may at times be excessive and difficult to control. There is also an element of risk of perforation of the uterine wall by the cystic villi, leading to fatal peritonitis. Infection of the uterine contents may also occur, especially if fragments are retained, resulting in a rapidly fatal issue from toxæmia.

Recent researches have further demonstrated that in a certain proportion of cases this affection is followed by chorio-epithelioma. This will be considered below.

*Treatment.* Once the diagnosis is made, no time should be lost in evacuating the uterus. The cervix should be dilated under anæsthesia, and the contents of the uterus carefully and completely removed. For this purpose the finger may suffice, but a blunt curette is often necessary to effect complete removal of the mole. Special care must be taken to avoid penetration of the uterine wall, which is often dangerously thinned.

In all cases it is important to pack the uterine cavity thoroughly with sterilized gauze, as the contractile power of the organ is often very deficient and hæmorrhage may be profuse.

The further progress of each case should be carefully supervised in view of the possible development of malignant disease.

**Chorio-Epithelioma (Deciduoma Malignum).—**During the last fifteen years it has been observed that a very malignant form of growth occasionally develops after labour or abortion, which presents special characteristics. Between forty and fifty per cent. of the cases hitherto published have occurred after a hydatid mole.

Much research has been devoted to the

pathology of this type of growth. It was formerly believed to be sarcomatous in its nature and was termed "deciduoma."

The researches of Marchand and others have demonstrated conclusively that it is in reality an epithelioma of the chorion. Microscopically the tumour is seen to be made up of large multinucleated masses of protoplasm, which have been clearly traced to the syncytium.

In addition, there are many areas of epithelial cells, derived from Langhans' layer, which permeate the stroma. Degenerative changes occur early. Large areas of hæmorrhage, with necrosis, develop throughout, even in the early stages. Metastases are very common, especially in the liver, lungs and brain, also locally in the vagina and vulva. They usually develop along the course of the veins.

*Symptoms.* These are practically those of malignant disease of uterus. They develop often within three to six weeks after labour, or a molar gestation, but may commence

as late as six months afterwards. Profuse hæmorrhage with foetid discharge is a characteristic feature.

On examination the uterus will be found enlarged, often irregular in shape, and contains friable growth, breaking down very readily. Local metastases frequently occurs relatively early, with the general symptoms of cachexia. Most cases end fatally within a few months.

*Prognosis.* This must be regarded as very grave, though a few instances have been recorded in which, after complete removal of the uterus and appendages which were involved in the growth, recovery, for a time at any rate, has ensued.

*Treatment.* If the patient is seen in the early stages a radical operation for removal of the uterus should be performed without delay. In early cases, with moderate enlargement of the uterus, the vaginal route may be selected, but as a rule it is wiser to remove the uterus from the abdomen.

A. W. W. L.

## IV.—DISEASES OF THE EYE

### DISEASES OF THE EYELIDS

THE skin of the eyelids is affected by many of the general skin diseases of the body.

*Herpes Ophthalmica*, often wrongly called herpes zoster, is not uncommon. It generally begins with neuralgia of the brow and eye, and then a crop of vesicles appears on the scalp, temple and upper eyelid, the eruption following the distribution of the ophthalmic nerve or division of the fifth nerve.

The disease may be complicated by herpes of the cornea and conjunctiva, and by iritis. Generally after weeks or months the disease comes to an end and does not recur. Sodium salicylate is a valuable drug in this complaint. The affected area should be powdered with aristol or dermatol and lightly bandaged.

*Eczema.*—All kinds of eczema affect the lids, some associated with general eczema, others local manifestations in many cases caused by irritating discharges from the eyes. Fomentations with normal saline solution are useful in the acute cases, followed by the application of compound calamine lotion. Other forms are best suited by zinc and other ointments.

The lids are affected by *syphilis*. A primary sore is not uncommon, and tertiary syphilis causes a chronic tarsitis. The lids in this latter disease become greatly thickened and ptosis results. Iodides in large doses are beneficial.

*Dermoid cysts* are frequently found at the outer angle of the upper lid. They should be carefully dissected out, for they may be asso-

ciated with a defect in the bones, and may extend deeply into the orbit.

*Nævus* is common on the lids. Small nævi can easily be cured by treatment with carbon dioxide snow.

*Tumours.*—*Rodent ulcer* is exceedingly common. The lower lid is more frequently affected than the upper. The normal situation is at the inner angle, or on the side of the nose. Small rodent ulcers can be most satisfactorily removed by carbon dioxide snow. Larger tumours should be excised. A margin of at least a quarter of an inch should be given and the resulting defect repaired, if necessary, by a plastic operation. In all operations upon the lids and in their neighbourhood care must be taken not to produce either ectropion and lagophthalmos or entropion. These extensive cases are best left to a specialist, but any competent surgeon may use the dioxide snow.

*Xanthelasma.*—The small yellow patches which appear round the inner angles of the lids in elderly people can be excised, but tend to recur. It is said that they can be satisfactorily removed by the action of radium.

*Styes (Hordeolum).*—These are due to the septic infection of a sebaceous gland at the margin of the lid, generally with the *staphylococcus aureus*. A small abscess forms round a cilium, often causing great pain. If the styte be situated near the canthus the swelling of the tissues blocks the lymphatics from the lid and so causes œdema, which may sometimes present a very alarming appearance to the inexperienced.



The small abscess should be incised from the lid margin with an old Graefe knife and a fomentation be applied. In a few hours the inflammation will subside. Styes are apt to be very chronic and may be multiple. In these cases "protargolage" is useful. This method is described below under *blepharitis*. Vaccine therapy has proved successful in cases caused by staphylococci, especially when the styes were associated with furunculosis or acne.

**Chalazion or Meibomian Cyst.**—This very common condition is due to the distension of a Meibomian gland with a granulomatous mass. It is an adenitis and periadenitis of the gland. The process is occasionally acute (*Hordeolum internum*). The swollen gland forms an external swelling under the skin of the lid. If the lid be everted a grey area will be seen. Sometimes the swelling bursts through this grey area and a granuloma sprouts out.

The treatment is very simple. The lid is everted and a few crystals of cocaine rubbed into the grey area. The tarsus is now incised with a small sharp knife and the cavity scraped out with a small Volkmann's spoon.

**Blepharitis.**—This very important and common disease is seen in two chief forms—*Blepharitis squamosa* and *Blepharitis ulcerosa*. In addition to these two forms, the lids may be inflamed by the extension of inflammation from neighbouring structures. Thus in severe angular conjunctivitis caused by the diplobacillus of Morax and Axenfeld the lids may become chronically inflamed, not only at the angles, but along the whole margin of both sides. Fissures which are very painful develop at the canthi. If the diplobacillus is found in smears from the secretion, zinc salts must be used—a lotion of zinc sulphate (one-quarter to one per cent.) for the conjunctiva, and unguentum zinci for the lid edges.

In *blepharitis squamosa* the cilia become matted together by dry scabs. When these are removed the skin is reddened but not ulcerated. This form of blepharitis is regarded by many as a seborrhœa. Treatment is generally satisfactory, the scales must be softened by a warm three per cent. solution of bicarbonate of soda and gently detached with cotton wool; the lid edge is now dried and an ointment of nitrate of mercury applied. (Unguenti hydrargyri nitratis 10 parts, soft paraffin 100 parts.) Any error of refraction must be corrected and general hygienic measures adopted.

*Blepharitis ulcerosa* is a much more serious condition. The edge of the lid is covered with small ulcers, which may coalesce until the whole surface of the lid margin is raw, each ulcer containing one or more cilia. The disease is generally found in neglected "strumous" children living in unhygienic surroundings.

*Staphylococcus pyogenes aureus* can generally be found in cultures inoculated from these ulcers. Unless the process be arrested the eyelashes fall out and the lids become deformed. Partial trichiasis of the upper lid may occur, while ectropion of the lower lid is usual in chronic cases.

A severe case may go on for years, and may require lifelong treatment. General hygienic measures must be adopted, and every care taken to improve the general health of the patient. Locally savonage with protargol (protargolage), introduced by Darier, gives the best results. The lid margins are sharply rubbed with a pad of wool dipped in a thirty-three per cent. solution of protargol until a lather forms. This should be done once a day for about three weeks. At the same time a mild ointment such as boracic, is smeared along the lids. As the case improves the savonage can be performed at longer intervals and bicarbonate of soda lotion and nitrate of mercury ointment used. Severe eczema of the lids may be treated by normal saline fomentations. If there is much photophobia, atropine ointment (one per cent.) will be indicated. In the presence of keratitis and corneal ulcer the eyes must be bandaged, but the bandage must be changed and the eyes washed out with boracic lotion every two or three hours. If the blepharitis be associated with a muco-purulent conjunctivitis this must be treated by instillation of thirty-three per cent. solution of protargol once a day and five per cent. solution three times a day.

**Trachoma.**—This is a severe chronic inflammation of the lids and cornea which appears sporadically in England. It is endemic in the far and near East, in eastern Europe and in Ireland. In England it is rare except among the alien population of our great cities.

Two chief varieties are recognized, the *papillary* and the *follicular*. In most cases, however, follicles can be detected in the upper cul-de-sac, even though they are not present elsewhere. The disease is characterized by the presence of granulations, which are seen scattered over the palpebral conjunctiva of both lids, although the upper lid is generally affected first and most severely. These granulations, which are in reality lymph follicles, increase in number until the whole upper lid is covered with them and the lower may be similarly affected. In other cases the follicles can only be seen when a double eversion of the upper lid is made. In the East it is quite usual to find enormous hypertrophy of the papillæ with practically no follicles; the everted lid is very hyperæmic and looks like velvet, and it bleeds easily. As the disease progresses the follicles coalesce and form large gelatinous nodules whose jelly-like contents can easily be expressed. These are seen in

their highest development along the orbital margin of the tarsus and in the upper cul-de-sac. The stage of cicatrization now follows. White thread-like bands can be seen crossing and re-crossing the palpebral conjunctiva. This process continues until the whole surface is a shining hard contracted plate of fibrous tissue. The tarsus becomes inflamed and thickened and ultimately deformed. As a result of these changes the lids become inverted (entropion) and the lashes rub against the eye—*trichiasis*. The inflammation round the hair follicles causes some of them to become misplaced, and in this way isolated lashes may grow inwards, or even a complete double row may be formed—*distichiasis*. If contraction go further the conjunctiva shrinks until the eye becomes fixed and finally completely dry—*xerosis*. At about the time when cicatrization commences, but often earlier, the trachomatous change begins to affect the cornea. A condition known as *pannus* ensues, which is due to an infiltrating and vascularising process under Bowman's membrane. This generally commences from above and spreads downwards until the whole cornea may be covered. Occasionally it commences below and spreads upwards, and quite frequently in the East it begins both above and below and meets in the middle. The horizontal edge of the advancing pannus may show small pin-head areas which stain with fluorescein.

*Etiology.* The cause of trachoma is still a matter of dispute. It is now held that the essential factor is an infiltration of the tissues with plasma cells; the presence of lymphoid follicles is another striking feature in the microscopical picture. In some of the cells obtained by scraping the conjunctiva in recent trachoma certain cell inclusions have been found. These cell inclusions are also present in some cases of ophthalmia neonatorum, both gonococcal and non-gonococcal, in molluscum contagiosum, and in several other conditions. Herzog believes the inclusions to be involution forms of gonococci—microgonococci. The fact that gonococcal, but non-venereal, ophthalmia is enormously prevalent in Palestine and Egypt, that it is an eye disease pure and simple and entirely unconnected with gonorrhœa, and that resting gonococci can be demonstrated in winter in eyes which are only mildly inflamed, lends some support to Herzog's theory, for the two diseases trachoma and gonococcal ophthalmia are universally prevalent in these countries.

*Diagnosis.* This is a matter of *enormous difficulty*, and the more trachoma one sees the more difficult the problem. The disease has to be distinguished from spring catarrh and from other forms of granular conjunctivitis. Spring catarrh is very rare in England and when once seen should never be confused with trachoma,

but there are many forms of simple conjunctivitis associated with follicle formation which so exactly counterfeit the picture of a mild case of trachoma that *an absolute diagnosis is often impossible*. The presence of pannus greatly favours the probability of trachoma, but there are cases of so-called strumous pannus with follicular conjunctivitis which clear up so rapidly and completely when appropriate treatment is initiated that the trachomatous nature of the disease is rendered very improbable. When the suspicious condition has failed to improve under treatment, and is obviously chronic, then we can safely decide that we have a case of trachoma. The presence of cicatricial bands in the central portion of the tarsus is practically pathognomonic. In many advanced cases there can be no doubt of the diagnosis; in early mild cases the diagnosis of a sporadic case in a non-trachomatous district is practically impossible.

*Treatment.* The onset of trachoma is generally so gradual and so devoid of symptoms that most cases are fairly advanced when first seen. A mild and perhaps doubtful case should be treated with ung. hydrarg. oxid. flav. one per cent., well massaged into the lids three times a day. The oxide must be thoroughly incorporated with the vaseline and care must be exercised that the patient is taking no iodides internally, otherwise nascent biniodide of mercury will be formed in the tissues and great irritation will ensue. If the lids do not improve under this treatment they should be *gently* rubbed with an alum-copper sulphate crayon (these are sold under the name of veterinary points). Copper sulphate alone is too irritating and is not well borne for long. This treatment must be continued for months, the crayon being passed up into the fornix, where the chief focus of the disease is situated. If the case does not improve and there are obvious large follicles in the fornix these should be expressed. The lids should be anæsthetized by cocaine and adrenalin injection and by the instillation of cocaine (codrenine is a good preparation to use), and then they are everted and the tarsus seized by Cropper's modification of Grady's forceps and forcibly squeezed. The forceps are put on high in the fornix, pressed tightly together and dragged off. The follicles are thus burst and their contents expressed. After a few days copper sulphate and yellow ointment are again used. With patience and care a cure may be attained in from one to three years. We have recently obtained gratifying results from the use of carbon dioxide snow in these severe cases. It is well to examine films from any secretion which may be present to detect a mixed infection with diplobacilli and Koch-Weeks' bacilli. Should diplobacilli be found a zinc sulphate lotion



should be used. The Koch-Weeks' infection yields to protargol (thirty per cent. to thirty-five per cent.).

Trachoma is contagious, a fact which has been conclusively proved by experiments upon the chimpanzee and upon man. Some individuals appear to be immune, and negroes are said not to suffer from the disease. It is necessary that a patient with trachoma shall have his own towels and washing materials, and shall sleep alone. Affected children should be sent to special trachoma schools.

**Entropion and Trichiasis** can only be remedied by an operation, Van Milligen's and Snellen's are the best. Epilation is of no value whatever.

**Follicular Conjunctivitis.**—This disease should not be regarded as a pathological entity; the German school as a whole do not recognize it as such. A granular condition of the lower lids is normal in many individuals who have been exposed to any chronic irritation such as dust and severe weather. It is caused by the use of unsterilized solutions of atropine and by infection with the diplobacillus and other organisms. Children with dirty verminous heads are especially liable to develop follicular catarrh. Occasionally a follicular conjunctivitis appears as an epidemic in a school, but yields to simple treatment. Careful bacteriological examination must be made, and if micro-organisms are found appropriate measures must be taken to destroy them. Thus if the Koch-Weeks' bacillus or pneumococci are present a thirty-three per cent. solution of protargol should be instilled once a day, and a five per cent. solution three times. Diplobacillary infection calls for zinc salts. A solution of zinc sulphate of from one to one and a quarter per cent. strength, is most suitable. If no organisms are present yellow oxide of mercury ointment will in most cases speedily cure the disease. General hygienic measures and correction of errors of refraction must never be omitted.

**Ptois.**—Any disease of the lid which increases its weight, such as trachoma or tumour, may cause ptois. When the disease responds to appropriate treatment the ptois tends to recover.

Ptois may be a congenital disease. **Con-genital ptois** may be complete or incomplete, and, especially in its partial form, is often hereditary. It is generally bilateral. The groove under the brow is absent, and any attempt to raise the lids causes over-action of the frontalis muscle. Gowers thinks it is due to a central defect. The deformity in severe cases should be remedied by operation. Several methods are employed, but none are quite satisfactory. In no case should the practitioner attempt to cure the defect by removing a piece of skin, if this be done lagophthalmos may result.

Slight Ptois is caused by *paralysis of the sympathetic nerve* which innervates certain unstriated muscle fibres—Müller's muscle, in the lid. This form does not call for treatment.

**Transient Reflex Ptois** may be caused by irritation of the fifth nerve; Gowers records a case which followed the extraction of a molar tooth.

**Hysterical Ptois.**—This is generally bilateral and is associated with considerable spasm of the orbicularis. There is generally much over-action of the frontalis, which, combined with the ptois, gives a typical clinical picture. Other stigmata of the disease will be present, such as anæsthesia of the palate and patches of anæsthesia. The treatment is that of hysteria.

**Morning Ptois.**—Certain individuals, mostly women, find it impossible to open their eyes for some minutes after they wake, it may be for even thirty minutes.

**Paralytic Ptois.**—The levator muscle of the lid is innervated by the oculomotor nerve, many lesions of which cause ptois. The ptois may exist alone, or be associated with paralysis or paresis of all or some of the muscles supplied by the third nerve. The usual syndrome is ptois, divergent strabismus, and a widely dilated inactive pupil. The drooping of the lid may be complete or incomplete. There is usually a conspicuous over-action of the frontalis which raises the brow above its fellow. This lesion is usually nuclear, especially if ptois be the sole symptom. The most frequent cause is tertiary syphilis. Large doses of iodide of potassium, twenty to thirty grains three times a day, will generally effect a cure, but some months may elapse before it is complete. Not infrequently, as soon as it is cured, ptois appears in the other side, and then the original eye may relapse again. Ptois as part of oculomotor paralysis may be a symptom of tabes and of insular sclerosis, but it is rare in the latter disease.

**Lagophthalmos**, or inability to close the eye, is generally the result of indiscreet operations upon the lids, or of the contraction of cicatrices. It is also a regular symptom of facial paralysis. In the first case the treatment demands special knowledge, and the defect can only be remedied by a carefully planned plastic operation. Facial paralysis must be treated according to its cause, which is often within the domain of otology.

**Blepharospasm.**—This condition is generally but a symptom, associated with corneal ulcer, keratitis, foreign bodies, and with other inflammatory conditions of the eye. It is not usually found in uncomplicated conjunctivitis. In some cases, however, in "strumous," ill-nourished children no ocular lesion is present. The child suffers from intense photophobia and

buries the eyes in its hands. Such a child may suffer from post-aural eczema, and very frequently from a chronic rhinitis. Treatment at home is often unsatisfactory and prolonged. Good food, plenty of fresh air, and warm clothing are necessary. Cod-liver oil and phosphate of iron should be given and atropine be instilled three times a day. A cold bath followed by

friction with a warm rough towel should be given daily. The child should be plunged right under the water and then receive several spinal douches. Any eczema or rhinitis should be treated in an efficient manner; adenoids and enlarged tonsils should be removed. As soon as the child is well enough he should be sent to a convalescent home. T. H. B.



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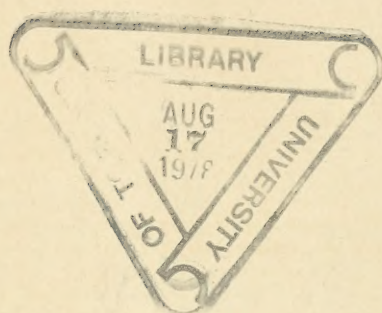
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